

**Office of the President**

**TO MEMBERS OF THE ACADEMIC AND STUDENT AFFAIRS COMMITTEE:**

**DISCUSSION ITEM**

*For Meeting of January 20, 2021*

**THE FUTURE OF INSTRUCTION: DESIGNING EQUITABLE CLASSROOMS AND TECHNOLOGY-ENHANCED LEARNING AT THE UNIVERSITY OF CALIFORNIA**

**EXECUTIVE SUMMARY**

At the University of California, the range of instructional delivery encompasses more than the distinction between traditional lecture courses and online courses. UC's pedagogy has evolved significantly to assess and improve course delivery and course content in contemporary ways including by reconfiguring space to support active learning, creating project-based courses to support student engagement, and incorporating technology into the classroom. Faculty, in partnership with Teaching and Learning Centers, are assessing and improving instructional delivery to advance learning outcomes and promote student success. This ongoing work in part contributed to UC's successful transition to remote instruction and the remote instruction period will continue UC's evolution in determining how to best design equitable classrooms and technology-enhanced learning. This item is meant to be a discussion of how technology and new approaches to pedagogy at UC are improving teaching and learning irrespective of the mode of delivery.

**BACKGROUND**

In November, the Academic and Student Affairs Committee heard how the University of California ensures students gain 21<sup>st</sup> century skills through curricular and extracurricular activities. This item examines the delivery of instruction, including UC efforts to assess and where needed adapt pedagogy to promote learning outcomes and advance student success. In a future meeting there will be a continuation of this subject, but with a focus on efforts to redesign the curriculum to eliminate equity gaps.

There has been a revolution in higher education pedagogy and curricula, with universities increasingly turning to research on the social, psychological, and cognitive dimensions of learning to reimagine the structure, delivery, and purpose of a university education. UC Teaching and Learning Centers are providing professional development for faculty and graduate students to turn this body of research into teaching practices and curricular programs, so that every student may thrive and have the opportunity to excel at UC. These innovations are promoted through instructor training and development, classroom innovation, curricular design, and leveraging technology. This work along with UC campus efforts to promote instructional

resilience, aided campuses in a successful transition to remote instruction in the spring and to improve remote instruction delivery in the fall. Campuses are beginning to evaluate the remote instruction period to determine what lessons have been learned and how those lessons can be applied both to in-person and online learning in the future

### UC EFFORTS TO ADVANCE THE FUTURE OF INSTRUCTION

UC instructional delivery has continued to evolve from lecture and discussion formats to flipped classrooms to active and project-based learning, with the expanded use of technology throughout including fully remote and online courses. As a research university, UC's approach has been to identify and disseminate effective modes for delivering instruction, leveraging research—including work conducted by campus Teaching and Learning Centers—to help identify new teaching approaches and formats that promote positive learning outcomes and are responsive to the changing needs of students. This item provides examples of how UC is supporting efforts to design equitable classrooms and technology-enhanced learning.

#### *Teaching and Learning Centers*

UC Teaching and Learning Centers offer a wide array of professional development opportunities to current and future faculty. Teaching and Learning Centers use data to measure student learning and track progress through academic programs; foster communities of teachers and learners committed to tackling the challenges facing institutions of higher education in the 21<sup>st</sup> century; conduct original research that promotes outstanding teaching; and endow educators with skills to create equitable classrooms that foster a sense of belonging and support student success.

Many centers began with a focus on introducing technology in the classroom and have since expanded to hubs of pedagogical innovation that adapt to the shifting needs of instructors, students, and campuses, including the recent shift to remote instruction. The table below provides a list of the teaching and learning centers across the UC system.

