



California Education Learning Lab



Enrollment and Completion Gaps in STEM Higher Education

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This brief surveys data on enrollment and completion gaps for female, African American, and Latinx students¹ in Science, Technology, Engineering, and Mathematics (STEM) fields in California's systems of public higher education—the University of California, the California State University, and California Community Colleges. This brief is the first in a three-part series examining equity gaps in STEM undergraduate education in California. The second brief will summarize research identifying sources of enrollment and completion gaps and the third will discuss approaches to closing enrollment and completion gaps and improving learning outcomes in STEM.

Both nationally and in California, female and underrepresented minority (URM) students are underrepresented in STEM overall and are highly underrepresented in particular STEM fields, including engineering and computer science. Female and URM students are more likely to leave a STEM major than their male and non-URM peers and they are less likely to graduate with a STEM degree. Research suggests that the resulting gaps in STEM enrollment and completion are the product of cultural and institutional barriers that deter many female and URM students from entering or remaining in STEM and that pose significant equity concerns for California's institutions of higher education and workforce. Barriers in STEM deprive women and underrepresented minorities of opportunities to earn degrees that provide access to growing fields and high wage careers in science and technology, and to learn skills that are increasingly in demand as technological developments reshape the economy and the workforce.² Moreover, as California's overall and college-going populations diversify, the persistence of enrollment and completion gaps among female and URM students in

¹ The low number of STEM degrees awarded to American Indian students do not allow for the inclusion of data regarding American Indian students in this brief. The number of degrees in particular STEM fields awarded to students identifying as American Indian, as reported on IPEDS, frequently falls below 10 degrees per year in CCC, CSU and UC systems. This produces relatively significant variations year to year in the percentage of degree recipients who identify as American Indian and, within the context of this brief, makes it difficult to compare completion gaps between 2006-7 and 2016-17. In addition, changes to IPEDS reporting definitions and the inclusion after 2007 of a "two or more races" category particularly affected the proportion of students identifying as American Indian, further making it difficult to compare completion gaps for American Indian students between 2006-7 and 2017-17. Joely Proudfit and Theresa Gregor, *The State of American Indian & Alaska Native Education in California, 2016* (California Indian Culture and Sovereignty Center, California State University San Marcos), https://www.csusm.edu/cicsc/projects/projects_docs_images/2016saiianec_final1.pdf.

² Andrew Chamberlain and Jyotsna Jayaraman, *The Pipeline Problem: How College Majors Contribute to the Gender Pay Gap* (GlassDoor, April 2017), <https://www.glassdoor.com/research/app/uploads/sites/2/2017/04/FULL-STUDY-PDF-Gender-Pay-Gap2FCollege-Major.pdf>.

STEM fields challenges the ability of California's institutions of higher education to meet workforce needs and demand for graduates with a STEM education.³

Overall, the number of female, Latinx, and African American students enrolled in STEM fields in California's segments of public higher education has grown considerably in the past decade, as has the number of baccalaureate degrees awarded to underrepresented students. The percentage of female, Latinx, and African American students majoring in STEM fields and earning STEM degrees is also growing; enrollment of female, Latinx, and African American students in STEM fields is, moreover, increasing at a faster rate than overall female and URM enrollment. This growth in enrollment and degrees among populations who have been historically underrepresented in STEM is a product both of growing interest in STEM fields overall and of the efforts of California's segments and campuses of public higher education, and their respective STEM departments and faculties, to address and close equity gaps.

Yet, even as more female, Latinx, and African American students enroll and earn degrees in STEM fields, notable enrollment and completion gaps remain:

- In 2016-17, female students accounted for 54 percent of all UC baccalaureates, but only 43 percent of bachelor's degrees in the STEM fields of biological and life sciences, computer and information sciences, engineering, mathematics, and physical sciences. Female students comprised almost 58 percent of CSU baccalaureates, but only 34 percent of students earning bachelor's degrees in those STEM fields.
- In the same year, African American students accounted for 2 percent and Latinx students accounted for 21 percent of UC baccalaureates, but African American and Latinx students respectively accounted for only 1.3 percent and 15 percent of UC baccalaureates in STEM fields. In the CSU system, African American students and Latinx students respectively accounted for 4 percent and 36 percent of all baccalaureates, but African Americans students accounted for only 2 percent and Latinx students accounted for only 27 percent of bachelor's degrees in STEM fields.
- These degree gaps are the result of both lower levels of enrollment in STEM among female and URM students and higher rates of attrition from STEM fields. High rates of student attrition characterize STEM fields generally, but women and URM students tend to leave STEM fields at higher rates than their male and non-URM peers. Among the 2011 cohort of first-time freshmen entering the CSU system, slightly more than half of white students who entered as STEM majors ultimately graduated with a STEM degree within six years. In comparison, only about a quarter of Latinx student who entered as STEM majors graduated within six years with a STEM degree and only about 15 percent of African American students who entered as STEM majors graduated within six years with a STEM degree.
- Although female and URM students are underrepresented overall in STEM fields, there is also significant variation in representation by field of study. Female, Latinx, and African American students

³ California Competes, *Mind the Gap: Delivering on California's Promise for Higher Education* (Berkeley, CA, 2015); Campaign for College Opportunity, *Needed: Sy(STEM)ic Response: How California's Public Colleges and Universities are Key to Strengthening the Science, Technology, Engineering, and Math (STEM) and Health Workforce* (Los Angeles and Sacramento, CA: June 2016).

are severely underrepresented in engineering and computer science in terms of enrollment and degree attainment. On the other hand, female students are overrepresented among biology students and biology baccalaureates; URM students are generally represented in biology departments at levels that approximate or equal their system-wide enrollment.

