Excellence in Engineering Education:
Enhancing Undergraduate Student Access, Retention, Graduation and Student Learning Outcomes to Meet Workforce Needs

Board of Governors' Update
SUS Council of Provosts

The SUS Engineering deans, department chairs, faculty, provosts and others have spent many hours gathering data and discussing and analyzing the many questions related to:

Why are varying numbers of student credit hours above 120 required in many SUS engineering degrees?

The question emerged from the discussions of the Board of Governors in November, 2018. In the intervening months, many people who are closely engaged with preparing engineers throughout the SUS have worked together to review all undergraduate programs, not only in terms of their required credits for each undergraduate degree, but also much more, including:

1) Required credits,
2) Time to degree,
3) Performance of diverse student groups,
4) Impact of mathematics preparation upon entering degree programs,
5) Earnings of first year SUS engineering graduates.

1. Required credits

All of the SUS institutions are committed to ensuring that engineering graduates meet the needs of the engineering workforce and are educated in the most effective and efficient manner possible, while maintaining the standards required for attainment of an accredited and reputable engineering degree. We work to successfully prepare students to enter the engineering workforce or additional graduate or professional education in a timely manner. "Chapter 471, Florida Statutes, and Rule 61G15-20.006, F.A.C., requires applicants [for examinations to become licensed as a professional engineer in the State of Florida) to have an EAC/ABET accredited Bachelor of Science degree in engineering". See Appendix I.

The SUS deans reviewed the top national undergraduate engineering programs as identified by US News & World Report (USNWR), which showed average credits to degree of 126 to 128, depending upon the discipline (**Table 1**), with some programs ranging as high as 133.

Table 1. Credits to Degree by Discipline for Top Public Engineering Programs Using the Semester System. All programs are ABET accredited except for the Biomedical Engineering program at University of California-Berkeley

Aerospace Eng	**BS Credits**	**Biomedical Eng**	**BS Credits**	**Chemical Eng**	**BS Credits**
Georgia Tech	132	Georgia Tech	131	Georgia Tech	132
Maryland	124	Berkeley	120	Delaware	126
Michigan	128	Michigan	128	Michigan	128
Virginia Tech	128	Minnesota	124	Minnesota	122
Texas A&M	128	Pitt	131	NCSU	125
UTexas-Austin	127	UTexas-Austin	133	UTexas-Austin	129
Ohio State	128	Virginia	126	Penn State	133
UC-Boulder	128	Wisconsin	128	Wisconsin	133
Purdue	130	Purdue	130	Purdue	130
Illinois	128			Illinois	129
		Avg	**128**		
Avg	**128**			**Avg**	**129**
Civil Eng	**BS Credits**	**Computer Eng**	**BS Credits**	**Electrical Eng**	**BS Credits**
Georgia Tech	128	Georgia Tech	132	Georgia Tech	132
Berkeley	124	Ohio State	129	Ohio State	128
Michigan	128	Michigan	128	Michigan	128
Virginia Tech	131	Virginia Tech	131	Virginia Tech	132
Texas A&M	128	Texas A&M	128	Texas A&M	128
UTexas-Austin	124	UTexas-Austin	122	UTexas-Austin	125
Penn State	127	Arizona State	120	Penn State	127
Wisconsin	128	Wisconsin	120	Wisconsin	124
Purdue	132	Purdue	125	Purdue	124
Illinois	128	Illinois	128	Illinois	128
Avg	**128**	**Avg**	**126**	**Avg**	**128**
Environmental Eng	**BS Credits**	**Industrial Eng**	**BS Credits**	**Materials Eng**	**BS Credits**
Georgia Tech	129	Georgia Tech	128	Georgia Tech	132
UC-Boulder	128	Ohio State	127	Ohio State	127
Michigan	128	Michigan	128	Michigan	128
UTexas-Austin	124	Virginia Tech	127	Berkeley	129
Purdue	128	Texas A&M	128	UF	125
		NC State	124	NC State	126
Avg	**127**	Penn State	129	Penn State	131
		Wisconsin	120	Wisconsin	127
		Purdue	123	Purdue	125
		Illinois	128	Illinois	129
		Avg	**126**	**Avg**	**128**
Mechanical Eng	**BS Credits**	**Nuclear Eng**	**BS Credits**		
Georgia Tech	129	Georgia Tech	126		
Berkeley	124	Tennessee	124		
Michigan	128	Michigan	128		
Virginia Tech	131	Berkeley	125		
Texas A&M	128	Texas A&M	125		
UTexas-Austin	126	NC State	123		
Penn State	131	Penn State	129		
Wisconsin	128	Wisconsin	129		
Purdue	128	Illinois	128		
Illinois	128				
		Avg	**126**		
Avg	**128**				

Within the SUS, credits to degree currently range from 120 to 131 (**Table 2**).

