

## CHAPTER EIGHT



# Teaching and Learning

Academic departments in ecology, evolution, and conservation biology are increasingly aware of the need to address longstanding barriers and challenges faced by Black, Indigenous, and People of Color (BIPOC) in these disciplines. A diverse group of faculty, staff, and students in the Department of Ecology and Evolutionary Biology (EEB) at UC Santa Cruz has now compiled a set of tools and strategies which departments can use to address shortcomings in equity and inclusion.

Published August 9 in *Nature Ecology & Evolution*, the recommendations are based on a review of the literature in an effort to identify evidence-based interventions for fostering anti-racism in the classroom, within research labs, and department-wide. “There’s nothing novel in our recommendations. These are empirically-based approaches developed by people who study these issues, and we’ve put them all in one place and tailored them for the disciplines of ecology, evolution, and conservation biology,” said first author Melissa Cronin, a Ph.D. candidate in ecology and evolutionary biology at UCSC. Cronin said she and senior author Erika Zavaleta, professor of ecology and evolutionary biology, saw a growing need for an easily accessible set of resources to help departments wanting to address historic and current inequities in their fields.

Cronin and Zavaleta recruited a diverse group of students, faculty, and staff within their department to work on the paper, which has 26 coauthors. “It was a really positive and constructive experience for our department to work together on this paper,” Cronin said. “And we built on this incredibly rich tradition of scholarship at UC Santa Cruz in critical race studies, a field which historically has not always intersected with the STEM fields.”

# TEACHING AND LEARNING

## Overview

The University of California provides its students with a rich learning environment created by faculty engaged in both teaching and academic research. Student learning at UC involves classes, seminars, and lab sections enhanced by collaboration with faculty and researchers. Through these activities, faculty and students engage in a learning process that helps develop critical thinking, communication, and problem-solving skills, as well as discipline-specific knowledge.

## Educating students and the public

UC's faculty are principally responsible for maintaining UC's academic excellence and promoting student success. Student retention, graduation rates, and measures of effectiveness are presented in Chapter 3. This chapter focuses on the learning experience of UC's undergraduate and graduate students, reporting what skills they have learned, their engagement with faculty and their peers, and satisfaction with their UC experience. A majority of both undergraduate and graduate students report improvement in academic skills. This chapter also reports on the composition and workload of instructional staff across different academic disciplines and professional programs.

Expanding learning opportunities beyond students on campus demonstrates the connection between the teaching and the public service missions of the University. UC Extension offers adult professional and continuing education programs to Californians and people around the world, enrolling hundreds of thousands of Californians in its programs each year.

## Promoting educational effectiveness

UC is committed to continuous improvement of instruction and employs a range of pedagogical and assessment strategies to enhance and support student learning. Campuses offer pedagogical development and training for faculty and teaching assistants to promote the use of evidence-based teaching practices and improve the quality of teaching and learning. UC's teaching and learning centers and offices of instructional development train hundreds of instructors each year, improving the quality of education for students in all disciplines across all ten campuses.

UC promotes educational effectiveness by supporting assessment of student learning. Assessment strategies include the development of program-level student learning outcomes and integration of evidence of student learning into academic program reviews. Programs across UC are undertaking curriculum redesign and improvement as a result of assessment work. Much of this aligns with the expectations of regional accrediting agencies, in particular the WASC Senior College and University Commission (WSCUC). As part of WSCUC accreditation, UC campuses assess five main core competencies of student learning: writing, oral communication, quantitative reasoning, information literacy, and critical thinking. Each UC campus posts its WSCUC accreditation reports online.

## Innovative instructional offerings

UC faculty develop and teach an ever-expanding catalog of online courses and programs, expanding learning opportunities for UC and non-UC undergraduates, graduates, and professional students. Through the UC cross-campus enrollment system, UC provides undergraduates access to high-demand courses offered at other UC campuses, increasing flexibility and opportunities for degree completion.



For non-UC students considering matriculation at a four-year university or resuming their studies, UC offers for-credit online courses that may transfer to other colleges and universities. UC Online provides courses that span a wide range of disciplines. UC Extension offers online continuing education courses, professional certificates, and post-baccalaureate programs for those seeking to advance their education and to enhance their professional skills.

In addition to online courses, UC leverages instructional technologies to enhance instruction and promote success. UC continues to develop and refine hybrid courses using multimedia resources, videos, podcasts, e-books, and other technology-based tools. UC follows best instructional practices to embed innovative technologies into course design and focuses on creating online and face-to-face learning experiences that encourage collaboration and maximize faculty-student and peer-to-peer interactions. Increasingly, UC courses utilize a flipped model of instruction, where lectures and other traditional classroom content are provided online, and classroom time is dedicated to group discussions, problem-solving activities, and other experiential exercises.

Ongoing assessment and data-driven approaches to teaching and learning are integral parts of UC's use of technology. Several UC campuses have adopted assessment systems that use online conceptual models and adaptive learning tools to determine students' knowledge quickly and accurately. Based on responses to questions, the software determines concepts or topics where each student needs to focus. Assessment and Learning in Knowledge Spaces (ALEKS) uses web-based adaptive tools to provide students with individualized feedback and learning pathways in entry-level math and chemistry courses. As part of the 2015 state budget framework agreement, three UC campuses engaged in a pilot study of the impact of adaptive learning technologies on student success and as a mechanism to strengthen instruction. The primary finding of the study was that when students use adaptive learning technology as intended, results are positive in relation to a student's overall performance in the course to which it is applied.

UC is enhancing student learning opportunities and success by expanding summer course offerings (in-person and online) to reduce students' time to degree and enrich their academic experience. Offering bridge experiences and orientation during summer also helps incoming students transition to campus life and prepare them for the rigorous courses at the undergraduate level.

## The impact and lessons of the pandemic

As a result of the COVID-19 pandemic, UC campuses shifted almost all of Spring 2020 courses to remote instruction and most courses remained remote during the academic year 2020–21. Faculty and staff did a historic and commendable job adapting almost all courses to remote in a matter of days or weeks. Campuses ramped up efforts to provide students the necessary technology, along with academic and counseling support to help students succeed in this environment. UC has been collecting and will continue to collect data and research about learning outcomes during this period. Among the most significant impacts of remote instruction is that students, on average, increased the number of units they were taking per term and enrollment in summer session increased dramatically.

