Self-Review

2019-20

UCLA CEILS
Center for Education Innovation & Learning in the Sciences

Name of Director:	Erin Sanders O'Leary
Key Contributors:	Shanna Shaked, Jess Gregg, Rachel Kennison
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A. Introduction

1. Description of the Self-Review Process

The Center for Education Innovation and Learning in the Sciences (CEILS) is undergoing its first 5-year self-review since being established in July 2014. The goal of this process is to document the Center's impact over the last five years and outline a strategic plan for the next five years. An *ad hoc* committee comprised of internal and external members invited by the Deans of Life and Physical Sciences will review this report and provide commendations and recommendations for consideration by the Center and campus leadership.

CEILS annually meets with its faculty advisory committee (FAC) comprised mostly of the Vice Chairs for Undergraduate Education/Academic Affairs representing every department and undergraduate interdepartmental program in UCLA's two science divisions. CEILS Director Erin Sanders O'Leary met with the FAC on June 5, 2019, to request their participation in a departmental impact tracking and needs assessment effort. Their engagement was essential in gathering feedback during fall 2019.

For Life and Physical Sciences departments, we devised an anonymous survey (identifiable only by department) for individual faculty/instructors to complete (see **Appendix G.1**) and a set of broader questions (see **Appendix G.2**) intended to guide a discussion about CEILS among faculty members, led by FAC members, at a departmental meeting. Survey responses and departmental discussion summaries were used to gauge CEILS' impact over the last five years and identify areas to focus on and/or improve upon in the future.

At the same time, a second survey (see **Appendix G.3**) was administered electronically to many of CEILS' campus partners who engaged as key collaborators supporting education innovation, teaching/faculty development, and student success efforts at UCLA. This feedback was critical to documenting the reach and impact of CEILS outside the Life and Physical Science divisions, efforts necessary to build a campus community of practitioners and educational leaders committed to fostering changes in the teaching culture, and supporting our most important stakeholders – UCLA students.

The CEILS leadership team, comprised of Director O'Leary, Senior Associate Directors Shanna Shaked and Rachel Kennison, and Associate Director Jess Gregg, led the self-review process. Assistance with analysis of survey response data (both quantitative and qualitative responses) was provided by UCLA's Center for Educational Assessment (CEA). A draft report was presented to the CEILS FAC on December 9, 2019 and revisions were made to reflect their input. The penultimate version was submitted to the Dean's office on December 20, 2019. With input from Associate Deans Blaire Van Valkenburgh and Albert Courey, final edits were made and a final, revised version was submitted to the Dean's office on January 2, 2020.

B. General Information

1. Discipline-specific learning centers

Within higher education, two distinct types of centers supporting faculty and educational development have emerged over the last 50 years: centers for teaching and learning (CTLs) and discipline-specific learning centers (Marbach-Ad *et al.,* 2015). The Center for Education Innovation & Learning in the Sciences (CEILS) is categorized as the latter and most accurately as a STEM (science, technology, engineering, and mathematics) Education Center (SEC). CEILS embodies the characteristics of SECs, which we summarize below, and this report aims to demonstrate our Center's impact as it aligns with those of other SECs across the U.S.

A recent study shows that CTLs and SECs have shared strengths as well as different yet complementary areas of expertise (Horii *et al*., 2017). For example, both are staffed by individuals with pedagogical expertise informed by literature in the science of learning. CTL expertise needs to encompass multiple disciplines whereas SEC expertise is informed specifically by discipline-based education research (DBER) and cognitive science relevant to STEM fields (National Research Council, 2012). Both CTLs and SECs are typically directly connected to campus student success efforts, play important roles in current and future faculty development around teaching, enhance the quality of instruction by facilitating the implementation of evidence-based instructional practices by instructors at all levels, and bring siloed academic units and individuals together to effect institutional change in the teaching culture (Horii *et al*., 2017; Carlisle and Weaver, 2018; Coleman *et al.,* 2019). Unlike CTLs, which tend to sit in units and thus act to facilitate change from outside the departments, SECs tend to be embedded and thus positioned to act within departments as change agents that can help implement, scale, and sustain student success programs and initiatives (Horii *et al*., 2017). Consequently, SECs have been identified as a locus of educational change on campuses wherein they broaden participation and institutional capacity for STEM learning (Carlisle and Weaver, 2018).