Table 2. Credits to Degree by Discipline
Yellow=Recent or upcoming changes
Green=Degrees closest to Student Credit Hour agreement across SUS
No Data=Degree program not offered at institution

CIP	CIP Title	FAMU	FAU	FGCU	FIU	FPU	FSU	UCF	UF	UNF	USF	UWF
14.0201	Aerospace, Aeronautical and Astronautical/Space Engineering							128	128			
14.0301	Agricultural Engineering	128										
14.0501	Bioengineering and Biomedical Engineering	131/128		129	128		131/128		131		126	
14.0701	Chemical Engineering	131/128					131/128		134/131		131	
14.0801	Civil Engineering, General	128	128	128	128		128	128	128	128/120	131/128	
14.0803	Structural Engineering							128				
14.0901	Computer Engineering, General	128	124		128	120	128	128	126		128/120	130/127
14.0903	Computer Software Engineering			120								
14.1001	Electrical and Electronics Engineering	128	128		128	120	128	128	128	128/120	128	130/127
14.1003	Laser and Optical Engineering							128				
14.1401	Environmental/Environmental Health Engineering		120	128	127			128	128			
14.1801	Materials Engineering								125			
14.1901	Mechanical Engineering	128	128		128	120	128	128	128	128/120	128	130/127
14.2301	Nuclear Engineering								127			
14.2401	Ocean Engineering		136/130									

CIP	CIP Title	FAMU	FAU	FGCU	FIU	FPU	FSU	UCF	UF	UNF	USF	UWF
14.2701	Systems Engineering								125			
14.3501	Industrial Engineering	128					128	128			128	
14.3801	Surveying Engineering		120									
14.4501	Biological/Biosystems Engineering								128			
15	Engineering Technology, General											120
15.0201	Civil Engineering Technology/Technician	124										
15.0303	Electrical, Electronic and Communications Engineering Technology/Technician	124										
15.1001	Construction Engineering Technology/Technician	124		123	121/ 120				125	126/ 120		
15.1102	Surveying Technology/Surveying								120			
15.9999	Engineering Technologies and Engineering-Related Fields, Other				120							

The deans then conducted reviews with their respective employer and alumni advisory boards with the goal of identifying any excess content and ensuring essential content is adequately covered. These reviews took into account the critical need for technical competence along with increasing employer demand for improved communications and team effectiveness skills. Such reviews are common in engineering as the engineering accrediting body, ABET, requires programs to gather constituent input as part of the process of reviewing and amending undergraduate engineering curricula. The engineering departments also consulted their respective industrial advisory boards and caucused with one another to discuss appropriate credits to degree.

As a result of these reviews and related analyses, many SUS programs have made changes to their required credits to degree. As examples, UF has reduced both Chemical Engineering and Civil Engineering by 3 credits and UNF has proposed to

reduce their four programs to 120 credits. As a system, we are closer to parity of student credit hour requirements across specific degree programs in many of our engineering degrees. All provosts have agreed that it is our goal to finish that process, as possible, this academic year. However, not all Deans, Chairs, and Provosts agree that not all engineering degree programs can be effectively reduced to 120- student credit hours and still include the required general education coursework that students need to graduate, especially in areas that are not STEM.

Similarly, our analyses show that not all engineering programs can be properly offered at a 120-student credit hour requirement, because of the broader, deeper and more interdisciplinary range of specialized study required for such fields (biomedical engineering is a good example). Most engineering programs in the SUS have determined that it is necessary to remain at more than 120 student credit hours to degree to satisfy constituent needs. Benchmarking with peer institutions across the country suggests that all SUS institutions are in line with national norms.

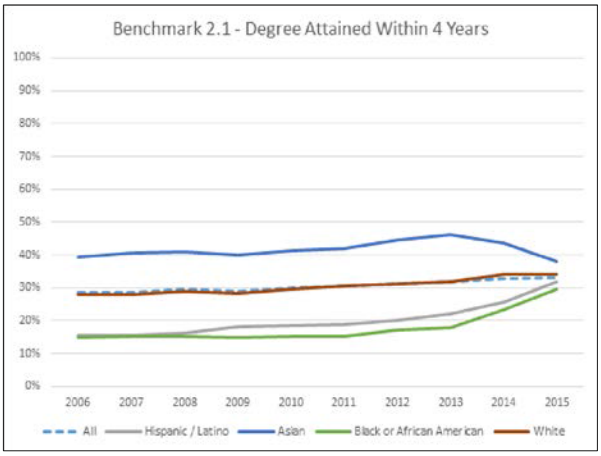
It also is important to note that ABET (Accreditation Board for Engineering and Technology, Inc.) requires all changes such as these to be reviewed and assessed through extensive constituent feedback. Though there are certainly areas of overlap within common disciplines, each program is required by ABET to tailor their majors to meet constituent demands as determined by feedback from each program's employers and alumni. Therefore, it may be expected that there will be some variation in programs given that each program may target a different employer market. The ABET accreditation process allows for such variation and often results in variation in credits to degree in the same discipline.

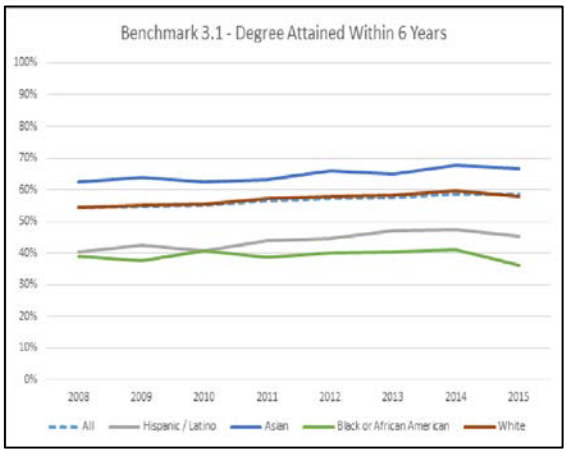
At this point, most SUS Engineering Deans and Chairs feel strongly that further reductions in credits to some degrees is not warranted, especially in light of the feedback from employers and alumni that further reduction in credits to degree will cause significant damage to successful student placement and program reputation. Failure to adequately address constituent feedback creates a potential for probation or even loss of accreditation. Thus, further reductions in credits to degree for many programs are not advised by university Deans and Chairs.