To keep the University community informed of the impact of the pandemic on instruction, a series of Regents items were presented with the most up-to-date information that was available at the time of presentation. In addition, remote instruction provided the opportunity for Regents' presentations that focused more generally on best practices available within the University to improve pedagogy and student success with the goal of reducing equity gaps in learning. Here is a listing of relevant Regents' items from the past two years

[\*Update of Covid-19 impact on the University of California: academic and student Issues\*](#), May 20, 2020 (pdf)

[\*Planning and Evaluation of Covid-19 Academic and Student Impacts\*](#), September 16, 2020 (pdf)

[\*Twenty-First Century Skill Development for University of California Students\*](#), November 18, 2020 (pdf)

[\*The Future of Instruction: Designing Equitable Classrooms and Technology-Enhanced Learning at the University of California\*](#), January 20, 2021 (pdf)

[\*Using Curricular Innovations and Enhancements to Address Equity Gaps\*](#), March 17, 2021 (pdf)

[\*Fulfilling the Academic Mission: Academic Senate Survey of UC Faculty and Instructors About Their Experiences During the Pandemic\*](#), March 2020 to May 2021, July 21, 2021 (pdf)

[\*Instruction and Research at the University of California: COVID-19 Impact and Plans for Fall 2021\*](#), July 21, 2021 (pdf)

[\*Innovations in Assessment and Grading at the University of California\*](#), March 16, 2022 (pdf)

[\*Discussion Academic Integrity at the University of California\*](#), March 16, 2022 (pdf)

## For more information

[Campus websites \(website\)](#)

[Summer enrollment \(dashboard\)](#)

[UC Education Abroad Program \(dashboard\)](#)

[Undergraduate research experiences \(dashboard\)](#)

[Results of UC Undergraduate Experience Survey \(UCUES\) questions that were specific to remote instruction and other accommodations due to the pandemic \(dashboard\)](#)

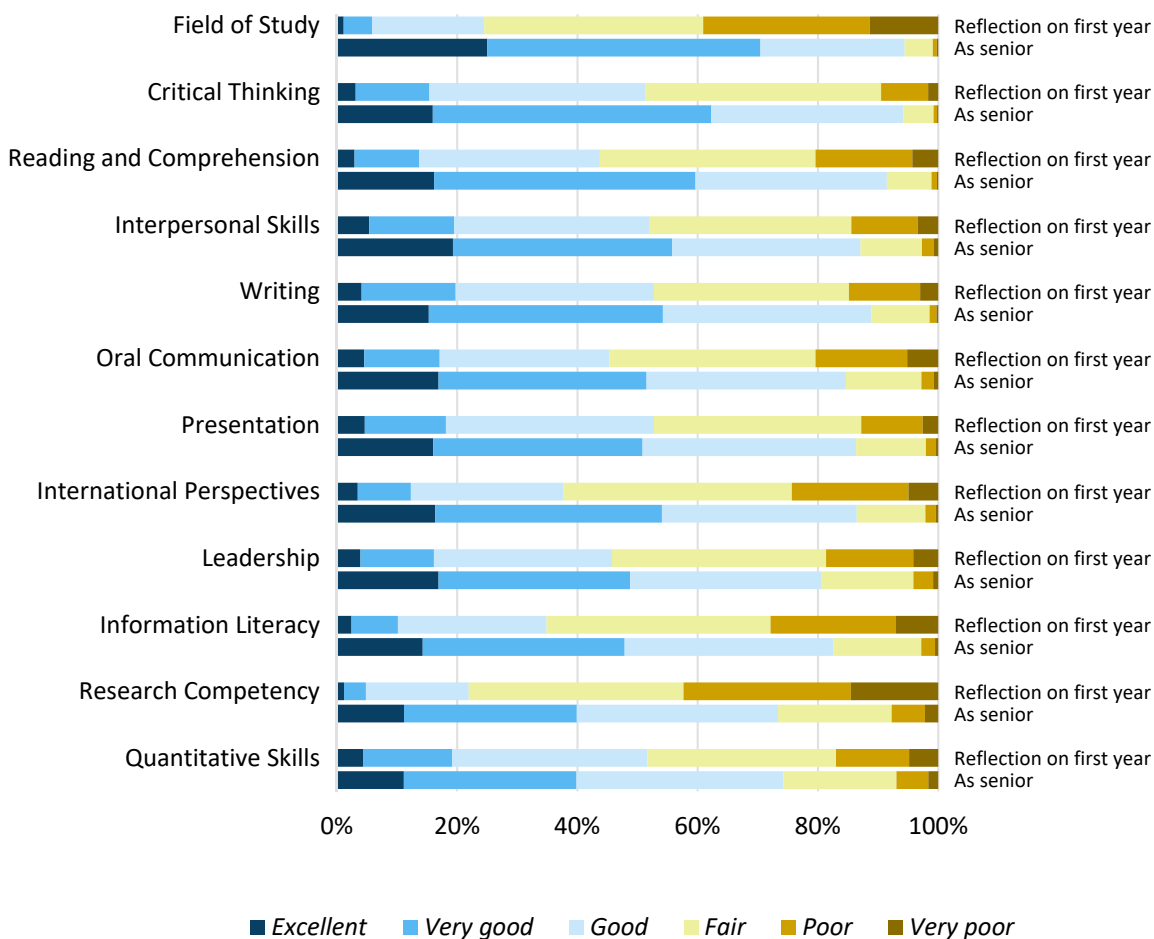
[Pandemic-specific questions from the UC Graduate Student Experience Survey \(dashboard\)](#)

[Adaptive Learning Technology Pilot Report \(pdf\)](#)

## 8.1 UNDERGRADUATE STUDENT LEARNING AND ENGAGEMENT

**UC undergraduates experienced significant improvement between their freshman and senior years in multiple areas, including reading and comprehension, critical thinking, research competency, and understanding of their chosen field of study.**