Organizationally speaking, SECs provide a mid-level institutional structure in which to engage in progressive action and lead educational change (Carlisle and Weaver, 2018). They are positioned to help an institution be proactive in addressing challenges related to STEM education due to their ability to be immediately responsive in ways that typically evade traditional vertical administrative structures (e.g., Provosts to Deans to Chairs to Faculty and vice versa) (Keeling *et al*., 2007). A common attribute of SECs is that the director holds a PhD in a STEM discipline and is jointly appointed as a faculty member in a STEM department, which can facilitate their ability to engage instructors around common educational goals using a shared lexicon and familiar teaching experiences (Carlisle and Weaver, 2018).

A study of SECs shows that these discipline-specific centers bring together disaggregated efforts on the part of faculty or departments to improve STEM education, thereby increasing recognition of existing efforts by campus leadership while also fostering communication and collaboration among different faculty members or departments as a means to increase their impact (Carlisle and Weaver, 2018). This

study goes on to show that SECs play a critical role in creating a community for instructors with interests in improving teaching or engaging in education research. SECs promote broad adoption of evidence-based instructional practices by offering training programs for undergraduate Learning Assistants (LAs), graduate teaching assistants (TAs), and postdoctoral scholars. They also position institutions to be competitive for external education-related funding, an activity that enhances their credibility locally and legitimizes their work within the national landscape of STEM education. Leveraging grant funding, SECs are positioned to directly engage in education research (towards the goal of publishing peer-reviewed manuscripts) (National Research Council, 2012) and action research (towards the goal of developing reflective teachers through systematic and collaborative evaluation of educational practice) (Riel, 2010-19). Research engagement helps to build a culture of assessment around efforts to improve teaching and learning, and it aligns with and supports faculty identities as scholars.

Since 2009, SECs have rapidly expanded on American university and college campuses, with nearly 300 SECs at more than 200 institutions as of August 2017. The magnitude of their national profile warranted establishment of the Network of STEM Education Centers (NSEC), an organization of campus-based centers that together are helping to broaden transformation in STEM education. CEILS is a member of the NSEC with a profile available on the network website. With a mission statement consistent with other SECs, CEILS seeks to strengthen and improve STEM education from the undergraduate to graduate and postdoctoral levels. We also help departments, faculty, and administrators understand how their student success efforts are situated within a broader national framework to improve STEM education.

SECs are symbolic of an institutional commitment to accelerate the pace of STEM education reform, where there is an urgent need to address nationally recognized, pervasive, and systemic inequities in college access, academic achievement, persistence and degree attainment that simply do not exist to the same extent in other disciplines (PCAST 2012). Nationwide, most students who enter college intending to major in STEM do not complete a STEM degree, with the 6-year completion rate being 29%, 22% and 25% for Latino, Black and Native American students, compared with 43% and 52% for White and Asian American students (National Academies of Sciences, Engineering, and Medicine, 2016). UCLA is not immune to these trends as made evident in the 2015 report to the Executive Vice Chancellor and Provost, *Enhancing Student Success and Building Inclusive Classrooms at UCLA* (Hurtado, Sork *et al.,* 2015).

At UCLA, across all disciplines the graduation rates for underrepresented minority students (URMs) are lower than that of non-underrepresented students (non-URMs) (**Figure B.1-1**). Additionally, degree attainment data shows a ~30% difference between URM and non-URM students initially aspiring to major in STEM compared to virtually no difference for students intending to major in HASS (humanities, arts, and social science). Switching out of a STEM major is often a result of low grades, poor teaching during early coursework experiences, unwelcoming learning environments, curriculum challenges that extend time-to-degree, and finding a better fit in another discipline (Seymour and Hewitt, 1997). These reasons are consistent with those cited by UCLA

undergraduates in 2013 and 2014 senior surveys[1], in which students who had switched from a STEM to HASS major reported similar reasons for changing their intended field of study (Hurtado, Sork *et al.,* 2015, Appendix H).