2. Time to Degree

Our SUS engineering programs are unanimous in support of the goal of timely graduation rates for all our students. Times to degree in engineering programs at public institutions are typically longer than for most other majors. The national graduation rates for engineering over a period of time are shown in Figure 1 below.

Figure 1. National graduation rates for engineering students. These data are determined by comparing the number of students who graduate in a certain time window with the number of students who began their freshman year as engineering students. Thus, students who leave engineering but graduate in another major reduce the reported graduation rate for engineering. Exclusion of students from the freshman pool who leave engineering to graduate in a different major would produce a higher graduation rate for any given time period. *ASEE Engineering by the Numbers 2017.*





The time to degree for SUS programs are in **Table 3.**

Table 3. Time to graduation data for SUS institutions. Rates shown in the table are for students who actually graduate with a degree in engineering. Students who dropped out of engineering are not reflected in the data.

Freshman Cohort Year	2012		2013	
	Graduated within 4 years	Graduated within 5 years	Graduated within 4 years	Graduated within 5 years
UF	26.60%	85.50%	29.70%	91.70%
FAU	26.00%	66.00%	29.19%	57.66%
FGCU	27.00%	71.00%	15.00%	47.00%
FIU	17.90%	54.50%	25.60%	56.30%
FPU	n/a	n/a	n/a	n/a
FAMU-FSU	32.90%	88.60%	43.00%	96.10%
UCF	31.60%	90.90%	32.30%	79.00%
UNF	21.1%	84.20%	20.00%	76.00%
USF	38.67%	85.00%	40.96%	95.22%
UWF	7.00%	29.00%	13.00%	30.00%

For every institution reporting, 4-year completion rates are low compared to other degree completion rates. Deans, Department Chairs, and Provosts are continuing to analyze what can be done to improve these graduation rates while still preparing students to appropriate professional levels. More specifics follow later in this report.

Time to degree rates for a select group of peer schools are in **Table 4**.

Table 4. Peer group graduation rates. Data are for students who entered an engineering program in their first year and graduated with a degree in engineering. The rate does not include students who start in engineering but then graduate with a degree in another major. Inclusion of students who graduate in other majors would increase the graduation rates shown in the table. Peer group consists of University of California-Berkeley, University of Illinois at Urbana-Champaign, University of Washington, the Ohio State University, University of Michigan, Georgia Tech, Texas A&M, Purdue. *ASEE 2017*

Freshman year at the institution	2007	2008	2009	2010	2011
All					
Total head count	11212	11397	11906	12416	12770
Degree attained within 4 years	31.60%	33.10%	33.70%	30.70%	28.10%
Degree attained within 5 years	59.50%	60.30%	63.90%	67.90%	No data available
Degree attained within 6 years	63.70%	64.70%	68.90%	No data available	No data available
Hispanic / Latino					
Total head count	706	719	812	920	940
Degree attained within 4 years	19.80%	19.90%	18.60%	21.20%	26.30%
Degree attained within 5 years	53.10%	51.00%	50.40%	47.10%	No data available
Degree attained within 6 years	60.30%	59.40%	55.40%	No data available	No data available
Black or African American					
Total head count	412	403	415	438	427
Degree attained within 4 years	11.20%	12.90%	14.90%	14.60%	23.00%
Degree attained within 5 years	40.00%	41.70%	42.40%	35.80%	No data available
Degree attained within 6 years	50.20%	48.40%	48.90%	No data available	No data available

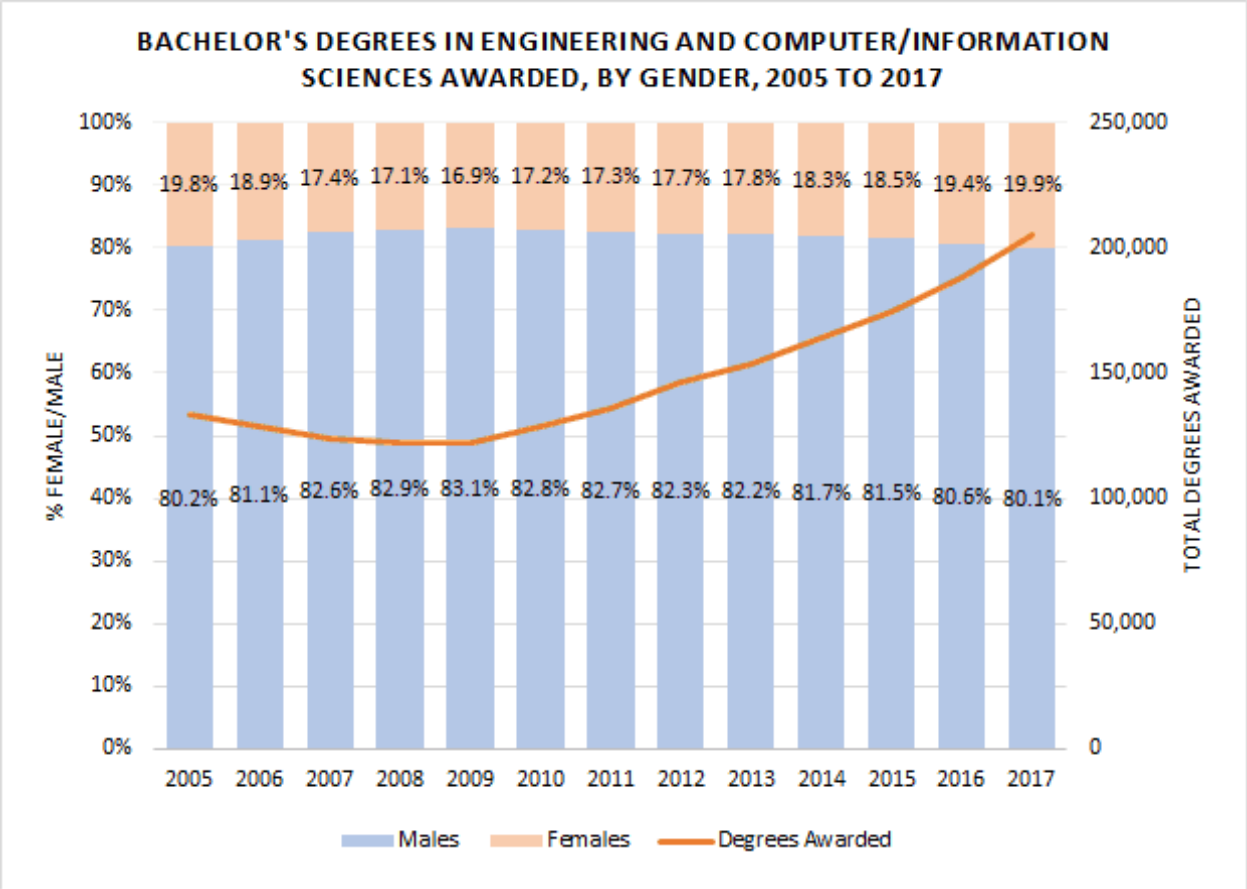
As can be seen from these data, national 4-year graduation rates for engineering are quite low at roughly 40%, but increase significantly to over 65% by the 6th year. The disparity between 4- and 6-year rates is even more pronounced among top public programs with a majority of graduates requiring at least 5 years.