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#### **UC teaching and learning centers**

UCB: Center for Teaching & Learning (<https://teaching.berkeley.edu/>)

UCD: Center for Educational Effectiveness (<https://cee.ucdavis.edu/>)

UCI: Division of Teaching Excellence & Innovation (<https://dtei.uci.edu/>)

UCLA: Center for Advancement of Teaching (<https://teaching.ucla.edu/>)

UCM: Center for Engaged Teaching & Learning (<https://cetl.ucmerced.edu/>)

UCR: Exploration Center for Innovative Teaching & Engagement (<https://ue.ucr.edu/units/xcite>)

UCSD: Teaching + Learning Commons (<https://commons.ucsd.edu/>)

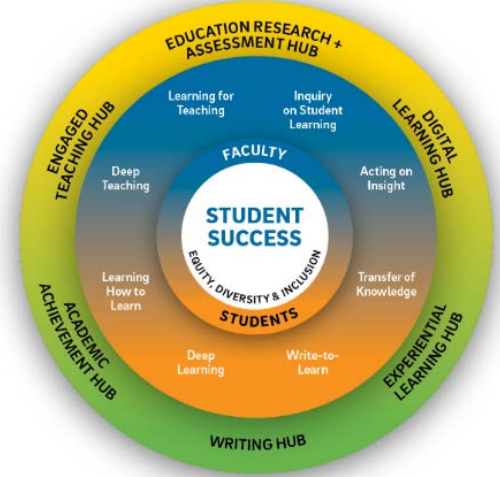
UCSF: Teaching & Learning Center (<https://edtech.ucsf.edu/teaching-learning-center>)

UCSB: Center for Innovative Teaching, Research, and Learning & Instructional Development (<https://www.citral.ucsb.edu/>)

UCSC: Center for Innovations in Teaching & Learning (<https://citl.ucsc.edu/>)

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November's discussion on 21<sup>st</sup> century skills highlighted the work of UC San Diego's **Teaching + Learning Commons**, specifically its efforts to promote experiential learning for students. But the Commons also provides other services that support faculty and students, organized along multiple "hubs" that interact, inform and mutually reinforce educational equity and inclusive pedagogy. Student learning research is at the heart of these pedagogies to ensure that research findings are translated into instructional and educational practices, services and programs. Analysis of student success data is used to identify opportunities to improve teaching and learning and identify unmet needs in student academic support.



The Engaged Teaching Hub offers faculty and graduate student instructors the opportunity to reflect on their teaching, including who they are as educators, their beliefs about student learning, their experiences teaching today's students, their pedagogical choices, and the content and context in which they teach. This helps to inspire and encourage evidence-based, learner-centered, and equitable teaching practices.

The Education Research + Assessment Hub facilitates systematic analysis of learning environments and outcomes, helping instructors design meaningful data-gathering tools and approaches to understand educational outcomes and use that information to support innovations to improve student success.

The Teaching + Learning Commons' Digital Learning Hub supports the integration of digital technology and the effective use of multimedia to enhance and support student success. The Digital Learning Hub collaborates with departments, faculty, and instructors to design or redesign courses for online and hybrid learning.

A second example is UC Riverside's **Exploration Center for Innovative Teaching & Engagement**, or XCITE, which provides professional development in instructional design. The instructional design team helps faculty integrate technology into course planning, ranging from technological-enhanced activities to flipped classrooms to hybrid courses to exclusively online courses. But teaching an academic course is more than the content or technology used to deliver it; it is facilitating learning experiences which give students opportunities to work with the topic content and grow toward mastery of the course learning outcomes. To achieve that goal, XCITE's instructional designers work with faculty to:

- brainstorm instructional activities to deepen student learning opportunities,
- identify the best educational technology to assist in delivering the learning experience,
- apply research-based and best practices in pedagogical design,
- oversee the production of various course elements including: lecture videos, multimedia, and development of the course within the learning management system (LMS),
- recommend course assessment strategies for applying to research,

- provide support throughout the course delivery over the quarter,
- follow-up after a course's completion to access future course improvements.

### *Instructional training and development*

UC campuses provide consultation and coaching to instructors—both faculty and graduate students—on how to develop, adapt and deliver curriculum to promote equitable learning outcomes and opportunities to leverage technology.