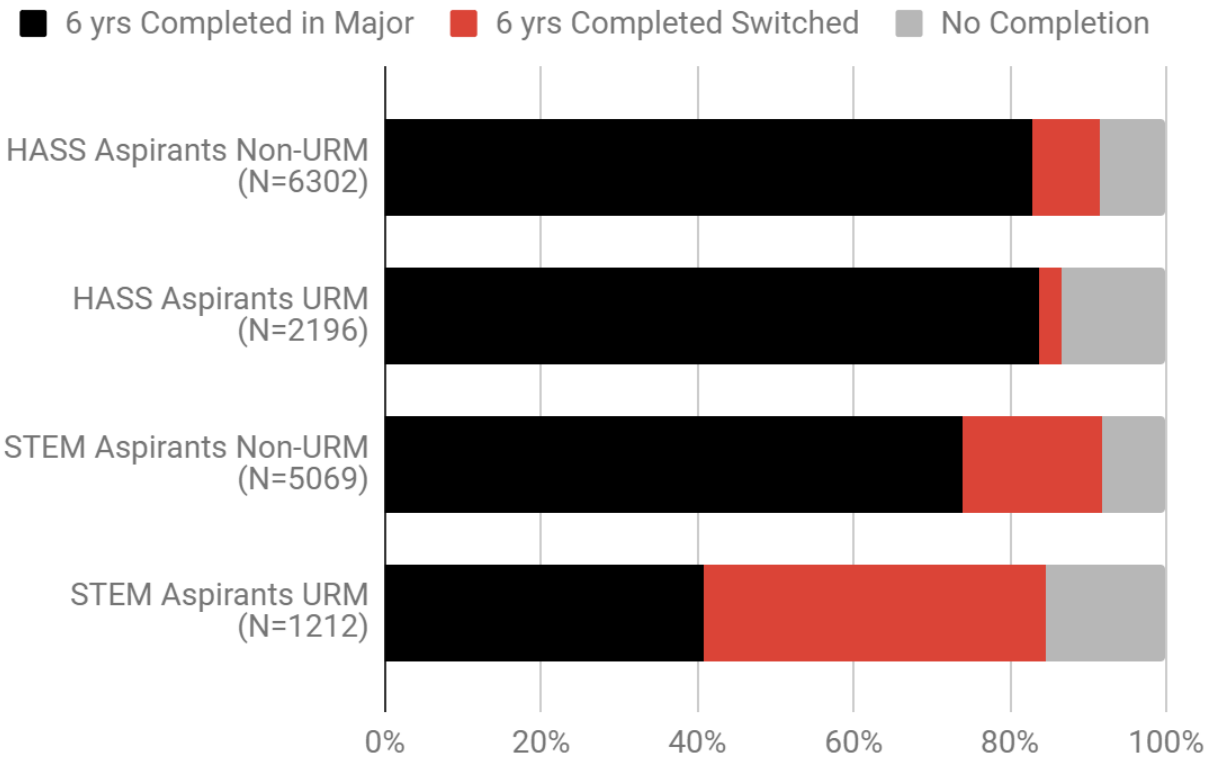

Fig. B.1-1. Graduate rates averaged across four freshmen cohorts entering UCLA in fall 2009 to 2012 for majors in Humanities, Arts, and Social Sciences (HASS) and Science, Technology, Engineering, and Mathematics (STEM). Race/ethnicity for URM classification includes Black/African American, Hispanic, and American Indian/Alaskan Native. Source: UCLA Office of Academic Planning and Budget (APB), spring 2018. Figure updated from Hurtado, Sork *et al.* (2015).

Recognizing an immediate and urgent need to eliminate the barriers to equity and inclusion in UCLA classrooms and support the success of all STEM students, particularly those historically marginalized and systemically weeded out of STEM majors (National Academies of Sciences, Engineering, and Medicine, 2016; Chen 2013; National Research Council, 2011), the Deans of Life and Physical Sciences established CEILS with a goal to become a hub for leading pedagogical change, a home for

[1] Source: 2013 and 2014 UCLA Senior Survey administered by the Center for Educational Assessment (CEA). The total sample contained more than 12,850 students of which 6,795 students responded (52% response rate) to an item asking for reasons they switched majors. Analysis of responses to this prompt focused exclusively on those students who had switched from a STEM to HASS major (approximately 11% of respondents).

instructors committed to engage in this work, and a resource benefitting campus goals to close degree attainment gaps and support student success.

2. The UCLA Center for Education Innovation & Learning in the Sciences (CEILS)

Mission

Founded in 2014, the Center for Education Innovation & Learning in the Sciences (CEILS) creates a collaborative community of instructors committed to advancing teaching excellence, assessment, diversity, and scholarship, resulting in the enhancement of student learning experiences in the Life and Physical Sciences at UCLA.

Goals

CEILS transforms the culture of science, technology, engineering, and math (STEM) teaching by pursuing the following five principal goals:

1. Lead initiatives that promote current and future faculty teaching development and create inclusive, student-centered classrooms.
2. Train instructors in innovative, validated teaching methods, assessment, and course design.
3. Create a community of instructors that advances the scholarship of teaching and learning in STEM education.
4. Partner with faculty to acquire grant funds to support undergraduate and graduate instructional initiatives in STEM.
5. Engage in collaborations and conversations across campus, regional, and national partners to promote multidisciplinary institutional transformation.