3. Performance of diverse students

Women students earned over 200,000 degrees in U.S. engineering and computer sciences programs in 2016-17. However, that figure still only represents about 20% of all bachelor's degree graduates in these fields. See Table 5 below. Although data indicate that SUS women students in engineering succeed at or near the same level as men students, they may be affected by the relative lack of female faculty as role models. Nationally, women are only 16.9% of tenured or

tenure-track faculty among engineering programs (American Society for Engineering Education, 2015).

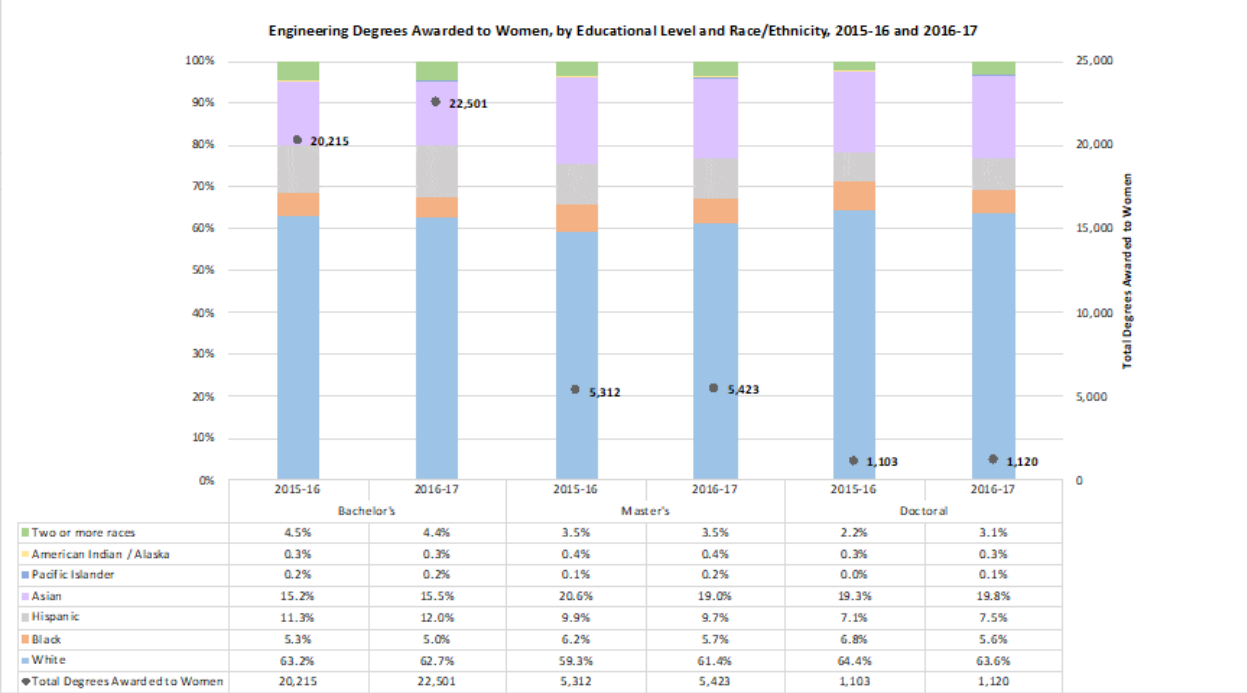
Table 5.



Source: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, *Digest of Education Statistics 2018,* Tables 325.35 and 325.45.

Further, engineering degrees earned by U.S. women of color represented only 17% of the total engineering degrees awarded to *all women*.

Table 6.