Defining STEM

This brief follows the [National Center for Education Statistics](#) (NCES) and the [Consortium for Student Retention Data Exchange](#) (CSRDE) in defining STEM to include the biological and life sciences, computer and information sciences, engineering, mathematics, and physical sciences. These are core science, technology, math, and engineering fields that are generally included under the rubric of STEM, and they represent (with the exception of pre-medicine) the undergraduate fields whose students are commonly eligible for participation in programs like MESA (Math, Engineering, Science Achievement) and LSAMP (Louis Stokes Alliance for Minority Participation), which aim to support underrepresented students in STEM. They are also fields that have traditionally been characterized by equity and achievements gaps in terms of enrollment, persistence, and completion.

There is, however, no single, commonly accepted definition of STEM and education researchers and education agencies vary as to which specific disciplines to classify as STEM. Some agencies use broader definitions of STEM that include the social and behavioral sciences, particular disciplines from the social and behavioral sciences, or applied science and technology fields (including health sciences).⁴ When the Public Policy Institute of California (PPIC) reported in July 2018 on STEM degree production in California, it based its calculations on degrees in engineering, biology, computer and information sciences, mathematics, and the physical sciences.⁵ The UC system, on the other hand, includes the health sciences when self-reporting overall STEM enrollment and completion data.⁶ Individual LSAMP programs, meanwhile, vary in their inclusion of agricultural science or applied engineering and technology fields as eligible STEM fields.⁷

The narrow definition of STEM used in this brief can understate overall student participation in science, technology, math, and engineering. This is particularly significant when looking at science and technology enrollment and completion data across California's higher education segments, since a higher proportion of CSU and CCC students are enrolled in applied fields (particularly in health science and technology) than in the UC. In the case of health professions majors, for example, approximately 5 percent of CSU undergraduates are in health profession majors, compared to about 1.5 percent of UC undergraduates. With regard to the following data, including health professions/health sciences as STEM would raise the percentage of CSU STEM students who are female from 33.5 (see Table 2) to almost 42 percent.

⁴ Boris Granoskiy, *Science, Technology, Engineering, and Mathematics (STEM) Education: An Overview* (Congressional Research Service, June 12, 2018), <https://fas.org/sgp/crs/misc/R45223.pdf>.

⁵ Hans Johnson and Sergio Sanchez, *More Students Are Earning STEM Degrees* (Public Policy Institute of California, July 31, 2018), <https://www.ppic.org/blog/more-students-are-earning-stem-degrees/>.

⁶ University of California Infocenter, UC STEM Degree Pipeline, <https://www.universityofcalifornia.edu/infocenter/uc-stem-degree-pipeline>.

⁷ For instance, compare the majors eligible for LSAMP participation at Cal State Los Angeles, <http://www.calstatela.edu/lsamp/about-lsamp>, to those eligible for LSAMP participation at Fresno State, <https://www.fresnostate.edu/csm/lsamp/prospective/index.html>.

STEM Enrollment

Student interest in STEM higher education is increasing. According to the National Science Board, the percentage of freshmen within the United States intending to major in a science or engineering field (excluding the social, behavioral, and health sciences) increased from 22.9 percent in 2004 to 35 percent in 2014. Notably, interest in STEM majors increased both for female and male students and across ethnic groups.⁸ PPIC, meanwhile, calculates that the number of students earning a bachelor's degree in a STEM field in California increased by 55 percent between 2010-11 and 2016-17, almost three times the level of growth in other degrees (17 percent).⁹

The following are enrollment data from the UC and CSU systems from fall 2008 and fall 2018, showing the percentage of students enrolled in select STEM fields who are women, African American, or Latinx.

In both UC and CSU, female, Latinx, and African American enrollment in STEM has grown and also increased at a greater rate than female and URM enrollment overall. In UC, the number of women majoring in broad STEM disciplines increased from 60,152 in 2008 to 92,703 in 2018; the number of Latinx students enrolled in STEM grew from 7,652 to 19,460, and the number of African American students majoring in STEM fields grew from 1,491 to 2,744. In CSU, over the same period, the number of women enrolled in STEM fields increased from 20,842 to 33,070. The number of Latinx students in CSU majoring in STEM grew from 13,550 to 35,536, while the number of African American students enrolled in STEM remained largely unchanged at about 2,840.¹⁰

Yet the extent to which increased STEM enrollment among female, African American, and Latinx students has reduced enrollment gaps varies among fields, since STEM enrollment has also grown for men and non-underrepresented students. In general, undergraduate STEM enrollment continues to display large gaps in female and URM enrollment. In addition, even though the percentage of female and URM students enrolling in STEM majors increased between 2008 and 2018, their level of participation in STEM majors remains significantly lower than that of their male and non-URM peers.