Specific Areas of Responsibility/Contribution

CEILS serves as a clearinghouse for educational tools and assessment resources that instructors need to engage in effective, evidence-based teaching practices to promote student learning, create inclusive and culturally-responsive classrooms, and retain students in Life and Physical Science majors. The three primary means for engaging instructors in these tools and resources is through our comprehensive website, workshops and institutes that vary in their level of time commitment (from an hour to a full day to a week in the summer to a full academic year), and individual consultations on a range of education-related issues (e.g., grant proposals, teaching practices, course revisions, educational technology integration, classroom observations).

CEILS fosters the professional development of faculty and provides pedagogical training for those who wish to incorporate evidence-based teaching approaches into their courses. Examples of training opportunities include quarterly Bringing Theory to Practice (BTtoP) workshops; the annual, all-day Faculty Workshop on Best practices in Teaching; the nationally-recognized, week-long Summer Institute on Scientific

Teaching; and the year-long, statewide Faculty Learning Program. CEILS also supports faculty engagement in learning communities and organizes special events such as the Scientific Teaching Scholars seminar series and division- or campus-wide symposia on teaching. In addition, CEILS offers programs supporting faculty efforts to transform their courses and improve their teaching. These include the undergraduate Learning Assistants (LA) program, which assists with adoption of collaborative learning techniques in lectures and discussion sections, and faculty learning communities (FLCs) such as teaching circles, which provide training in peer classroom observations and feedback to instructor teams. Through these efforts, CEILS seeks to transform institutional attitudes about teaching and promote student-centered, inclusive education.

Working with partners in the Center for Educational Assessment (CEA) in UCLA's Center for the Advancement of Teaching (CAT), CEILS also assists with the design of assessments needed in the development of successful grant proposals that will fund curricular innovations and faculty development programs. With awards from external agencies such as NSF, NIH, HHMI, and other private foundations, as well as internal units such as CAT's instructional improvement program, this partnership with CEA extends to include administration of program evaluations of grant-funded projects and conduct of assessments in support of education and action research undergone with faculty collaborators on these grants. Since 2014, CEILS has helped UCLA secure over $15M total in grant funding.

Leveraging this external support for assessment resources, CEILS directors, in collaboration with faculty and instructors participating in curricular innovation, contribute to discipline-based education research (DBER) about student learning related to pedagogical shifts. Instructors have the opportunity to explore this literature in-depth and present their own work to get formative feedback from a friendly community of UCLA educators during a weekly STEM Education Research Journal Club. By presenting at education conferences and publishing project results in peer-reviewed education journals, CEILS ensures that UCLA has a voice in the national conversation supporting STEM education. We also bring credibility to the science of learning and its essential role in informing change in teaching and classroom practices. Between 2014-2019, CEILS directors have participated in 50 conference presentations (talks, posters, workshops) and have published a total of 6 manuscripts.

CEILS was established to provide a supportive home for tenured, tenure-track, and non-tenure track faculty and instructors who are involved as practitioners and education leaders in undergraduate instruction. Later participation was expanded to include graduate students and postdocs who express interest in pursuing academic careers. Initiatives supporting future faculty include the CIRTL@UCLA teaching development program, the UPLIFT postdoctoral fellowship program, and the Aspire2Teach and Aspire2Lead internship programs. In addition, CEILS provides training for graduate student teaching assistants (TAs) in partnership with CAT and the Excellence in Pedagogy and Innovative Classrooms (EPIC) program in Humanities. Educators who engage with CEILS are dedicated to achieving teaching excellence and eager to integrate innovative and inclusive pedagogical approaches and reflective teaching practices into their courses. Many such change agents sustain their engagement with CEILS by becoming mentors for the Summer Institute on Scientific Teaching, co-

facilitators for workshops offered by CEILS, and instructional consultants who broaden the capacity for CEILS to help STEM faculty implement best teaching and classroom practices.

Benefits Expected from CEILS Engagement

Transforming the manner in which the undergraduate curriculum for Life and Physical Science majors is taught at UCLA should produce a more diverse and competent body of undergraduate scholars prepared to meet the intellectual demands of a scientifically literate and technologically competent 21st century workforce. Likewise, instructors should benefit from the resources and services provided by CEILS, gaining perspective, skills, and satisfaction from teaching experiences that more effectively explore the current breath of scientific knowledge and constructively employ the tools of scientific inquiry. Departments and interdisciplinary programs also should benefit from interactions with CEILS by having instructors who are well prepared to create student learning outcomes for their courses with aligned educational activities and assessments. This has a positive impact on teaching effectiveness when used to inform and enhance the educational experience, and also generates standards by which departments and interdisciplinary programs can measure student success. Collectively, these efforts support a culture of effective, inclusive, and culturally-responsive teaching and student-centered learning in alignment with institutional priorities.