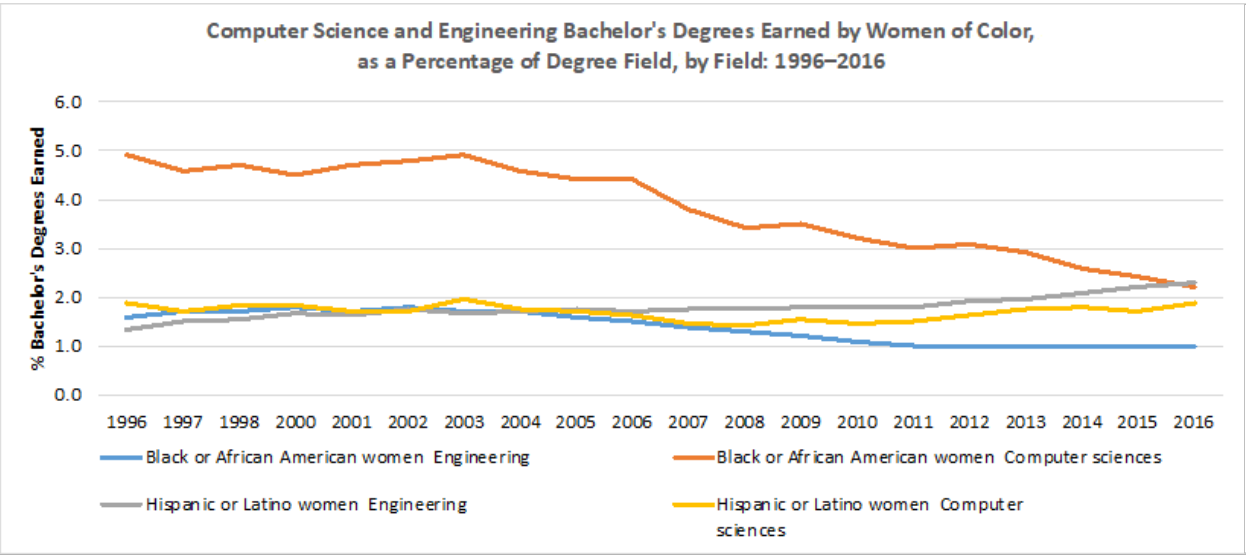


	Bachelor's		Master's		Doctoral	
	2015-16	2016-17	2015-16	2016-17	2015-16	2016-17
Two or more races	4.5%	4.4%	3.5%	3.5%	2.2%	3.1%
American Indian / Alaska	0.3%	0.3%	0.4%	0.4%	0.3%	0.3%
Pacific Islander	0.2%	0.2%	0.1%	0.2%	0.0%	0.1%
Asian	15.2%	15.5%	20.6%	19.0%	19.3%	19.8%
Hispanic	11.3%	12.0%	9.9%	9.7%	7.1%	7.5%
Black	5.3%	5.0%	6.2%	5.7%	6.8%	5.6%
White	63.2%	62.7%	59.3%	61.4%	64.4%	63.6%
Total Degrees Awarded to Women	20,215	22,501	5,312	5,423	1,103	1,120

Source: U.S. Department of Education, Institute of Education Sciences, National Center for Education Statistics, Digest of Education Statistics 2017. Tables 322.50, 323.50, and 324.35.

Over the past ten years, Black and Hispanic women comprised fewer than 3.5% of the Bachelor's degree holders in engineering and about 4% of the bachelor's degree holders in computer science. Black women have represented about 1% of the engineering Bachelor's degree holders in the last several years. See Table 7 below.

Table 7.



Source:
National Science Foundation, National Center for Science and Engineering Statistics. 2019. Women, Minorities, and Persons with Disabilities in Science and Engineering: 2019. Special Report NSF 19-304. Alexandria, VA.

Disparity in 4- and 6-year graduation rates is pronounced among all underrepresented students, regardless of gender. Black students, in particular, drop out of engineering at higher rates than all other students and take longer to graduate. For example, UF produces a slightly lower overall rate for all students relative to the peer group, but a roughly equal 5-year rate for Hispanic students and 6-year rate for Black students.

Rates for Black students (from several SUS institutions), shown in Table 8 below, generally tend to be lower than that for all students. Five-year completion rates for all students including Black students are significantly higher.

Table 8. Time to graduation for Black engineering students in SUS institutions. Rates shown in the table are for students who actually graduate with a degree in engineering. Students who dropped out of engineering are not reflected in the data.

	2012		2013	
	Graduated within 4 years	**Graduated within 5 years**	**Graduated within 4 years**	**Graduated within 5 years**
UF	6.70%	60.00%	30.80%	88.50%
FAU	11.76%	35.29%	20.00%	40.00%
FGCU	n/a	n/a	n/a	n/a
FIU	n/a	n/a	n/a	n/a
FPU	n/a	n/a	n/a	n/a
FAMU-FSU	28.00%	92.00%	37.50%	75.00%
UCF	18.50%	77.80%	27.80%	83.30%
UNF	n/a	n/a	n/a	n/a
USF	33.33%	87.50%	38.24%	91.18%
UWF	0.00%	0.00%	0.00%	0.00%

The graduation rate deficit for underrepresented students has been shown to derive from a variety of causes, including those discussed briefly in later sections.

Table 9 indicates graduation rates for the University of Florida and the University of South Florida, for examples among the SUS.

Table 9. UF and USF graduation rates. Data is for students who entered an engineering program in their first year and graduated with a degree in engineering. The rate does not include students who start in engineering but then graduate with a degree in another major. Inclusion of students who graduate in other majors would increase the graduation rates shown in the table.