### 8.1.1 Self-reported skill levels from first year to senior year Seniors who entered as freshmen Universitywide, Spring 2020



Source: UCUES

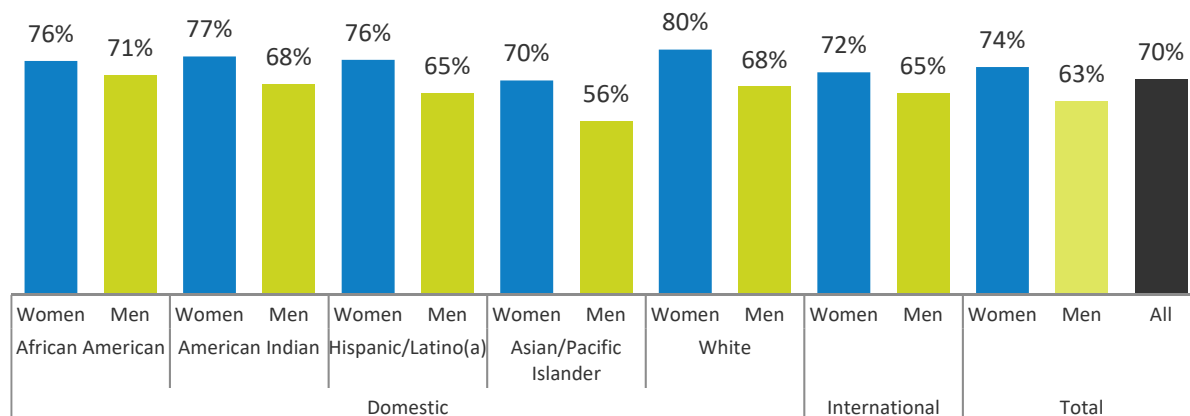
The University of California Undergraduate Experience Survey (UCUES), which is conducted every two years, provides a valuable source of information on how UC undergraduates view their educational experience. These indicators also show students' perception of how much they have developed core competencies of student learning. In UCUES, students are asked to reflect on their skill

levels between their freshman and senior years. During this period, UC students self-reported significant improvements in all areas, including reading and comprehension, critical thinking, research competency, understanding international perspectives, and understanding of their chosen field of study.

## 8.1 UNDERGRADUATE STUDENT LEARNING AND ENGAGEMENT

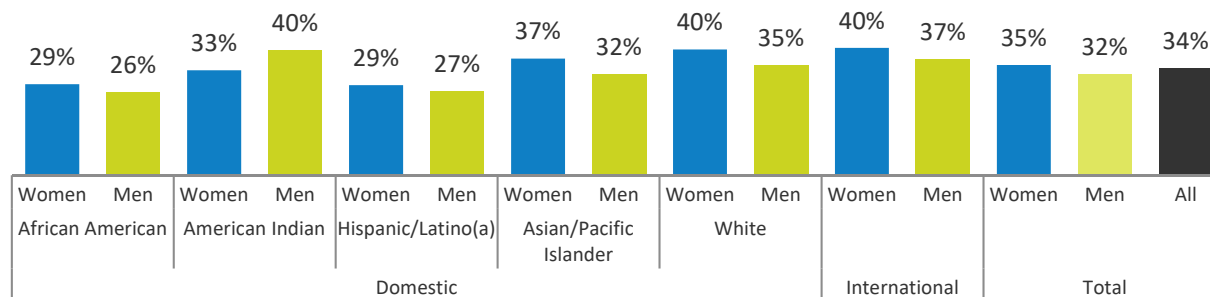
**Research participation is high among UC's seniors across racial/ethnic and gender groups. Seventy percent of students completed research as part of their coursework and one-third assisted faculty in research.**

### 8.1.2 Students completing a research project or research paper as part of their coursework Universitywide seniors Spring 2020



Source: UCUES

### 8.1.3 Students assisting faculty in conducting research Universitywide seniors Spring 2020



Source: UCUES

One of the benefits of attending an academic research university is the opportunity for undergraduates to conduct research, both through class research projects and by assisting faculty with

their research. Overall, a high percentage of undergraduates reported that they participated in research. Women were more likely than men to indicate research coursework and participation.

## 8.1 UNDERGRADUATE STUDENT LEARNING AND ENGAGEMENT

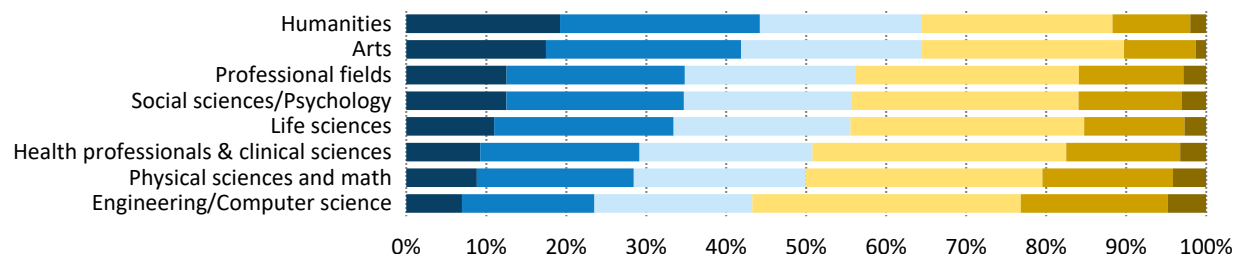
### Engagement varies by discipline, with Arts and Humanities showing higher levels of engagement.