In considering the following data, it is important to note that enrollment data are not fully comparable between the UC and CSU systems, since the systems categorize broad disciplines differently—the UC system categorizes natural resources and conservation sciences and selected agricultural/animal sciences in the life sciences, while CSU groups these disciplines with non-STEM fields as interdisciplinary subjects.¹¹ Neither UC nor CSU publishes enrollment data by specific major/concentration disaggregated by student gender and ethnicity. In addition, the two segments use different definitions when identifying students by race/ethnicity.

⁸ National Science Board, *Science & Engineering Indicators, 2016*, Chapter 2, “Higher Education in Science and Engineering. Retrieved from: <https://www.nsf.gov/statistics/2016/nsb20161/#/report/chapter-2/undergraduate-education-enrollment-and-degrees-in-the-united-states>.

⁹ Hans Johnson and Sergio Sanchez, *More Students Are Earning STEM Degrees* (Public Policy Institute of California, July 31, 2018), <https://www.ppic.org/blog/more-students-are-earning-stem-degrees/>.

¹⁰ These numbers are from enrollment data as reported in UC InfoCenter, Enrollment at a Glance, <https://www.universityofcalifornia.edu/infocenter/fall-enrollment-glance>; and California State University Office of the Chancellor, Institutional Research and Analyses, Statistical Reports, <https://www.calstate.edu/as/stats.shtml>.

¹¹ The UC and CSU systems do not publicly report enrollment data (disaggregated by gender and ethnicity) by specific field, so it is not possible to precisely calculate STEM versus non-STEM enrollment in broad disciplines that include both STEM and non-STEM fields, or to arrive at fully comparable data on STEM enrollment gaps for the two systems.

UC

Between 2008 and 2018, the number of UC female students enrolled in STEM increased by 60 percent, twice the rate of growth of overall female enrollment, and the number of UC Latinx students enrolled in STEM increased by more than 150 percent (in comparison, Latinx enrollment in UC overall increased by 100 percent). Meanwhile, African American enrollment in UC STEM fields increased by 84 percent, while overall African American enrollment grew by 58 percent. As a result of this growth in STEM enrollment among underrepresented students, the percentage UC STEM students who were female or African American increased slightly between 2008 and 2018, and there was a notable increase in Latinx representation in UC undergraduate STEM enrollment.

Nevertheless, gaps by student ethnicity and gender continue to characterize UC STEM enrollment. In fall 2018, female students comprised 53.8 percent of total UC undergraduate enrollment, but only 45.8 percent of UC undergraduate enrollment in the broad STEM disciplines of the biological and life sciences, the physical sciences, and engineering/computer science (see Table 1).¹² Latinx students comprised 24.4 percent of overall UC undergraduate enrollment but only 21 percent of STEM enrollment, and African American students accounted for 4.1 percent of overall undergraduate enrollment but only 3 percent of STEM enrollment. Female and URM students thus remain underrepresented in STEM, but underrepresentation has decreased since 2008 for female and Latinx students (see Table 1).

Table 1 – Percentage of UC Undergraduate Enrollment Overall and by STEM Field that is Female, African American* or Latinx Fall 2008 and 2018

	Female		African American		Latinx	
	2008	2018	2008	2018	2008	2018
Total Enrollment	53.6	53.8	3.3	4.1	15.7	24.4
Total STEM Enrollment	44.0	45.8	2.5	3.0	12.7	21.0
Engineering/CS	19.8	24.9	1.8	2.1	12.0	17.2
Life Sciences**	59.0	65.0	2.9	4.0	13.0	24.9
Physical Sciences	43.0	42.1	2.2	2.2	13.3	19.5

Source: UC Infocenter, Enrollment at a Glance, <https://www.universityofcalifornia.edu/infocenter/fall-enrollment-glance>.

Notes: * For this and following tables: the number of students identifying as multi-racial has increased in the last decade, which may reflect changes in cultural and data definitions, as well as actual demographic change.

**In UC reporting, the life sciences include the biological sciences, conservation sciences, and selected agricultural sciences.

In UC, STEM participation (in terms of the proportion of female and URM student enrollment that is in STEM majors) has increased for female and URM students but remains lower than it is for male and non-URM students.

¹² UC reports enrollment based on broad discipline, rather than students’ specific major field. According to UC, the life sciences category includes the biological sciences, conservation science and selected agricultural sciences. The physical sciences include mathematics. An explanation of these broad discipline classifications is included in UC’s *Annual Accountability Report, 2018* at p. 215, https://accountability.universityofcalifornia.edu/2018/documents/pdfs/Accountability_2018_web.pdf.

- In 2018, 35.5 percent of female students majored in a STEM field (up from 28.6 percent in 2008).
- STEM participation also increased among Latinx and African American students between 2008 and 2018. In 2018, 35.9 per cent of Latinx students were enrolled in STEM (up from 28.2 percent in 2008) and 30.2 percent of African American students were enrolled in a STEM field (up from 26 percent in 2008).
- In comparison, however, 48.3 percent of male undergraduates were enrolled in STEM majors in 2018 (up from 42.1 percent in 2008) and 40.4 percent of white students were enrolled in STEM fields (up from 30.0 percent in 2008).

CSU

For calculating STEM enrollment for the CSU system, this brief includes the broad disciplines of biological sciences, engineering, information science (including computer science), mathematics, and the physical sciences. It does not include some fields commonly categorized with the biological/life sciences, including natural resources and agricultural/animal science fields, since the CSU system categorizes those fields with non-STEM disciplines within the broad division of “interdisciplinary” studies. Including those additional fields would slightly change the CSU STEM enrollment figures and percentages discussed in this section.