Freshman Year at UF	2007	2008	2009	2010	2011
All					
Total head count	942	1058	1111	1190	1222
Engineering degree attained within 4 years	15.7%	17.3%	16.4%	16.2%	16.9%
Engineering degree attained within 5 years	52.2%	52.1%	52.5%	51.4%	
Engineering degree attained within 6 years	58.8%	59.4%	57.7%		
Hispanic/Latino					
Total head count	138	178	186	202	211
Engineering degree attained within 4 years	13.0%	14.6%	10.8%	11.4%	7.6%
Engineering degree attained within 5 years	52.2%	51.7%	53.8%	49.5%	
Engineering degree attained within 6 years	61.6%	60.7%	59.1%		
Black or African American					
Total head count	71	56	64	67	79
Engineering degree attained within 4 years	5.6%	5.4%	6.3%	9.0%	12.7%
Engineering degree attained within 5 years	28.2%	33.9%	43.8%	31.3%	
Engineering degree attained within 6 years	47.9%	46.4%	51.6%		

Freshman year at USF	2008	2009	2010	2011	2012
All					
Total head count	490	397	390	399	527
Engineering degree attained within 4 years	10.0%	14.1%	16.2%	21.6%	20.7%
Engineering degree attained within 5 years	31.6%	37.0%	35.4%	41.1%	42.3%
Engineering degree attained within 6 years	36.7%	42.6%	42.8%	45.4%	
Hispanic/Latino					
Total head count	79	75	64	65	90
Engineering degree attained within 4 years	7.6%	21.3%	17.2%	16.9%	17.8%
Engineering degree attained within 5 years	30.4%	34.7%	32.8%	33.8%	41.1%
Engineering degree attained within 6 years	38.0%	38.7%	34.4%	40.0%	
Black or African American					
Total head count	31	19	33	15	34
Engineering degree attained within 4 years	3.2%	5.3%	12.1%	13.3%	14.7%
Engineering degree attained within 5 years	29.0%	15.8%	30.3%	26.7%	41.2%

Again, deans, department chairs, and provosts are continuing to analyze what can be done to improve these graduation rates while still preparing students to appropriate professional levels. More specifics follow in this report.

4. Impact of mathematics preparation upon entering degree programs

Many students, especially those from underrepresented groups and those from lower socioeconomic backgrounds, have poorer high school preparation, particularly in mathematics. A lack of adequate mathematical preparation then requires such students to begin their university math sequence with Pre-Calculus (or even lower level math courses) rather than Calculus 1.

Engineering curricula are different from many majors in that they are predominantly hierarchical. Almost every course builds on another and can only be taken in a particular sequence so that technical skills can build upon one another.

As an example, consider the study of Statics. This is the study of methods for quantifying the forces between bodies and is an essential prerequisite for many engineering fields, such as mechanical, civil, aeronautical, and bioengineering, which address the various consequences of forces. One cannot study statics without first mastering Physics 1 with Calculus, and one cannot study Physics 1 with Calculus without first mastering Calculus 1.

Thus, students who start their math sequence with Pre-Calculus are delayed on their path to graduation by at least one semester. Many students from inner city or rural high schools may be less well prepared in mathematics and thus take a longer time to degree.

Table 10 shows this effect in SUS institutions.

Table 10. Time to graduation for engineering students in SUS institution whose first math class is Pre-Calculus. Rates shown in the table are for students who actually graduate with a degree in engineering. Students who dropped out of engineering are not reflected in the data.

Freshman Cohort Year	2012		2013	
	Graduated within 4 years	Graduated within 5 years	Graduated within 4 years	Graduated within 5 years
UF	3.20%	69.80%	4.40%	83.80%
FAU	10.71%	53.57%	16.67%	55.56%
FGCU	n/a	n/a	n/a	n/a
FIU	9.70%	65.50%	17.40%	52.20%
FPU	n/a	n/a	n/a	n/a
FAMU-FSU	14.10%	84.80%	22.10%	92.60%
UCF	n/a	n/a	n/a	n/a
UNF	n/a	n/a	n/a	n/a
USF	20.21%	84.04%	25.00%	88.75%
UWF	2.50%	20.00%	0.00%	5.30%

Imposing a 4-year time to graduation metric would penalize schools with high populations of students from diverse, lower income backgrounds, even if they are successful in graduating them with a degree in engineering. This seems counter to the goal of helping such students elevate their financial and social mobility prospects, which obtaining an engineering degree clearly could impact. See salaries in Table 11 below.

5. Earnings of SUS engineering, 2016-17

Table 11.

CIP	CIP Title	FAMU	FAU	FGCU	FIU	FPU	FSU	UCF	UF	UNF	USF	UWF
14.0201	Aerospace, Aeronautical and Astronautical/Space Engineering							$14.4/47/45%	$17.9/33/39%			
14.0301	Agricultural Engineering	$11.9/**67%							$14.0/**50%			
14.0501	Bioengineering and Biomedical Engineering			$11.0/20/53%	$9.4/27/36%							
14.0701	Chemical Engineering						$12.7/17/28%		$13.8/31/27%		$13.0/36/44%	
14.0801	Civil Engineering, General	$11.6/**100%	$14.0/42/75%	$14.0/28/72%	$13.0/73/79%		$13.7/61/73%	$14.2/88/84%	$15.6/68/59%	$15.6/18/78%	$15.1/766/0%	
14.0803	Structural Engineering							$16.4/**/89%				
14.0901	Computer Engineering, General		$14.7/21/68%		$14.9/41/50%		$15.1/11/33%	$16.0/74/69%	$16.0/33/37%		$14.7/28/62%	$15.3/***
14.0903	Computer Software Engineering			$13.4 21/62%								
14.1001	Electrical and Electronics Engineering	$22.3/***/33%	$15.0/20/43%		$17.0/48/51%		$16.2/16/27&	$15.7/97/58%	$16.2/50/41%	$17.0/***	$16.3/38/61%	$13.5/28/44%
14.1003	Laser and Optical Engineering							13.0/***				
14.1401	Environmental/Environmental Health Engineering			$13.5/15/65%	$11.1/***			$13.5/15/48%	$13.0/20/45%			
14.1801	Materials Engineering								$16.6/***			
14.1901	Mechanical Engineering	$15.5/**/43%	$14.4/52/72%		$14.4/48/43%	15.4/**67%	$14.7/40/45%	$13.8/192/61%	$15.2/116/40%	$15.0/26/76%	$13.1/84/57%	
14.2301	Nuclear Engineering								$6.8/***			
14.2401	Ocean Engineering		$11.0 14/37%									