#### 8.1.4 Student responses to questions about areas of engagement

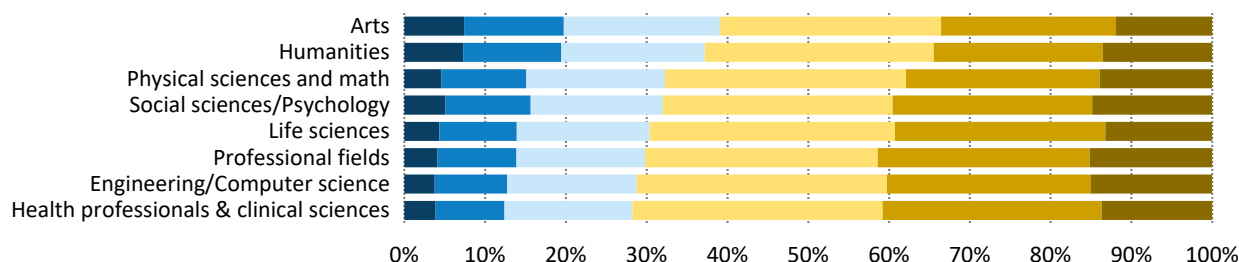
Universitywide

Spring 2020

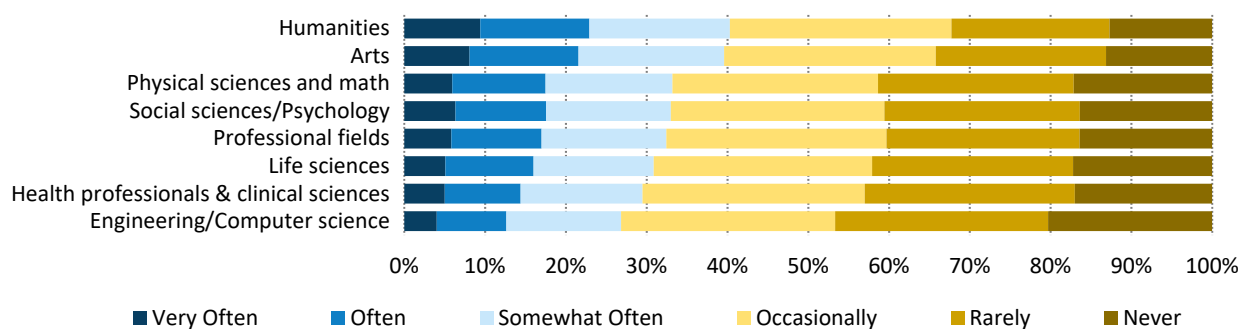
During this academic year, how often have you contributed to a class discussion?



During this academic year, how often have you found a course so interesting that you did more work than was required?



During this academic year, how often have you worked with a faculty member on an activity other than coursework?



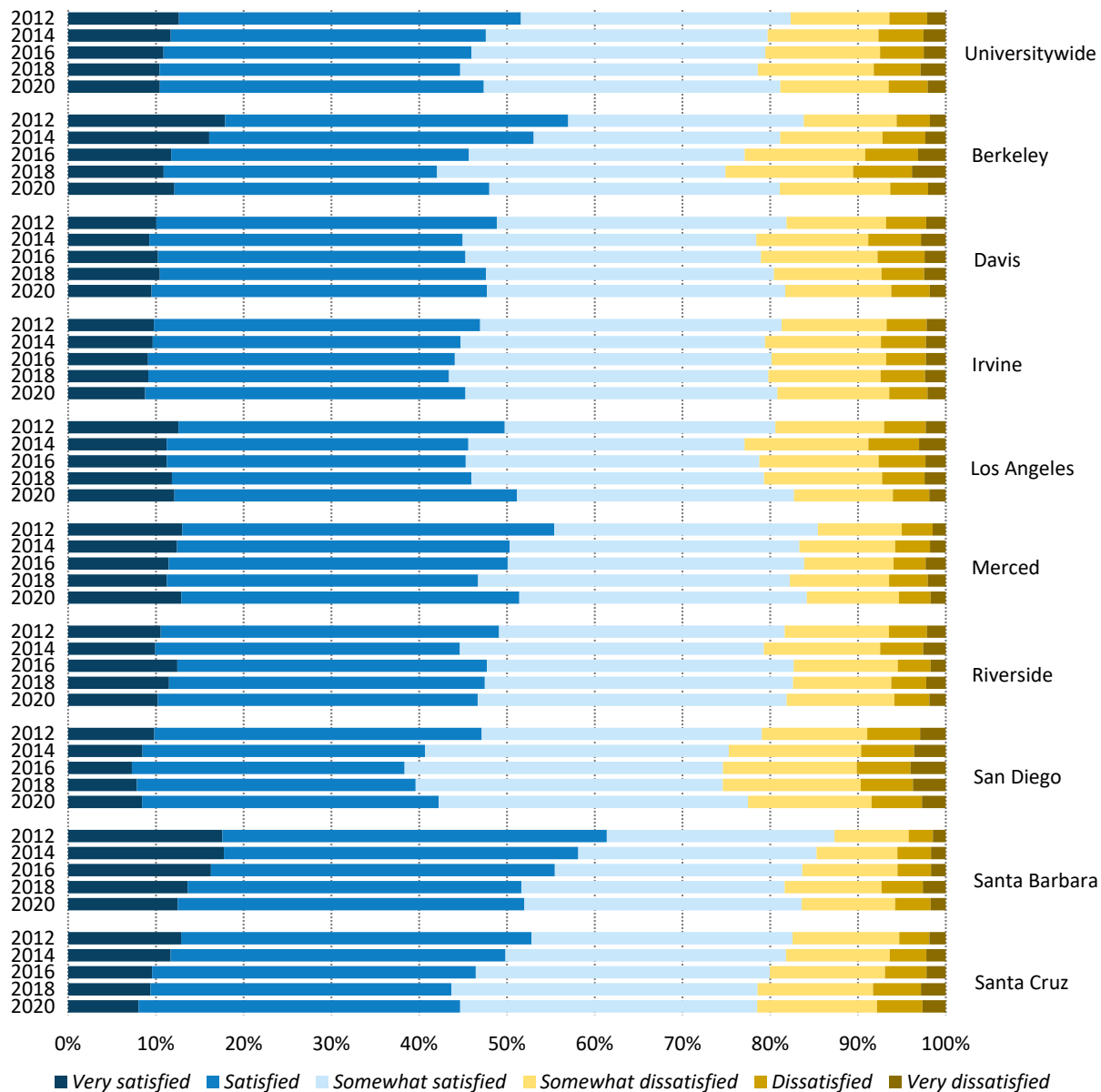
Source: UCUES

More than half of students reported that they contributed to class discussions at least somewhat often, and more than one-third at least somewhat often went beyond required coursework in a class they found interesting. Forty-one percent worked with a faculty member on an activity other than coursework, such as research or creative projects, at least once.