Connections to Other Campus Units

CEILS is a STEM Education Center (SEC) that emerged at UCLA five years ago in the context of a campus with *decentralized* support for teaching and learning and faculty development. CEILS leadership (Director) reports to the Deans of Life and Physical Sciences in the College of Letters and Science via the Associate Deans in each science division. CEILS formally supports faculty in 15 academic units within Life and Physical Sciences but also engages frequently with departments and programs in Humanities, Arts, Social Sciences, Undergraduate and Graduate Education; multiple professional schools such as Engineering, Education, and the Medical School; Academic Senate committees related to instruction; administrative units serving the campuswide teaching community such as the Center for the Advancement of Teaching (CAT), the Online Teaching & Learning Initiative (OTLI), the UCLA Library, and the National Center for Research on Evaluation, Standards, and Student Testing (UCLA CRESST); and other discipline-specific organizations such as the Excellence in Pedagogy and Innovative Classrooms (EPIC) program, the Humanities Technology (HumTech) center, Writing Programs, and the Social Sciences IDP (SS-IDP). CEILS also formally collaborates with Graduate Division to coordinate pedagogical training and professional development of UCLA graduate students (including Teaching Assistants) and postdocs by leveraging our institutional membership in the Center for the Integration of Research, Teaching and Learning (CIRTL), a national network of more than 35 research-intensive universities supporting the career advancement of future faculty.

CEILS is distinct from UCLA's campus-wide center for teaching and learning (CTL), the Center for Advancement of Teaching (CAT), which supports instruction in a variety of ways across all disciplines at UCLA. Their services, resources, and programs include (1) grants supporting curricular innovation, (2) assessment services, (3) workshops and

learning communities supporting pedagogical development of faculty (with emphasis on those outside the sciences and humanities where discipline-specific support already exists), (4) TA training workshops and resources supporting departmental pedagogy courses for new TAs, (5) classroom facilities, and (6) campus LMS and lecture capture technology. CAT leadership, an Associate Vice Provost and tenured faculty member, reports directly to the Vice Provost of Undergraduate Education in the College of Letters and Science. Although CAT is separate from CEILS (e.g., independent funding streams, different target audiences for services and programs, distinct organizational structures), the two communicate and collaborate on many campus-wide initiatives. Recently, both units have played a pivotal role in helping to better *coordinate* activities that support teaching and learning, TA training, and faculty development at UCLA.

Creating a culture of teaching excellence involves many stakeholders from across the campus. “No one office, unit, or individual can create an environment of teaching excellence” (American Council on Education 2017, pp. vii). This point highlights an advantage to sustaining a *decentralized* albeit *coordinated* support model for teaching and learning and faculty development, particularly on large campuses such as UCLA. However, effort to create such a culture requires a commitment on the part of all stakeholders to engage in shared leadership, embrace common standards and metrics for faculty development and curricular enhancing activities, and demonstrate through assessment the effectiveness of their contributions in meeting this institutional goal. CEILS is well-positioned to play a key role in advancing this goal in the Life and Physical Sciences and this report documents the success of these efforts over the last five years.

3. Personnel

CEILS is administered under the umbrella of the Life Sciences Core Education Department (LS Core). A draft of the current CEILS organizational chart is shown in **Figure B.3-1**.

There are currently five full-time, core staff members responsible for day-to-day CEILS operations:

- Erin Sanders O’Leary (Academic Administrator VII; Associate Adjunct Professor), Director for CEILS
- Shanna Shaked (Academic Administrator V), Senior Associate Director for CEILS and Director of the Learning Assistant (LA) Program
- Rachel Kennison (Academic Administrator V; 50% Graduate Division, 50% CEILS; Assistant Adjunct Professor), Senior Associate Director for Instructional & Professional Development and Director of the CIRTL@UCLA Program
- Jessica Gregg (Academic Coordinator II), Associate Director for Educational Development
- Stephy Lao (Assistant III), Administrative Assistant for CEILS