**UC Santa Barbara's Reimagining Instruction for the Student Experience (RISE)**, a collaboration between its Center for Innovative Teaching, Research and Learning and Instructional Development, is an institute that guides and supports instructors as they delve more deeply into inclusive, innovative practices to (re)design remote or hybrid courses. Working with facilitators, mentors, and peers, participants engage in asynchronous and synchronous interactions, focusing on one or more of the following areas as they develop their courses:

- Fostering communities of learners: How to create courses where students work together to create new knowledge and support each other?
- Designing engaging, authentic assessments: How to design equitable activities and assessments that allow students to demonstrate mastery of course concepts?
- Cultivating research experiences: How to build in research experiences that allow students to engage in and contribute to research?
- Integrating inclusive, engaging curriculum and pedagogy: How to design courses where diverse voices are heard and students can engage with issues they care about?

**UC Davis's ACCELERATE**, run through its Center for Educational Effectiveness (CEE), is an intensive fellowship designed to support the creation of inclusive and equitable e-learning environments during the transition of face-to-face courses to online courses. ACCELERATE is meant to inform course transformation efforts for faculty at various stages of the process, including those who are still exploring opportunities to those who are already in the process of redesign and would like more information on inclusive practices. ACCELERATE participants receive intensive, hands-on professional development in equitable and inclusive digital pedagogies and instructional strategies over four days of programming. The program includes tools to scale course development for equity and efficiency. The workshops and structure of ACCELERATE also provide opportunities to collaborate with other colleagues who are committed to equity and inclusion. Workshops are self-paced and carried out on Canvas with live meetings on Zoom. To date, 83 faculty have participated in ACCELERATE.

In addition, CEE developed a self-paced version, called **ACCELERATE Asynchronously**, that is open to all faculty, instructors, teaching assistants, and staff. To date, 472 faculty, graduate students, and staff have enrolled in ACCELERATE Asynchronously.

**UC Berkeley's Graduate Student Instructor (GSI) Teaching & Resource Center**, an academic unit of the Graduate Division, prepares GSIs for teaching undergraduates at UC Berkeley and beyond. The GSI Teaching & Resource Center provides a variety of services

including workshops, seminars, classroom observations, workshops and others all designed to support and mentor GSIs. All GSIs at UC Berkeley are also required to take a five-module course, “Professional Standards and Ethics in Teaching,” which among other things engages in best practices for creating an inclusive classroom in order to promote learning. Further expanding support for GSIs in fall 2020, they launched the GSI Remote Teaching Hub. The Hub contains a curated set of training guides on remote instruction tools, best practices, support options for GSIs, and important campus policies and resources.

***Active learning and classroom innovation***

Research has shown that in some areas shifting from a lecture-based to an active learning model facilitates greater interactions between students and faculty and course material and can increase student engagement and improve 21<sup>st</sup> century learning outcomes. Active learning has also shown positive results in closing achievement gaps especially in STEM.

Active learning engages students with the course material through discussions, listening, problem solving, eliciting student proposed solutions, reflection, and articulating ideas. Active learning spaces allow for reconfiguration of the classroom that promote equity through greater interaction between students, faculty and course material. Technology can enable active learning spaces or encourage actively learning through flipped classrooms, where the instructor shares predetermined digital resources with students through a platform outside the classroom and during class time, active, collaborative, and interactive problem-solving activities and consolidation practices are carried out.

UC campuses are aware of the value of active learning for any classroom, with some campuses transitioning some traditional style classrooms into active learning spaces.

**UC Irvine’s Anteater Learning Pavilion** is an entire building devoted to active learning. The classrooms are high tech collaborative spaces that facilitate student centered teaching and collaborative/team approaches to learning.