## 8.1 UNDERGRADUATE STUDENT LEARNING AND ENGAGEMENT

For the UC system overall and for most campuses, the percent of students who were satisfied (somewhat through very satisfied) has remained as high as about 80 percent.

### 8.1.5 Student satisfaction with overall academic experience Universitywide and UC campuses Spring 2012 to 2020



Source: UCUES.

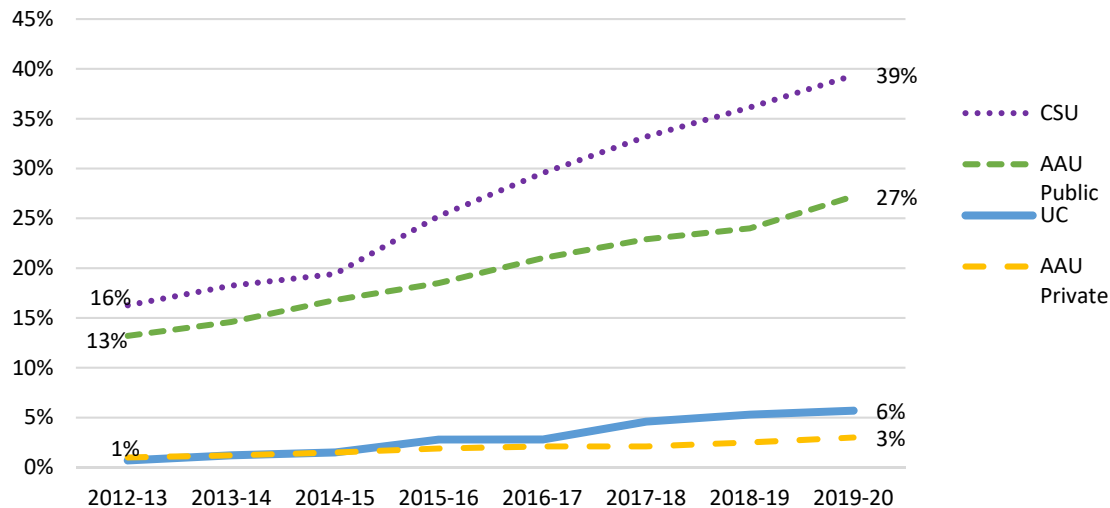
While overall fairly high, student satisfaction has generally declined since 2012.



## 8.1 UNDERGRADUATE STUDENT LEARNING AND ENGAGEMENT

**The proportion of undergraduate students taking at least one course online has increased from one percent in 2012-13 to six percent in 2019-20.**

### 8.1.6 Share of undergraduates taking at least one course online Universitywide and comparison institutions 2013–14 to 2019–20



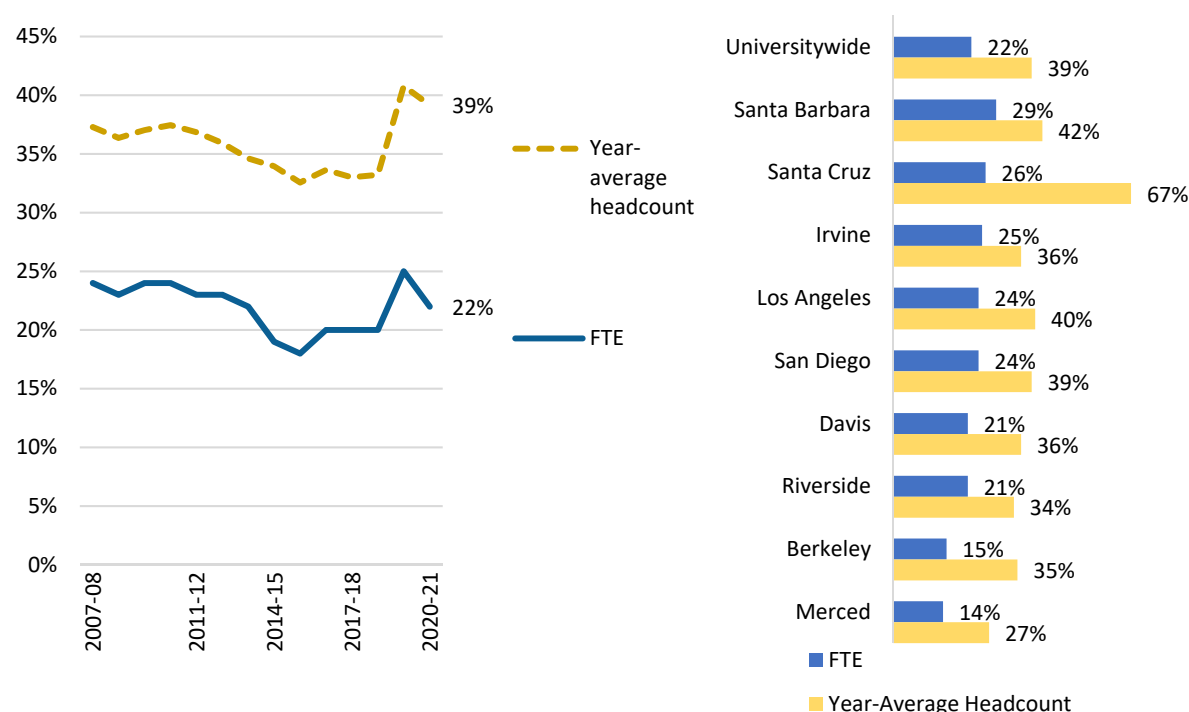
Source: IPEDS

The proportion of undergraduate students taking at least one course online has increased from one percent in 2012–13 to six percent in 2019–20. In 2019–20, three percent of all undergraduate units, or approximately 279,000 out of 9.8 million, were delivered online. The Governor’s 2022–23 Budget is proposing to double that number by 2030.