Between 2008 and 2018, the number of women enrolled in STEM fields in CSU increased by nearly 60 percent, while overall enrollment of female students in CSU increased by about 15 percent. Latinx enrollment in STEM increased by more than 162 percent, while Latinx enrollment overall increased by 100 percent. The number of African American students enrolled in CSU STEM fields remained largely unchanged during this period, even as African American CSU enrollment overall dropped by 23 percent.

Table 2: Percentage of CSU Undergraduate Enrollment Overall and by STEM Field that is Female, African American* or Latinx, Fall 2008 and 2018

	Female	Female	African American	African American	Latinx	Latinx
	2008	2018	2008	2018	2008	2018
Total Enrollment	56.7	55.8	6.1	4.0	24.9	42.8
Total STEM Enrollment**	33.2	33.5	4.6	2.9	21.6	35.9
Biological Sciences	61.7	66.0	6.0	3.6	21.6	43.1
Engineering	13.7	18.6	3.4	2.3	22.8	33.8
Information Science***	16.2	17.9	5.3	3.1	15.6	28.6
Mathematics	48.3	45.2	4.0	2.4	28.3	44.3
Physical Sciences	44.8	44.9	4.5	3.1	19.0	39.2

Source: California State University Office of the Chancellor, Institutional Research and Analyses, Statistical Reports, <https://www.calstate.edu/as/stats.shtml>.

Notes: *CSU and UC employ different definitions for reporting race and ethnicity data, with particularly large discrepancies in enrollment reporting for students who identify as Black or African American. As a result, enrollment figures by student race/ethnicity for CSU and UC are not comparable.

**The total STEM calculation for CSU does not include conservation and agricultural science fields that are commonly classified as STEM.

*** The CSU broad discipline category of information science includes a small number of students in fields, including accounting information and management information systems, that are not commonly classified as STEM.

Despite notable growth in the number of female and Latinx students enrolled STEM fields, gaps remain in CSU STEM enrollment. As illustrated in Table 2 above, female students constituted 55.8 percent of overall undergraduate enrollment in the CSU system in fall 2018, but only 33.5 percent of STEM enrollment. Latinx students constituted 42.8 percent of overall undergraduate enrollment, but only 35.9 percent of STEM enrollment; African American students constituted 4 percent of overall undergraduate enrollment, but only 2.9 percent of STEM enrollment. The percentage of STEM enrollment comprised by female students increased slightly between 2008 and 2018, while the Latinx share of STEM enrollment expanded considerably from 21.6 percent in 2008 to 35.9 percent in 2018. On the other hand, the African American share of STEM enrollment declined during this period.

As in the UC, STEM participation has increased for female and URM students but remains lower than it is for male students and for white students.

- In 2018, twice as many male CSU undergraduates were enrolled in STEM majors as female undergraduates (65,783 to 33,070). Male students were also much more likely than female students to be STEM majors. In 2018, 13.8 percent of female undergraduates were enrolled in STEM fields (up from 10 percent in 2008). In comparison, 34.7 percent of male undergraduates were enrolled in STEM majors in 2018 (up from 26.4 percent in 2008).
- In 2018, 16.5 percent of African American undergraduates were enrolled in STEM majors (up from 12.7 percent in 2008) and 19.3 percent of Latinx students were enrolled in STEM fields (up from 14.8 percent in 2008). In comparison, 24.3 percent of white students were enrolled in STEM majors in 2018 (up from 16.5 percent in 2008).

Enrollment by Field of Study in UC and CSU

In addition to illustrating enrollment gaps by gender and ethnicity in STEM overall, Tables 1 and 2 reveal that enrollment gaps vary considerably by field. In 2018, female students accounted for about 65 percent of undergraduate enrollment in the life and biological sciences in UC and CSU. African American and Latinx students, meanwhile, are represented in these fields at approximately their levels of system-wide enrollment. Conversely, URM and, especially, female students are severely underrepresented in engineering and computer science. Female and URM students are also underrepresented in math and the physical sciences, but less so than in engineering and CS.

Female students constituted only 25 percent of engineering/CS enrollment in the UC system in 2018. In the CSU system, in that same year, female students represented only 18.6 percent of engineering enrollment and 18 percent of enrollment in CS/Information Sciences.

- As of fall 2018, 7 percent of female UC undergraduates were enrolled as engineering or computer science majors, compared to a quarter of male UC undergraduates.¹³

¹³ This information is calculated from enrollment figures contained in UC Infocenter, Enrollment at a Glance, <https://www.universityofcalifornia.edu/infocenter/fall-enrollment-glance>.