*UC Irvine Anteater Learning Pavilion and Active Learning Classroom*



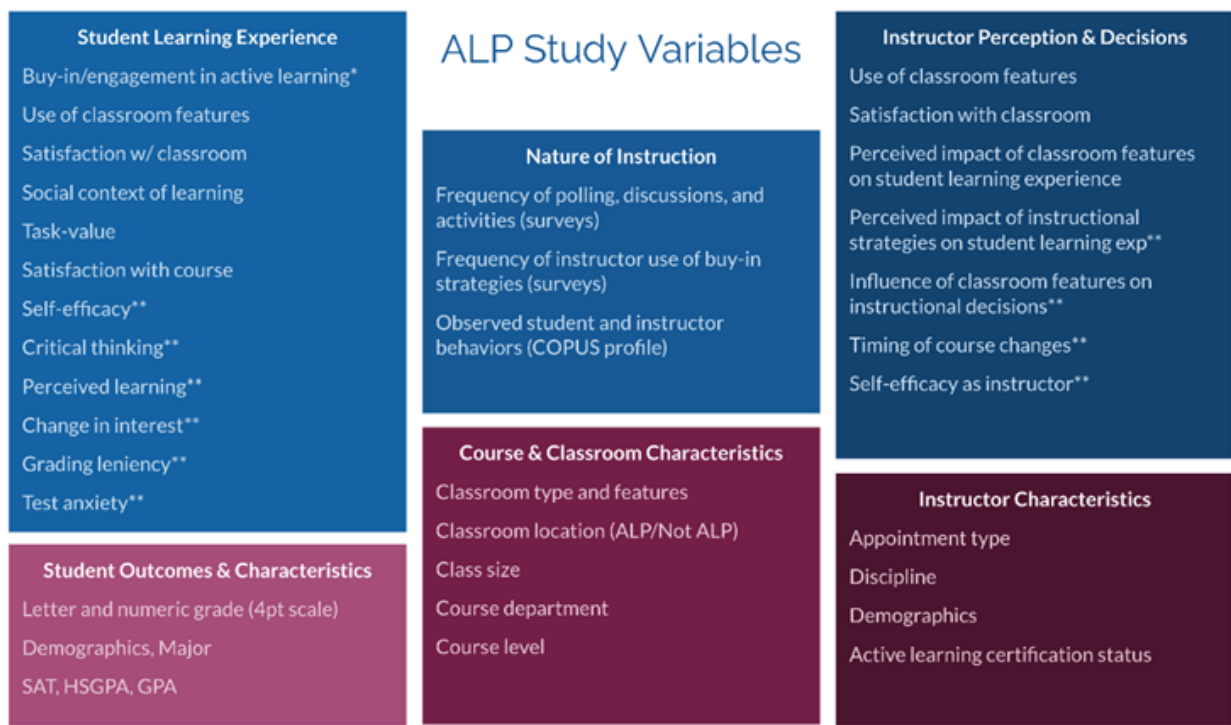
Before teaching in the building, faculty are required to complete the **Active Learning Institute (ALI)**, a series of eight workshops that support faculty in integrating active learning strategies into their courses.

The ALI covers course goals, active learning activities and assignments, use of technology, and more. These interactive workshops give faculty the opportunity to practice techniques and design strategies that work best in their own courses. It also has an opportunity to discuss teaching and gain insight from faculty across disciplines. The ALI has two parts:

- Part 1: Participants (re-)design their curricula to integrate active/collaborative strategies
- Part 2: Participants apply strategies in the classroom. ALI staff also observe and provide feedback.

ALI evaluates the effectiveness of the program through student and faculty surveys, faculty interviews and through the classroom observation protocol for undergraduate STEM. The figure below shows measures used to assess student and faculty experiences in active learning classroom.

*Anteater Learning Pavilion Student and Faculty Measures for Active Learning*



Completion of the first part provisionally certifies the participant to schedule courses in an Active Learning Classroom; successful completion of the second part provides the participant with their final certification for continued preferential scheduling in Active Learning Classrooms. Since it began in 2017, 200 faculty have participated in the ALI and there are long wait lists for future participants.



**UC Merced’s Technology Enhanced Active Learning (TEAL)** is a teaching format that merges facilitated discussions, simulations, and hands-on desktop experiments to create an active and collaborative learning experience. UC Merced has four TEAL labs: two 45-seat labs and two 90-seat labs. These labs offer a fundamentally different learning environment from other instructional spaces on campus through the design, layout, technology and potential pedagogical choices available to the instructor. The labs are designed for collaborative and applied learning, there is no front or back to the classroom, worktables to allow for smaller groups of students to work together (equipped with connectivity for laptops, tablets and document cameras).