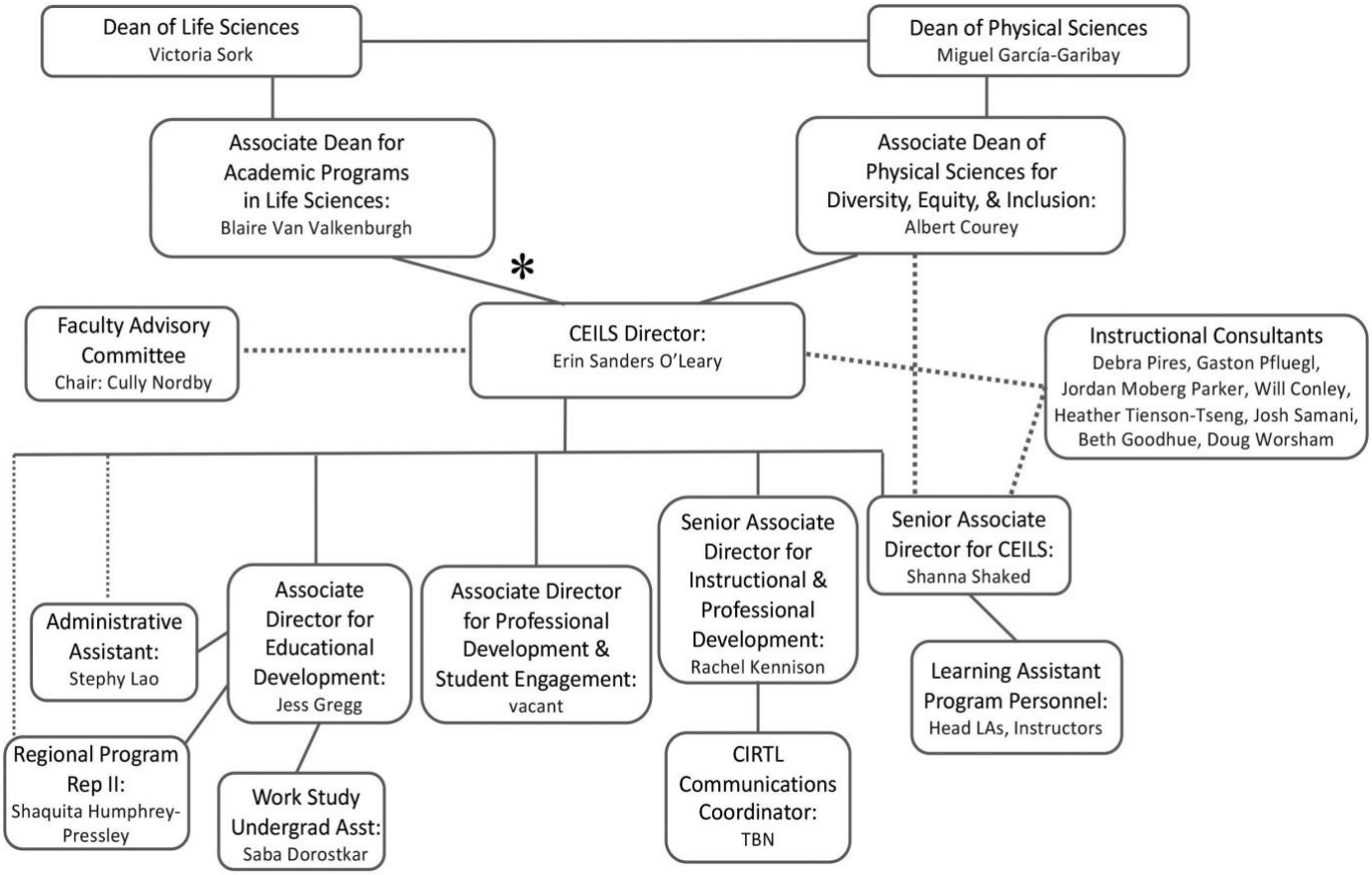

Fig. B.3-1. CEILS Organizational Chart, FY 2019-20. Asterisk (*) designates primary person to whom Director reports; this can switch from one Associate Dean to the other as necessary. Solid lines indicate direct reporting relationships; dotted lines delineate indirect or informal reporting relationships; dashed lines define collaborations and partnerships essential to CEILS org structure.

Senior Associate Directors Shaked and Kennison and Associate Director Gregg report directly to Director O'Leary whereas Administrative Assistant Lao reports directly to Associate Director Gregg. Also reporting directly to Gregg is the full-time, NSF INCLUDES Alliance grant-funded Regional Programming Representative (Program Rep II) and a part-time Undergraduate Assistant (work study student). Reporting directly to Shaked are all personnel associated with the Learning Assistant (LA) program including head LAs (~35 undergraduates per year) and pedagogy course instructors and TAs (1-2 per year). Reporting directly to Kennison is a part-time CIRTL Communications Coordinator (previously occupied by a graduate student; currently vacant).