- In fall 2018, only 3 percent of female students in the CSU system were enrolled as engineering majors, compared to 17.5 percent of male students. Only about 1.5 percent of CSU female students were information science majors, compared to about 9 percent of male students.¹⁴

STEM Attrition and Graduation Rates

High rates of attrition and low rates of degree completion are primary barriers to increasing degree attainment in STEM fields. The National Center for Education Statistics (NCES) reported in 2013 that 48 percent of baccalaureate candidates who entered a STEM program between 2003 and 2009 had left STEM majors by spring 2009. NCES also reported that of associate degrees candidates who indicated that they were majoring in a STEM field between 2003 and 2009, 69 percent had left STEM by spring 2009.¹⁵

Low rates of persistence and completion in STEM fields are particularly pronounced among female and underrepresented minority students. A national 2014 study, which focused on the students entering 4-year institutions in 2004, found that less than one-third of Latinx students and slightly more than one-fifth of African American students in STEM majors finished in six years or less. Conversely, 46 percent of white and Asian American students in STEM majors graduated in six years or less.¹⁶

Among California's segments of higher education, system-wide data on STEM attrition is available only for CSU through that system's reporting to the Consortium for Student Retention Data Exchange (CSRDE).¹⁷

These system-wide data reveal notable gains in retention and improvements in graduation rates for female, African American, and Latinx students (see Tables 3 and 4). Between the 2007 and 2015 entering student cohorts, the proportion of female, first-time freshmen who entered as STEM students and remained in a STEM discipline after two years increased from 52.2 to 57.1 percent. The proportion of African American students who remained in STEM after two years increased from 39.4 percent to 51.8 percent and the proportion of Latinx students who remained in STEM increased from 47.6 to 52.8 percent. Improvements in retention and graduation rates are suggestive of the impact of campus and system-wide work to strengthen STEM diversity, including faculty and departmental efforts to reduce achievement gaps and programs like the California State University Louis Stokes Alliance for Minority Participation (CSU LSAMP).¹⁸

Despite gains, significant gaps in STEM retention and graduation remain:

¹⁴ This information is calculated from enrollment figures contained in CSU Office of the Chancellor, Institutional Research and Analyses, Statistical Reports, https://www.calstate.edu/as/stat_reports/2017-2018/fmaj06.htm.

¹⁵ Xianglei Chen and Matthew Soldner, *STEM Attrition: College Students' Paths Into and Out of STEM Fields* (National Center for Education Statistics, November 2013), <https://nces.ed.gov/pubs2014/2014001rev.pdf>, p. 14.

¹⁶ Kevin Eagan, et al., *Examining STEM Pathways among Students Who Begin College at Four-Year Institutions* (The National Academies, 2014), http://sites.nationalacademies.org/cs/groups/dbassesite/documents/webpage/dbasse_088834.pdf; Adrianna Kezar and Elizabeth Holcombe, *Creating a Unified Community of Support: Increasing Success for Underrepresented Students in STEM—A Final Report on the CSU STEM Collaboratives Project* (USC Pullias Center for Higher Education, 2017), p. 7. Retrieved from: <https://pullias.usc.edu/csustemcollab/#report>.

¹⁷ [California State University Office of the Chancellor, Institutional Research and Analyses](http://asdc.calstate.edu/csrde/index.shtml#stemi), California State University Graduation Rates, Consortium for Student Retention Data Exchanges (CSRDE), <http://asdc.calstate.edu/csrde/index.shtml#stemi>.

¹⁸ Lisa Hammersley, *CSU-LSAMP 2015 Impact Report* (California State University, Sacramento, 2015), [https://www.csus.edu/csu-lsamp/CSULSAMP%20Impact%202015\(small\).pdf](https://www.csus.edu/csu-lsamp/CSULSAMP%20Impact%202015(small).pdf).

- For the 2015 first-time freshmen cohort, only about 57 percent of female students who entered CSU intending to major in STEM remained in a STEM major, compared to nearly 64 percent of male students. Only about half of Latinx and African American students who entered intending to major in STEM remained in a STEM major after two years, compared to nearly 68 percent of white students.
- Slightly more than half of the white students who entered CSU as STEM majors ultimately graduated with a STEM degree within six years. Conversely, only 27.2 percent of Latinx students who entered as STEM majors graduated with a STEM degree in six years; for African American students, that figure is 15.4 percent.

CSRDE reporting does not provide data for retention and graduation rates for students by discipline, so it is not clear based on publicly reported information how retention rates for female and URM students compare among STEM fields.

Table 3 – STEM 2-Year Retention Rates in CSU for First-Time Freshmen (2007 and 2015 Cohorts)

	Total	Total	Female	Female	African American	African American	Latinx	Latinx
	2007	2015	2007	2015	2007	2015	2007	2015
Total System-wide Retention Rate	75.0%	74.9%	75.4%	75.9%	64.1%	66.7%	72.5%	72.5%
% of STEM Entry Students Remaining in a STEM Discipline	55.3%	61.2%	52.2%	57.1%	39.4%	51.8%	47.6%	52.8%

Source: California State University Office of the Chancellor, Institutional Research and Analyses, California State University Graduation and Continuation Rates, Consortium for Student Retention Data Exchanges (CSRDE), <http://asd.calstate.edu/csrde/index.shtml#stemi>.

Table 4 – STEM 6-Year Graduation Rates in CSU for First-Time Freshmen (2007 and 2011 Cohorts)

	Total	Total	Female	Female	African American	African American	Latinx	Latinx
	2007	2011	2007	2011	2007	2011	2007	2011
Total System-wide Graduation Rate	51.8%	59.2%	54.9%	62.1%	35.9%	43.3%	44.9%	53.6%
Graduation Rate for STEM Entry Students Graduating with STEM Degree	32.5%	39.1%	30.6%	35.7%	11.2%	15.4%	19.5%	27.2%

Source: California State University Office of the Chancellor, Institutional Research and Analyses, California State University Graduation and Continuation Rates, Consortium for Student Retention Data Exchanges (CSRDE), <http://asd.calstate.edu/csrde/index.shtml#stemi>.