Instructors are required to conduct assessment to the effectiveness of the environment in enhancing active learning and student success. A recent survey found 94 percent of TEAL lab students agreed the TEAL lab positively impacted their learning, compared to traditional learning spaces. In addition, other data assessing the impact of TEAL labs shows increased class attendance, improved student performance, and increased conceptual understanding compared to lecture classes. TEAL labs also use established psychological and cognitive scales to assess student motivation using the Self-Determination Motivational Assessment and basic psychological needs using the Learning Climate Questionnaire, which show a positive association with active learning in the TEAL environment.

**UC Santa Cruz’ STEM Active Learning Initiative** is an ambitious program to address the pressing problem of student persistence in science and engineering. Its overarching goals are to increase the number of science, technology, engineering and mathematics (STEM) graduates, with those graduates reflecting the diversity of UC Santa Cruz’s student population and to build an institutional culture that sustains learner-centered, inclusive, evidence-based STEM education. The STEM Active Learning Seminar aims to cultivate a community of scientist-teachers and STEM educators at UCSC. Seminar speakers will have the opportunity to share in-class experiments, insights, accomplishments, and challenges teaching STEM classes emphasizing scientifically-based teaching techniques.

*UC Santa Cruz STEM Active Learning Initiative Classrooms*



*Project-based and service courses learning*

Project-based learning is similar to active learning in that it encourages a student centered-focus but engages students in solving a real-world problem or by answering a complex question. Because students are tackling complex questions or completing projects that have personal appeal or special meaning to the student, faculty teaching project-based classes report that their students are more engaged given their sense of agency. Project-based learning, when coupled with extended professional development for instructors has been shown to significantly increase student critical thinking, collaboration, communication, creativity, self-direction, technological skills and being able to apply what they learned to community issues. Gains are most significant for students with lower academic performance prior to taking a project-based learning course. Faculty also report that project-based learning unleashes a contagious, creative energy among students and teachers.

**UC San Diego's Bending the Curve course** is an example of active and project-based learning focused towards solutions for climate change. The course is centered on a curriculum designed to empower one million climate champions across the world to solve the climate change problem and has participation from all ten UC campuses. Students review short video lessons from faculty and then participate in discussion sections, "knowledge checks", and then complete course assignments which are reviewed by other students. Technology enables this course to happen and support active learning and greater peer-to-peer interactions. Students cited being able to work on different modules one-at-a-time, interactions with other students, and being able to propose solutions and enact them as being the most compelling aspects of participating in the course. The course has three notable components: hybrid online/in-person course, which is now taught at all ten UC campuses and is licensed to five other universities, including Stockholm University and National Taiwan University. It also is offered as a fully online UC course, which allows one UC campus instructor to instruct students at any UC campus. Third the course offers an open-source "Bending the Curve" digital textbook—authored by the lecturers of the course, published by the University of California Press, and funded by the Gates Foundation—available for download through the California Digital Library.

**UC Merced service-learning courses**, such as the Human-Centered Research and Design (ENGR 096) and Engineering Service Learning (ENGR 097/197) courses, have students work in multi-disciplinary teams to work side-by-side with local non-profit organizations to solve design challenges and/or implement innovative engineering solutions to meet real world challenges. These classes provide students project-based opportunities to learn important 21st century skills, gain practical hands-on professional and technical skills while making meaningful contributing to their local communities. Projects are staffed and lead by students providing a real-world opportunity for leadership development.

One example is Project Protect, a multidisciplinary cultural literacy and preservation project dedicated to promoting the health and well-being of all people in our multi-ethnic community. Students participating in Project Protect are developing a free mobile app that translates and correctly pronounces medical words to assist younger people in helping their elders communicate better with health-care providers. By capitalizing on the strengths of all disciplines



represented at UC Merced, Engineering Service-Learning teams are able to implement meaningful solutions that have lasting effects on their community.

### *Leveraging technology*

UC campuses use technology to enhance the learning experience, support students and faculty, and increase accessibility to course content. In addition to Learning Management Systems (LMS), campuses are creating tools and leveraging additional technology to promote equitable classrooms and student success.