## 8.1 UNDERGRADUATE STUDENT LEARNING AND ENGAGEMENT

**The COVID-19 pandemic was associated with an increase in the proportion of summer enrollment as a percentage of academic year enrollment.**

### 8.1.7 Summer enrollment as a percentage of Fall-Winter-Spring enrollment Universitywide and UC campuses 2007–08 to 2020–21



Summer is counted as a trailing term: e.g., the 2020–21 year includes summer 2021. Source: Budget Analysis and Planning

The systemwide summer 2021 headcount was approximately 39 percent of that in the 2020–21 fall, winter, and spring terms, ranging from 27 to 67 percent by campus. Summer enrollments represent 22 percent of an average academic year term's full-time equivalent (FTE) student enrollment.

The growth over the last two years is partially attributable to the transition to remote instruction resulting from, and occurring during, the COVID-19 pandemic. In the 2016 summer session, the University piloted three initiatives aimed at increasing summer enrollment through alternative pricing models. In the following years, campuses applied best practices established by the pilot programs to increase summer enrollment.

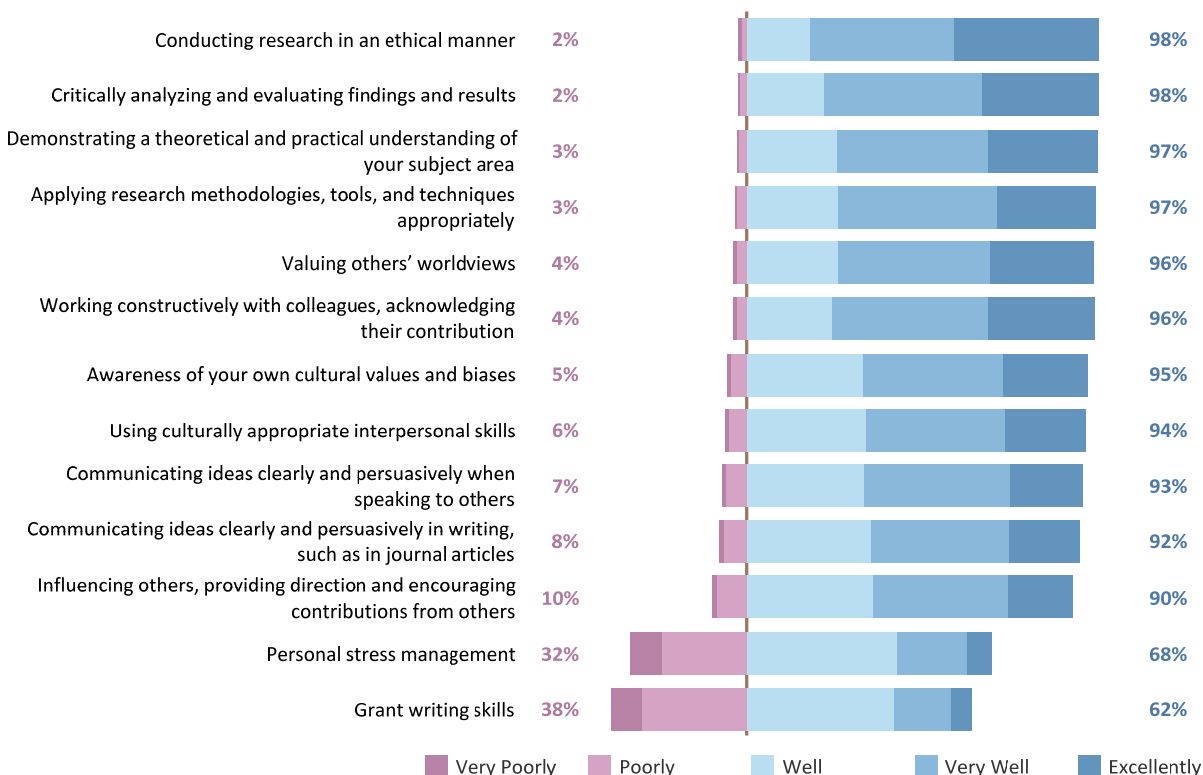
Expansion of summer enrollments has resulted in more efficient uses of facilities and accelerated time-to-degree for undergraduates, making room for more students during the academic year. Campuses have offered a greater breadth of courses during the summer to maximize efficiency and student progress toward the degree; campuses offered more than 3,800 primary classes in summer 2020 (the last year for which complete data are available) — 40 percent more than the number of primary classes offered in summer 2000. Students report using summer as a means to graduate on time and enjoy the smaller class sizes and greater faculty contact often provided by summer courses.

## 8.2 DOCTORAL STUDENT LEARNING

### UC doctoral students credit their doctoral programs with having strengthened multiple skill sets.

#### 8.2.1 Preparation by skillset Universitywide 2018 and 2019 combined

How well prepared do you feel you are in the following skillsets?



Source: UC Ph.D. Career Pathways Student Survey

The Ph.D. Career Pathways Student Survey, a collaboration between the University of California and the Council of Graduate Schools, was administered in the spring 2018 and 2019 terms. As more years of the survey are administered, this report can track trends over time.

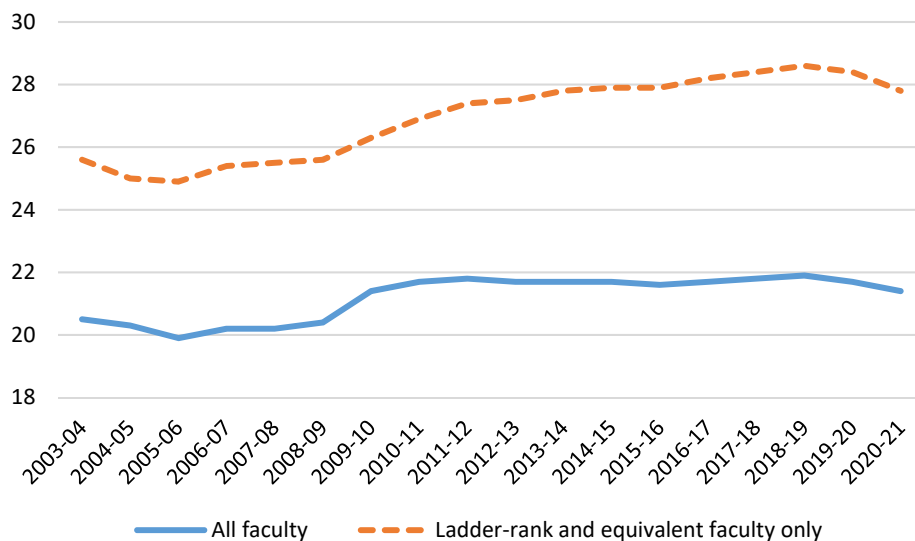
UC doctoral students responded overwhelmingly positively about the preparation received in their programs along the skillsets in the survey, with the exception of stress management and grant writing skills.