Gaps in STEM Degrees

Low rates of female and URM student participation in STEM fields like engineering and computer science combine with high levels of attrition from STEM fields among female and URM students to produce significant equity gaps with regard to the completion of STEM degrees. NCES reports that, in 2015-16, 58 percent of all

baccalaureate degrees were awarded to female students, but that only 36 percent of STEM bachelor's degrees were awarded to women. During that year, 18 percent of all baccalaureate degrees were awarded to students in STEM fields. Yet only 15 percent of baccalaureates awarded to Latinx students and only 12 percent of baccalaureates awarded to African American students were in STEM disciplines.¹⁹

The following sections survey the state of completion gaps by examining data on undergraduate STEM degrees awarded by California's segments of public higher education in 2006-7 and 2016-17 (the most recent year for which completion data is available), as reported to the National Center for Education Statistics' Integrated Postsecondary Education Data System (IPEDS).²⁰ These data show that California's colleges and universities have dramatically increased the number of STEM degrees awarded to female and URM students:

- Between 2006-7 and 2016-17, the number of UC bachelor's degrees in STEM fields awarded to women increased by 63 percent (from 5,655 to 9,243), while the number of bachelor's awarded to female students overall increased by 28 percent.
- During the same period, the number of CSU bachelor's degrees awarded to female students in STEM increased by 85 percent (from 3,223 to 5,954), while the total number of baccalaureate degrees awarded to women increased by 35 percent.²¹
- The number of Latinx students receiving UC bachelor's degrees in STEM fields more than tripled (from 983 to 3,185) and the number of Latinx students earning CSU bachelor's degrees in STEM fields nearly quadrupled (from 1,227 to 4,645). In both segments, the growth in the number of STEM baccalaureates awarded to Latinx students was about double the overall rate of increase for baccalaureates going to Latinx students.²²

Despite these gains, substantial STEM completion gaps remain in California's system of higher education and the extent to which increases in degree completion have mitigated equity gaps varies by student group and by field. Although the number of STEM degrees awarded to women increased between 2007 and 2017, the rate of growth in the number of STEM degrees awarded to men was even faster. As a result, the percentage of STEM baccalaureate degrees awarded to women actually declined slightly between 2006-7 and 2016-17 in all three segments of California public higher education. The percentage of STEM degrees awarded to African American students also declined. On the other hand, the percentage of STEM degrees going to Latinx students increased considerably and completion gaps in STEM for Latinx students have narrowed.

¹⁹ Cristobal de Brey, et al., *Status and Trends in the Education of Racial and Ethnic Groups 2018* (National Center for Education Statistics and American Institutes for Research, February 2019). Retrieved from: <https://nces.ed.gov/pubs2019/2019038.pdf>

²⁰ This brief follows CSRDE in including the following fields, by Classification of Instructional Programs (CIP) code, as STEM: CIP 03.xxxx (Natural Resources and Conservation), CIP 11.xxxx (Computer and Information Science), CIP 14.xxxx (Engineering), CIP 15.xxxx (Engineering Technologies), CIP 26.xxxx (Biological and Biomedical Sciences), CIP 27.xxxx (Mathematics and Statistics), CIP 40.xxxx (Physical Science), as well as CIP 01.0000 (Agriculture, General), CIP 01.0801 (Agricultural and Extension Education Services), CIP 01.09 thru 01.9999 (Animal and Agricultural Sciences), CIP 30.1901 (Nutrition Sciences).

²¹ The overall number of baccalaureate degrees awarded to female students increased from 22,800 to 29,076 in UC and from 42,124 to 57,008 in CSU.

²² The overall number of baccalaureate degrees awarded to Latinx students increased by 110 percent in UC (from 5,331 to 11,227) and by 142 percent in CSU (from 14,483 to 35,020).

STEM Degrees in UC and CSU

Tables 5 and 6 show the percentage of bachelor's degrees in STEM subjects in the UC and CSU systems going to female and URM students in 2006-7 and 2016-17. In order to avoid double-counting students and degrees, the following calculations are based on students' primary major.

In relation to their share of all baccalaureate degrees awarded, female students are underrepresented in STEM fields outside the biological and life sciences.

- In 2016-17, female UC students earned 54.1 percent of baccalaureate degrees, but (based on students' primary major) only 42.5 percent of baccalaureate degrees in STEM, down from 43.7 percent of STEM degrees in 2006-7.
- In 2016-17, female CSU students earned 57.7 percent of all baccalaureate degrees, but only 34.4 percent of bachelor's degrees in STEM, a figure that is slightly lower than the 34.6 percent of CSU STEM degrees that went to female students in 2006-7.
- The proportion of female baccalaureates in both systems who earned their degrees in STEM fields increased between 2006-7 and 2016-17. In 2016-17, 31.8 percent of female UC baccalaureates earned a STEM degree (up from 24.8 percent in 2006-7) and 10.4 percent of female CSU baccalaureates earned a STEM degree (up from 7.7 percent in 2006-7). In comparison, however, 50.7 percent of male UC baccalaureates earned a STEM degree in 2016-17 (up from 38.7 percent in 2006-7); in the same year, 27.2 percent of male CSU baccalaureates earned a STEM degree (up from 21.1 percent in 2006-7).