**UC Davis's Know Your Student Tool**, developed by its Center for Educational Effectiveness, provides aggregated information to faculty teaching large classes on the profile of students in their courses; including pre-requisite course taking information, major, freshman or transfer entrance, student engagement, and survey data. This technology analyzes gaps in grading and engagement of students by demographics and can also assess how much active learning is taking place in the classroom. For example, the transcript analyzer reviews video course sessions in which faculty can see how much students are engaging, what proportion of the time the professor is speaking compared to how much is devoted to student discussion, and compare that information to other courses.

**UC Irvine's Assessment and Learning in Knowledge Spaces (ALEKS)** is a Web-based, artificially intelligent assessment and learning system. ALEKS is an adaptive learning technology that continually assesses what a student knows, a list of concepts in the subject-area being learned, and an adaptive sequencing of content based on what the student knows. Computer algorithms identify which particular elements of knowledge (concepts in Algebra, for example) can be gathered to form distinct knowledge states of individuals. ALEKS evaluates a student's mastery of a topic and uses this information to determine if the student is ready to move on to the next topic while not losing time by reviewing concepts the student already knows. This makes learning more efficient and effective by offering the student a selection of only the topics he or she needs to learn and is ready to learn at each stage. Adaptive learning can also build confidence and the flexible "learning momentum" and allows the student to learn new topics at faster rate.

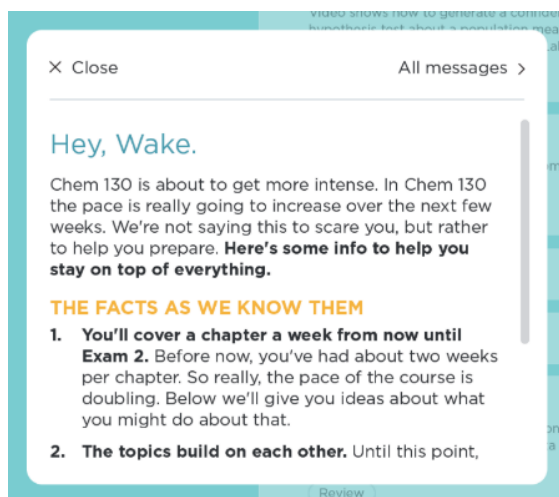
ALEKS is used on several campuses in the UC system including at UC Santa Cruz and UC Merced for math placement, UC Davis for preparatory chemistry and mathematics, and at UC San Diego for Math placement and during their Summer Bridge program for Chemistry placement.

**UCLA use of Piazza and Labster** are two tools that provide additional support for LMS and remote instruction. Piazza is an online Q&A platform that promotes engagement between student and faculty and integrates into any LMS system. It has been shown to increase student participation in a remote environment by offering customizable polls to assess student engagement during class, flagging items that need to be addressed for instructors (e.g., unread posts or unresolved questions), and tracking student usage in real time which allows for assessing and rewarding student participation. Piazza also provides an option for introverted

students to ask and answer questions anonymously. In addition, UCLA implemented the Labster technology to adapt to the absence of in-person labs by offering an alternative. Labster is an online virtual lab environment, with a 360-degree video-game-like approach to learning and the awarding points for acquired knowledge.

Finally, some campuses are leveraging tools to help students improve their performance. UC Santa Barbara offers the **ECoach platform** in partnership with the University of Michigan. ECoach can be accessed on mobile phones and allows students to track their grades and study habits compared to other students and to get personalized feedback on how to improve their grades. Instructors send personal messages to students to tell them about upcoming milestones and tasks in the course and why they are important. It also offers a scheduling function integrated with google calendar to schedule study groups with other students and to block off time for other study practices like making flashcards or transcribing notes from class.

*UC Santa Barbara's ECoach personal messaging and scheduling components*



## REMOTE INSTRUCTION'S IMPACT ON PEDAGOGY

Before COVID-19, UC campuses were already examining ways to promote instructional resilience after having courses disrupted by poor air quality and power outages from fires and wind storms. This early planning on how to make course content available in alternative platforms, such as Zoom, along with support from Teaching & Learning Centers, aided the rapid transition to remote instruction. Faculty leverage Zoom technology for active learning by putting students into break-out rooms, “visiting” rooms to monitor student learning, and creating “drop-in” problem-solving sessions. During the pandemic, every campus provided techniques like these and other resources to support instruction continuity/resilience on their ‘Keep Teaching’ websites.