Additional data from the survey can be found here: [universityofcalifornia.edu/infocenter/doctoral-experience-survey](https://universityofcalifornia.edu/infocenter/doctoral-experience-survey)

## 8.3 THE INSTRUCTIONAL WORKFORCE

Over time, the student-faculty ratio has grown worse, as faculty hiring has not kept pace with increasing student enrollment. The latest improvement is related to temporary enrollment declines related to the pandemic.

### 8.3.1 General campus student-faculty ratio Universitywide 2003–04 to 2020–21



Source: UC Information Center Data Warehouse

One measure of academic quality is the student-faculty ratio. The student-faculty ratio reflects resources available for instruction and the average availability of faculty members to every student. Thus, lower ratios are preferable for students.

Because the student-faculty ratio varies considerably by degree, major, and instructional level (lower-division, upper-division, and graduate), student experiences will vary as well. Indicators 8.3.2 and 8.3.3 on student credit hours (SCH) provide additional insight into the student experience.

The student-faculty ratio has increased, particularly in the last decade. During the most recent recession, campuses responded to uncertainty in State funding by delaying faculty hiring, or deciding not to fill vacant faculty positions on a permanent basis.

While the student-faculty ratio improved slightly in 2019–20, another 893 FTE additional faculty would need to be added to restore the 2005–06 ratio. In 2020–21, likely due to the pandemic, student FTE declined and thus the small improvement in the ratio is due more to this temporary enrollment decline rather than adding new faculty.

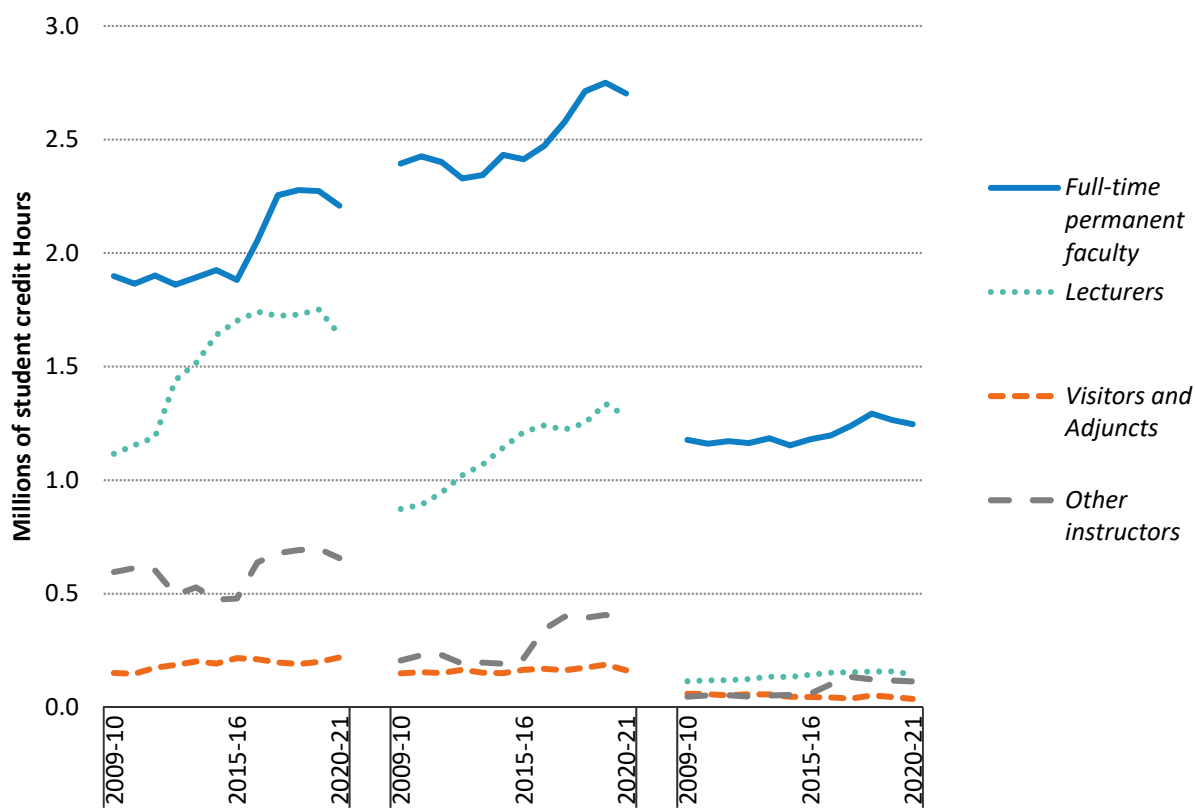
As part of its multi-year plan, UC is not on track to hire 1,100 ladder-rank faculty between 2018–19 and 2022–23. More information on the plan can be found here: [universityofcalifornia.edu/infocenter/uc-2030-dashboard](https://universityofcalifornia.edu/infocenter/uc-2030-dashboard)

The expanding gap between the student-faculty ratio for all general campuses and the ratio for only ladder-rank and equivalent faculty illustrates the trend of hiring lecturers. Additional data can be found here:

[universityofcalifornia.edu/infocenter/student-faculty-ratio](https://universityofcalifornia.edu/infocenter/student-faculty-ratio)

**At the undergraduate level, full-time permanent faculty and lecturers are teaching increasing numbers of student credit hours.**

**8.3.2 Student credit hours, by instructional staff and class type**  
Universitywide  
2009–10 to 2020–21



Source: UC Faculty Instructional Activities dataset<sup>1</sup>

Student credit hours (SCH) represent the number of student enrollments in a course multiplied by the number of credits earned from that course. For example, a four-credit class with 50 students generates 200 SCH; a two-credit class of 15 students generates 30 SCH. This measure gives an indication of the relative teaching load across different types of instructors at different levels of instruction.