CIP	CIP Title	FAMU	FAU	FGCU	FIU	FPU	FSU	UCF	UF	UNF	USF	UWF
14.2701	Systems Engineering								$15.3/ 52/39%			
14.3501	Industrial Engineering	***					$14.0/ 10/34%	$16.9/ 10/***			$18.8/ ***/25%	
14.3801	Surveying Engineering		n/a									
14.4501	Biological/Biosystems Engineering		$11.0/ 20/53%		$9.4/ 27/36%				n/a			
1515000	Engineering Technology, General											$11.1/ 15/48%
15.0201	Civil Engineering Technology/Technician	n/a										
15.0303	Electrical, Electronic and Communications Engineering Technology/Technician	n/a										
15.1001	Construction Engineering Technology/Technician				n/a				n/a	n/a		
15.1102	Surveying Technology/Surveying								$16.6/ **/67%			
15.9999	Engineering Technologies and Engineering-Related Fields, Other				$18.8/ **/60%							

Table 11 above shows by institution and degree, data for the 2016-17 graduates of SUS engineering programs:

- the average, quarterly income of graduates who are employed full-time;
- the number of employed students in each group; and
- the employed students' percentage of their entire graduating 2016-17 class by institution *and* degree.

Not all data are available. The source of **Table 11** is the Florida Department of Education, Florida Education & Training Placement Information Program.

We do not have data differentiated by *time to degree* that indicate any significant differences in salary among first year graduates of SUS engineering programs at this time. However, we certainly recognize that the longer one is in school, the higher one's costs are likely to be. Thus, our overall SUS push for timely graduation, which we all support.

Given the relatively high first-year salaries of engineering graduates throughout the SUS (early career--not first-year--salaries systemwide for **all** degrees are about $48,000 annually), our Deans, Chairs, and Provosts are committed to offering the best possible curricula, as approved by ABET and SACSCOC, that lead to the post-graduation success of our students and the heightened national reputations of our programs.

6. Access to internships and co-ops for student preparation in industry and impact upon time to degree

Because of the very structured and relatively complex nature of engineering curricula, many students need to attend summer school sessions to graduate in as timely a manner as possible. One problem that the Deans note is that when students focus on graduating as quickly as possible, they may be precluding any opportunity for internship or co-op experiences. Such internships, most of which are paid and are for zero-credit, may add considerable strengths to the job application of those students, whether at the company with which they interned or another. Grumman, a company which hires a large number of SUS engineering graduates, reports that their employees who did more than one internship during their university experience tend to stay with the company for five years or more, longer than other hires. This allows great opportunities for promotions and movement into leadership roles for the employees.

So, while zero credit internships don't add to the overall student credit hour requirement, they may well add to the time to degree. Nonetheless, the Deans, Chairs, Advisory Boards, and frequent employers of our graduates indicate that they are critically important. Finding a balance among the many technical and professional courses that engineering students must complete, along with other university requirements, and along with one or more internship or co-op experiences is an important issue that the SUS Deans, Chairs, and Provosts are exploring.

Impacts to Date and Next Steps

As noted above, all SUS Deans and Department Chairs of engineering, as well as Provosts, Advisory Boards, employers and national colleagues have worked to determine where we are and what we need to do moving forward to help build even greater student success in engineering.

In addition to the work to bring similar degrees to the same student credit hour requirement, many other efforts are ongoing:

1. The Provosts have established a Provost Engineering Committee (PEC), which now helps to oversee ongoing SUS program actions, as we work to provide our students a robust experiential learning environment for their overall university education as well as preparation for successful engineering careers.

   PEC will prepare an annual report for the Board of Governors, to be presented at the August meetings, and will provide additional updates as requested throughout the year.