Table 5 – Percentage of UC Bachelor's Degrees Overall and in STEM fields (by Primary Major) Awarded to Female, African American*, and Latinx Students, 2006-7 and 2016-17

	Female	Female	African American	African American	Latinx	Latinx
	2006-7	2016-17	2006-7	2016-17	2006-7	2016-17
All	54.8	54.1	2.8	2.2	12.8	20.9
All STEM	43.7	42.5	1.5	1.3	7.6	14.7
Biological and Life Sciences**	59.7	60.3	1.6	1.7	7.7	16.4
Engineering	18.9	22.8	1.3	1.2	6.7	14.9
Computer Science	13.1	19.1	1.7	1.0	5.7	8.5
Mathematics	40.6	43.2	1.8	0.5	11.1	12.2
Physical Science	43.7	36.1	1.4	1.3	8.4	16.7

Source: Integrated Postsecondary Education Data System (IPEDS).

Notes: *IPEDS uses different definitions for reporting race and ethnicity data than UC; these different definitions produce particularly large discrepancies in the reporting of enrollment and completion data for African American or Black students. As a result, these completion statistics are not comparable to the UC enrollment figures in Table 1.

**The Biological and Life Sciences in this table and in Table 6 include degrees in the following fields: Natural Resources (CIP 03.xxxx); Biological and Biomedical Sciences (CIP 26.xxxx); and selected agricultural/animal sciences (CIP 01.0000, CIP 01.0801, CIP 01.09 thru 01.9999, and CIP 30.1901).

Table 6 – Percentage of CSU Bachelor’s Degrees Overall and in STEM fields (by Primary Major) Awarded to Female, African American, and Latinx Students, 2006-7 and 2016-17

	Female	Female	African American	African American	Latinx	Latinx
	2006-7	2016-17	2006-7	2016-17	2006-7	2016-17
All	59.4	57.7	4.9	3.8	20.4	35.5
All STEM	34.6	34.4	3.0	2.0	13.2	26.8
Biological and Life Sciences	60.8	60.8	3.4	2.4	11.9	28.2
Engineering	16.0	17.1	2.8	1.6	14.1	25.9
Computer Science	16.4	13.2	2.9	1.8	10.0	22.0
Mathematics	46.8	43.5	1.9	2.0	20.7	34.3
Physical Science	40.2	39.1	3.3	2.4	12.0	27.4

Source: IPEDS.

The percentage of bachelor’s degrees in computer science going to female students has increased in the UC system (from 13.1 to 19.1 percent) but decreased in the CSU system (from 16.4 to 13.2 percent). The percentage of bachelor’s degrees in engineering going to female students increased in both the UC and CSU systems, from 18.9 to 22.8 percent and from 16.0 to 17.1 percent, respectively.

UC and CSU African American students are underrepresented among students obtaining bachelor’s degrees in all STEM fields.

- The percentage of STEM degrees going to African American students decreased in both the UC and CSU systems between 2006-7 and 2016-17. The percentage of UC STEM degrees going to African American students fell from 1.5 to 1.3 percent and the share of CSU STEM degrees going to African American students fell from 3.0 to 2.0 percent. This decline in the African American share of STEM degrees is present across most STEM fields.
- Although the percentage of STEM degrees going to African American undergraduates decreased, the proportion of African American baccalaureates who earned their degrees in STEM fields increased in both UC and CSU systems between 2006-7 and 2016-17. In 2016-17, 24.4 percent of African American UC baccalaureates earned a STEM degree (up from 16.9 percent in 2006-7) and 9.1 percent of African American CSU baccalaureates earned a STEM degree (up from 8.0 percent in 2006-7). In comparison, however, 40.7 percent of white UC baccalaureates earned a STEM degree in 2016-17 (up from 27.4 percent in 2006-7) and 20.4 percent of white CSU baccalaureates earned a STEM degree (up from 13.3 percent in 2006-7).

Latinx students are also underrepresented among STEM degree holders, but the percentage of STEM degrees going to Latinx students increased substantially in the UC and CSU systems, doubling in many fields, and reducing the degree of Latinx underrepresentation in STEM.

- Between 2006-7 and 2016-17, the percentage of STEM degrees earned by Latinx students (from 7.6 to 14.7 percent in UC and from 13.2 to 26.8 percent in CSU) grew more quickly than the percentage of baccalaureates overall earned by Latinx students.

- The proportion of Latinx baccalaureates who earned their degrees in STEM fields also increased considerably. In 2016-17, 28.4 percent of Latinx UC baccalaureates earned a STEM degree (up from 18.4 percent in 2006-7) and 13.3 percent of Latinx CSU baccalaureates earned a STEM degree (up from 8.5 percent in 2006-7).

California Community Colleges

The Community College system does not report enrollment data by student concentration, but does report data on degree awards to IPEDS, as well as through the California Community College Datamart system. Between 2006-7 and 2016-17, the number of associate degrees in STEM fields awarded by California's community colleges (as reported by IPEDS) grew from 2,869 to 10,009, an increase that is likely attributable, in large part, to the introduction of the Associate Degree for Transfer in 2010 by SB 1440. Transfer data would provide an alternative basis for evaluating changes in community college STEM completion, and also include students who transferred to a 4-year institutions without receiving associate degrees, but only the CSU system makes available data on community college transfers, disaggregated by gender, ethnicity, and field of study.