Lower-division courses such as writing, language, and other required courses are most often taught by lecturers; introductory courses to the major are most often taught by full-time permanent faculty. Upper-division courses, which are core to the student's major, are more likely taught by full-time permanent faculty, as are graduate courses. The decline in 2020–21 is attributable to the COVID-19 pandemic.

<sup>1</sup> Data are for general campus courses only. These data are submitted annually by UC campuses and contain information on all general campus courses taught in that year.

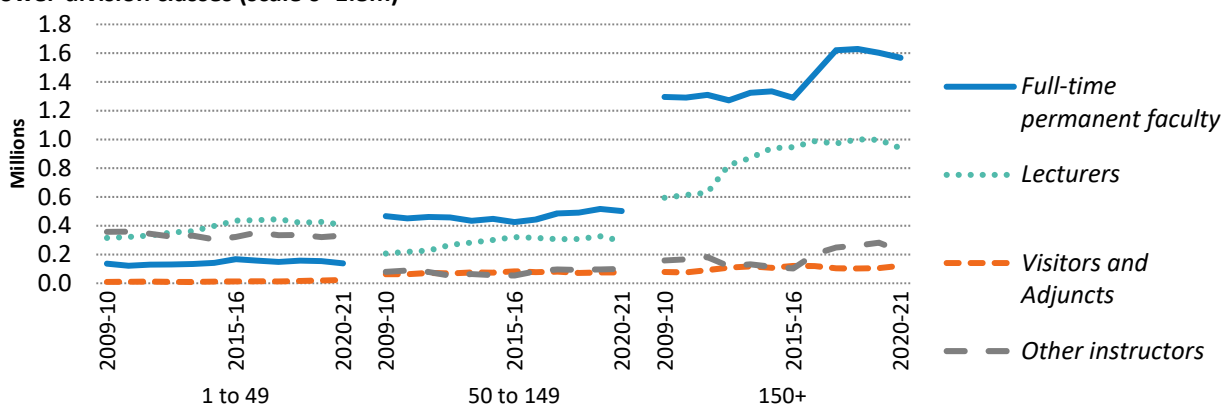


## 8.3 THE INSTRUCTIONAL WORKFORCE

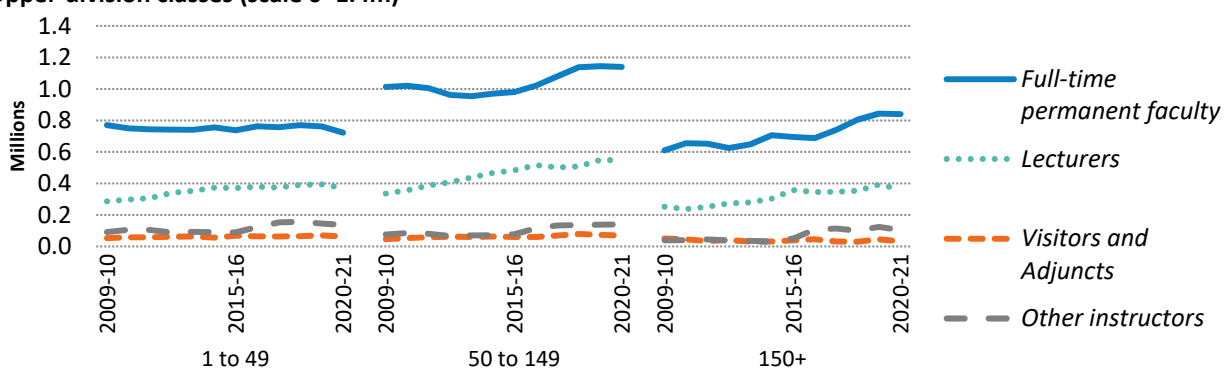
**As students enroll in upper-division and graduate classes, they have greater contact with full-time permanent faculty and smaller classes.**

### 8.3.3 Student credit hours, by instructional staff and class type and class size Universitywide 2009–10 to 2020–21

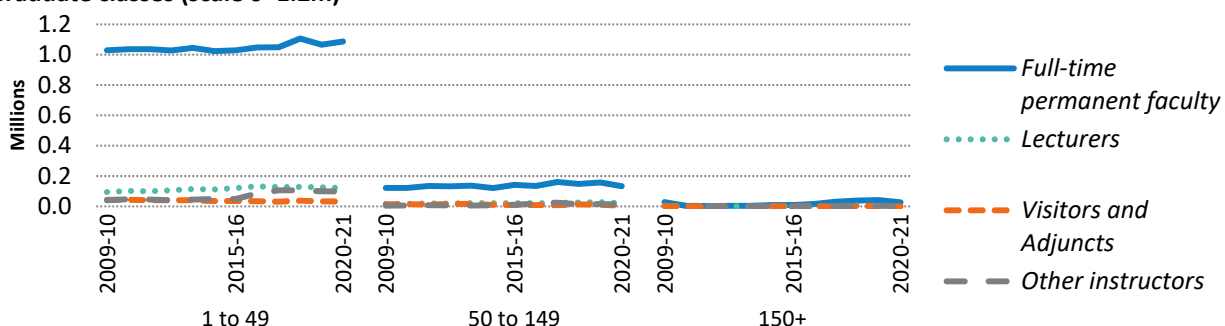
#### Lower-division classes (scale 0–1.8m)



#### Upper-division classes (scale 0–1.4m)



#### Graduate classes (scale 0–1.2m)



Source: UC Faculty Instructional Activities dataset

In the lower division, full-time permanent faculty generally teach large lecture classes; lecturers generally teach both large sections and smaller classes. In the upper division, student contact with full-time permanent faculty is fairly evenly distributed across classes of all sizes.

Graduate academic students are almost uniformly taught by full-time permanent faculty in classes with fewer than 50 students. The large enrollment increases in 2016–17 and 2017–18 resulted in a substantial uptick in SCH being offered in large lower-division lecture classes.