Beginning in 2020, the Program Representative position, given the similarity in job duties, will be responsible for supporting both the NSF INCLUDES Alliance grant and CIRTL program as a single position with a direct, dual reporting relationship to Gregg and Kennison. In addition, a sixth full-time position, the Associate Director for Professional Development & Student Engagement (Academic Administrator III) is currently vacant. As part of our strategic plan, we will propose rewriting the job description to better fit staffing needs for CEILS.

Figure B.3-2 shows the full-time staff FTE counts and changes by year since 2014.

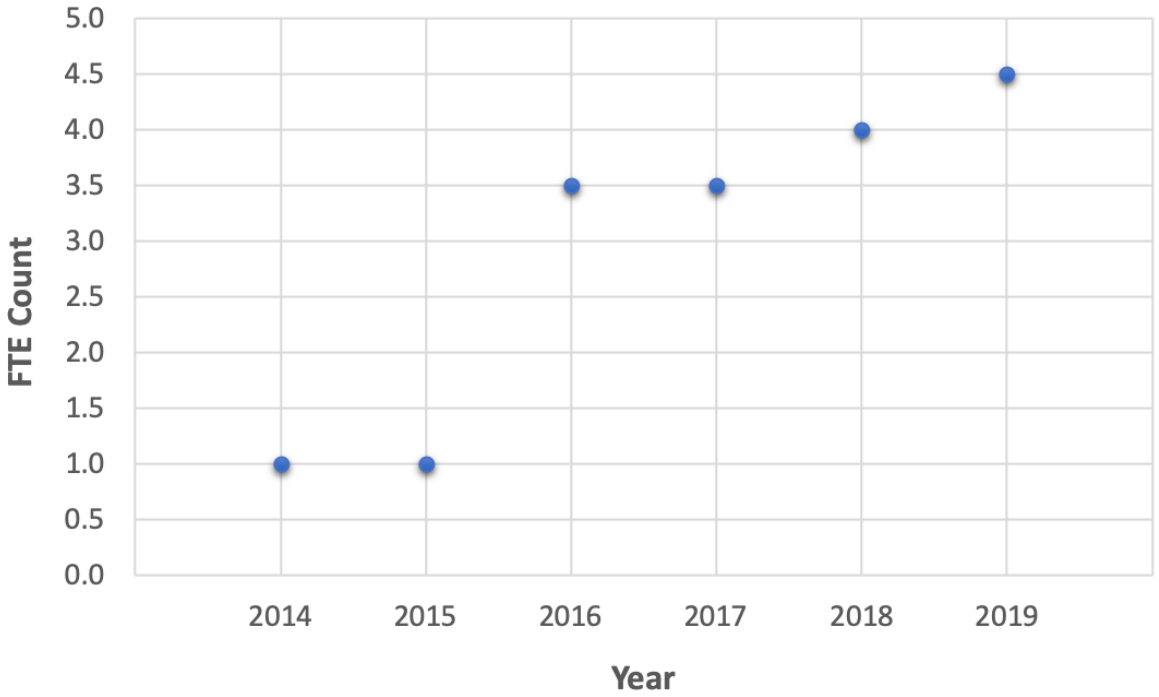

Fig. B.3-2. FTE counts and changes by year since 2014.

A Faculty Advisory Committee (FAC) contributes to efforts essential to CEILS operations (**Table B.3-1**). No funding is requested for the faculty serving on the FAC; however, the Deans formally recognize these members for their service and support of the teaching and learning community at UCLA.

Table B.3-1 Members of the CEILS Faculty Advisory Committee (FAC), 2019-20.

Anastassia Alexandrova	Associate Professor and Vice Chair of Undergraduate Education, Dept. of Chemistry & Biochemistry
Don Blasius	Distinguished Professor and Undergraduate Vice Chair, Dept. of Mathematics; Chair, Math/Econ IDP
Albert Courey (ex-officio)	Professor, Dept. of Chemistry & Biochemistry; Associate Dean of Physical Sciences for Diversity, Equity, and Inclusion
Robert Gould	Teaching Professor (Lecturer SOE) and Undergraduate Vice Chair, Dept. of Statistics
Jay Hauser	Professor and Vice Chair of Academic Affairs, Dept. of Physics & Astronomy
Sylvia Hurtado	Professor, Graduate School of Education & Information Studies
Christopher Kelty	Professor and Vice Chair of Undergraduate Education, Institute for Society & Genetics
Barbara Knowlton	Professor and Vice Chair for Undergraduate Studies, Dept. of Psychology