As in the UC and CSU systems, female and URM students are underrepresented among community college STEM graduates, in comparison to their overall share of degrees received (Table 7). Between 2006-7 and 2016-17, the level of underrepresentation among female and African American students earning associate degrees remained relatively constant while declining among Latinx students.

- The percentage of community college STEM associate degree recipients who were female decreased slightly (from 38.7 percent to 36.6 percent).
- The percentage of STEM degree recipients who were African American declined more substantially (from 4.0 percent to 2.8 percent).
- On the other hand, the percentage of STEM degree recipients who were Latinx more than doubled (from 19.8 percent to 33.3 percent).

The proportion of female, African American, and Latinx associate degree recipients who earned their degrees in STEM fields also increased. In 2006-7, about 2.2 percent of female students and 2.2 percent of African American students earning associate degrees received their degrees in STEM fields. Conversely, in 2016-17, 4.4 percent of female community college graduates and 3.8 percent of African American community college graduates received associate degrees in STEM. During this decade, the proportion of Latinx community college graduates who received associate degrees in STEM fields also increased from 2.7 percent to 5.5 percent. In comparison, however, the proportion of male community college graduates receiving associate degrees in STEM increased from 5.7 to 11.4 percent and the proportion of white community college graduates receiving STEM degrees increased from 3.7 to 8.3 percent.

With regard to particular STEM fields, the percentage of students receiving associate degrees in engineering who were female increased from 16.8 to 21.1 percent, but the percentage of students receiving associate degrees in computer science who were female declined from 27.5 percent to 18.7 percent.

The African American share of STEM degrees declined in every field except the physical sciences. Conversely, although Latinx students remain underrepresented in STEM fields, the Latinx share of degrees in the biological and physical sciences doubled and increased substantially in every other STEM field.

Data is also available on community college transfers to the CSU system (see Table 8). In general, female and URM students are represented at a lower rate among CSU transfer students in STEM fields than among students earning associate degrees in STEM, but, overall, community college degree and CSU transfer data show similar trends. In comparison to first-time freshmen, community college transfers to CSU are significantly less likely to major in STEM fields. Based on CSU’s STEM designations, 16 percent of community college transfers in fall 2014 were STEM majors at entry, compared to 28 percent of first-time freshmen.²³

Table 7 – Percentage of Community College Associate Degrees Overall and in STEM Fields Awarded to Female, African American, and Latinx Students, 2006-7 and 2016-17

	Female	Female	African American	African American	Latinx	Latinx
	2006-7	2016-17	2006-7	2016-17	2006-7	2016-17
All Majors	62.5	60.0	6.5	5.2	25.5	43.6
All STEM	38.7	36.6	4.0	2.8	19.8	33.3
Biological and Life Sciences*	70.4	68.0	3.9	3.0	17.8	35.3
Engineering	16.8	21.1	3.5	2.5	23.9	37.1
Computer Science	27.5	18.7	6.3	4.6	18.6	28.4
Mathematics	27.8	30.2	3.1	1.8	23.2	33.7
Physical Sciences	44.6	38.1	--*	2.0	16.0	32.0

Source: IPEDS.

Notes: Percentages are not provided when fewer than 10 students received a degree for the year.

*The Biological and Life Sciences in this table and in Table 8 include degrees in the following fields: Natural Resources (CIP 03.xxxx); Biological and Biomedical Sciences (CIP 26.xxxx); and selected agricultural/animal sciences (CIP 01.0000, CIP 01.0801, CIP 01.09 thru 01.9999, and CIP 30.1901).

Table 8 – Percentage of California Community College Transfers to CSU Overall and by STEM field who are Female, African American, and Latinx, 2006-7 and 2016-17

	Female	Female	African American	African American	Latinx	Latinx
	2007	2017	2007	2017	2007	2017
All Majors	56.8	54.7	5.4	3.9	23.4	40.2
All STEM	34.8	29.8	3.9	2.5	18.0	31.6
Biological and Life Sciences	57.0	55.5	3.9	2.4	15.8	34.8
Engineering	12.6	15.3	3.7	2.3	19.9	31.6
Computer Science	15.4	14.0	3.8	3.1	16.5	26.4
Mathematics	47.8	38.3	5.0	3.1	24.7	37.5
Physical Science	40.2	40.8	4.1	1.8	18.0	29.8

Source: California State University Office of the Chancellor, Institutional Research and Analyses, California Community College Transfers to the CSU, <https://www.calstate.edu/as/stats.shtml>.

²³ California State University Chancellor’s Office, *CSU Outcomes Report 2015*, p. 23, http://asd.calstate.edu/doc/CSU-Undergraduate-Outcomes-Report_FINAL.pdf.

Conclusion

Data from California's segments of public higher education illustrate the existence of sizeable enrollment and completion gaps in STEM undergraduate education. Although enrollment of female, Latinx, and African American students in STEM majors is increasing and the scale of enrollment and completion gaps varies significantly by STEM field, levels of underrepresentation of female and URM students in STEM remain high overall. In addition, female and URM students are more likely than their male and white peers to leave a STEM major and less likely to graduate with a STEM degree.

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