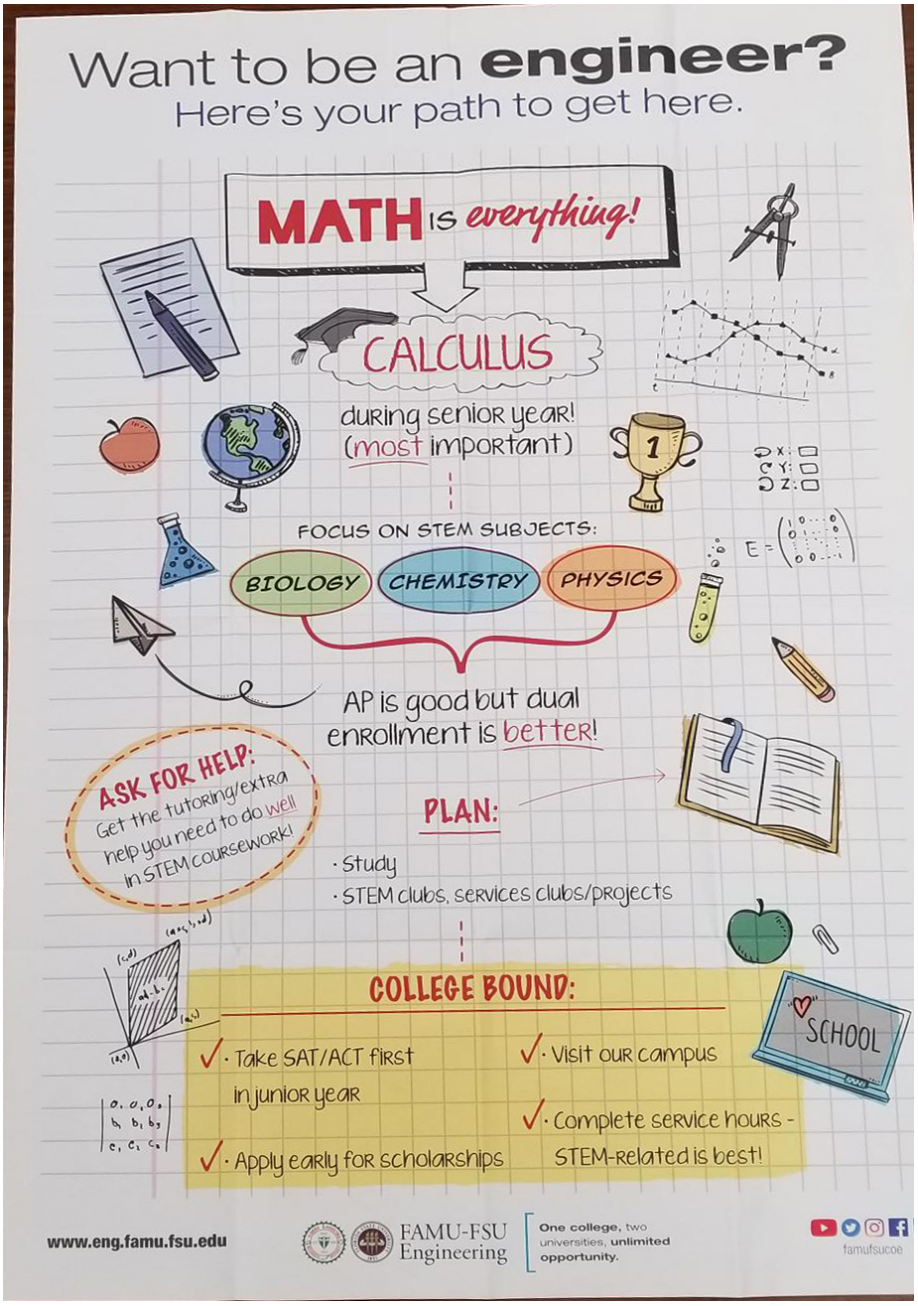
2. PEC will continue to work with the Florida K-12 mathematics teachers, providing workshops, posters (like the one sent last year from FSU to all high school math teachers illustrating the centrality of calculus to beginning to study engineering, see below), and materials; the Florida Department of Education mathematics initiatives; and the Florida State College System. Pre-calculus and calculus are the keys to successful and timely entrance into engineering, and we have to both make that case and help our educational partners succeed in helping students successfully study math at these levels in high school.

3. PEC also will work on expanding and better unifying summer bridge programs for students who graduate high school and begin university engineering curricula the next fall. It is possible that such programs could be on-line or hybrid, which would make them more available to underrepresented students who may need them most.

4. Department Chairs are working with their faculty and staff colleagues to review every engineering program and produce academic maps that provide guidance for timely completion of graduation and disciplinary preparation requirements at their universities. These maps will be available on university/departmental websites.

   Maps will then be compared across programs in the SUS for improved internal consistency, and utilized by advisors at each university to help students meet graduation requirements in a timely manner. They also will help students and families recognize the likely need for summer enrollments, the importance of group and capstone projects, and particularly the need to try to integrate internships into their academic maps.

Not all of our engineering students are prepared equally to retain, graduate, and succeed professionally, but all our students deserve our best efforts and every opportunity to succeed. We are committed to that objective and pledge to work to better our efforts in successfully educating every student accepted into our engineering programs and universities.



Poster sent to all Florida high school math teachers and county school boards.

Appendix I

61G15-20.006 Educational Requirements.

(1) The evaluation of curricula and standards of accreditation for approval of degree programs required by Section 471.013, F.S., shall be based upon:

(a) An overview of engineering programs within the United States accredited by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology, Inc., (ABET), and

(b) An evaluation of such programs and schools, following the definition of the practice of engineering set forth in Section 471.005(6), F.S.

(2) This rule shall not apply to Board approved engineering programs or where ABET accreditation is available to a school or college of engineering.

(3) Acceptable curricula requirements and degree programs shall conform to the criteria for accrediting engineering programs set forth by the Engineering Accreditation Commission of the Accreditation Board for Engineering and Technology, Inc., (ABET) and found in the applicable Annual Report of ABET.

(4) The evaluation of the applicant's transcript and degree program shall include a determination of whether such a transcript and degree program is comparable to the above-mentioned model by the Education Advisory Committee as defined in Rule 61G15-18.015, F.A.C.

(5) In order to verify the applicant's curriculum and engineering program the Board may require evidence from the applicant's institution(s) at the cost of the applicant as to the areas mentioned in subsection 61G15-20.006(3), F.A.C., including when the information necessary for the evaluation set forth in subsection (4) above is not available, a site visit by Educational Advisory Committee of the Board at the expense of the applicant.

Specific Authority 471.013(1)(a)3. FS. Law Implemented 471.013(1)(a)3., 471.005(6) FS. History–New 8-18-87, Formerly 21H-20.006, Amended 12-26-94.