Campuses have used experiences and assessment of the spring 2020 remote instruction period to support curricular development and improve fall 2020 remote instruction efforts.

**UCLA's Fall Forum on Leaning into Remote Teaching**, sponsored by the Center for Advancement in Teaching, Excellence in Pedagogy and Innovative Classrooms, Center for Advancement of Teaching, and Center for Education Innovation & Learning in the Sciences, featured lessons learned from Spring quarter and provided an opportunity for instructors to collaborate within and across disciplines to prepare for Fall. Though the workshops focused on remote teaching, the forum centered on commitments to equity-minded pedagogy, student-centered instruction, and evidence-based teaching. Attendees chose from a variety of workshops over the three weeks on topics such as being an anti-racist educator, fostering student engagement remotely, creative approaches to remote assessment, and more. The collaboration across three centers attracted a wider range of faculty, enabled a greater number of sessions, and contributed to deeper collaboration.

**UC Santa Cruz's Integrated Course Design for Remote Instruction** helped faculty design and develop courses in remote and online environments. The course covers pedagogical approaches, as well as technical tutorials on how to produce lecture videos, creating digital assessments and assignments, and using LMS effectively.

**UC Berkeley's Graduate Remote Instruction Innovation Fellows Program** supported around 300 GSIs who were assigned to collaborate with faculty in high demand courses. These fellows developed high-quality approaches for remote instruction through discussion sections, stand-alone courses, or courses that are being converted by faculty in order to be effective for distance learning. The program enabled GSIs to design integrated lesson plans, learning activities, and courses for the remote environment driven by learning outcomes and principles of inclusion; make decisions about the best use of synchronous and asynchronous activities based on research on learning; design assignments and assessments appropriate for the course and learning context; come away with demonstrated skills in using UC Berkeley's official campus Learning Management System (LMS), bCourses, in order to create bCourses sites, modules, pages, quizzes and announcements, as well as a plan to use Zoom and bCourses for the purpose of community building and collaboration.

**UC Riverside** has leveraged a number of tools to address concerns related to grading and administering web-based assessments. **GradeScope** allows faculty members to more effectively grade online assignments. The platform offers a suite of tools for more streamlined grading of paper-based, digital, and code assignments as well as statistics to better gauge students' understanding of questions and topics. Finally, UC Riverside's, XCITE developed a temporary homegrown solution to live remote proctoring called R'Proctoring to address concerns with commercial products. In addition, XCITE produced a digital workshop for instructors on developing alternative assessments within a remote learning environment, such as student-led teaching exercises, portfolios, and other performance-based assessments.

As part of efforts to continuously improve instructional delivery, UC campuses are beginning to examine what should be kept from remote instruction and what technologies can improve student learning outcomes. In addition, more UC instructors are now familiar with the support Teaching and Learning Centers provide, which could lead to increased use of these services and their tools in the future. For example, before COVID-19 less than 100 UC Davis faculty used the

“Know Your Student Tool,” but that grew to 800 faculty after the shift to remote instruction. This crisis provides an opportunity to examine ways promote student success in the classroom and leverage technology to expand access and inspire efficiencies.

### **CONCLUSION**

UC instructional delivery and pedagogy has evolved over time, including efforts to promote equitable classrooms and leverage technology. Because of ongoing efforts, UC was able to shift successfully to remote instruction. Now UC is beginning to assess what it has learned from this period to identify effective strategies to promote learning outcomes and student success, while also expanding access and promoting throughput.

#### **Key to Acronyms**

ALEKS	Assessment and LEarning in Knowledge Spaces
ALI	Active Learning Institute
ALP	Anteater Learning Pavilion
CEE	Center for Educational Effectiveness
GSI	Graduate Student Instructor
LMS	Learning Management System
STEM	Science Technology Engineering and Math
TEAL	Technology Enhanced Active Learning
XCITE	Exploration Center for Innovative Teaching and Engagement