Beth Lazazzera	Associate Professor, Dept. of Microbiology, Immunology, & Molecular Genetics; Chair, Life Sciences Core Education Dept.
Jeffrey Long	Professor and Vice Chair for Education, Dept. of Molecular, Cell, and Developmental Biology
Cully Nordby (Chair)	Associate Director, Institute of the Environment and Sustainability
Gilles Peltzer	Professor, Dept. of Earth, Planetary, and Space Sciences
Patricia Phelps	Professor and Vice Chair, Dept. of Integrative Biology & Physiology
April Pyle	Professor and Vice Chair for Undergraduate Affairs, Dept. of Microbiology, Immunology, & Molecular Genetics
Lawren Sack	Professor and Vice Chair for Undergraduate Education, Dept. of Ecology & Evolutionary Biology
Van Savage	Assistant Professor and Co-Vice Chair for Computational and Systems Biology IDP
Jochen Stutz	Professor and Chair, Dept. of Atmospheric & Oceanic Sciences
Blaire Van Valkenburgh (ex-officio)	Distinguished Professor, Dept. of Ecology & Evolutionary Biology; Associate Dean of the Life Sciences for Academic Programs
Stephanie White	Professor, Dept. of Integrative Biology & Physiology; Director for Undergraduate Neuroscience IDP

The Deans appoint a Chair of the FAC, which rotates every 1-2 years between Life and Physical Sciences members of the FAC. Responsibilities of the FAC Chair include interacting with the CEILS Director to organize meetings with the larger committee and to help to identify CEILS programming and service priorities. The composition of the FAC changes every few years as faculty members transition into and out of their departmental roles as Vice Chairs; these changes are not so frequent as to disrupt the continuity of the committee's charge to communicate the educational needs and interests of all the departments and interdisciplinary programs in the Life and Physical Sciences. Director O'Leary meets with the FAC at least once per year while interacting with individual or smaller groups periodically throughout the year. The Deans guide the priorities of the FAC and CEILS leadership through communications with FAC *ex-officio* members, Associate Deans Albert Courey and Blaire Van Valkenburgh, to whom the CEILS Director reports directly.

The Instructional Consultants are UCLA educators who formally collaborate with CEILS to support the research, development, and implementation of best educational practices in the classroom (**Table B.3-2**).

Table B.3-2 CEILS Instructional Consultants, 2019-20.

Will Conley	Assistant Teaching Professor of Mathematics (LPSOE)
Noah Garrison	Director of Environmental Science Practicum, UCLA Institute of the Environment and Sustainability (IoES)
Beth Goodhue	Associate Director for Faculty Engagement at UCLA's Center for the Advancement of Teaching (CAT)
Jordan Moberg Parker	Assistant Adjunct Professor, Academic Coordinator Department of Microbiology, Immunology & Molecular Genetics

Debra Pires	Academic Administrator, Department of Life Sciences Core Education
Gaston Pfluegl	Academic Administrator, Department of Life Sciences Core Education
Joshua Samani	Assistant Teaching Professor of Physics and Astronomy (LPSOE)
Heather Tienson-Tseng	Continuing Lecturer, Department of Chemistry and Biochemistry
Doug Worsham	Team Lead for Teaching and Learning & Library Liaison for Psychology and Food Studies

Instructional consultants, each with unique areas of pedagogical and technological expertise, are available to support faculty across the Life and Physical Sciences in exploring, implementing, and assessing new teaching strategies. Instructional Consultants also help with CEILS events such as workshops and institutes, assist with the development of innovative course and curriculum projects, and promote collaborations between CEILS and other campus units. In these ways, Instructional Consultants assist CEILS in building capacity to support education innovation and teaching development more broadly across the sciences.

4. Space

CEILS staff occupies permanent space in two locations, Hershey Hall and Young Hall, with a total of 946 square feet:

- 3 individual offices in Hershey Hall (room 228, 134 sq. ft., occupied by Director O'Leary; room 226, 138 sq. ft., occupied by Senior Associate Director Kennison; and room 222B, 136 sq. ft., occupied by Associate Director Gregg)

- 1 shared office suite in Hershey Hall (room 222, 384 sq. ft., occupied by Administrative Assistant Lao, Undergraduate Assistant Saba Dorostkar, and Program Representative Shaquita Humphrey-Pressley)
    - The suite also contains a small meeting space used for CEILS staff meetings and consultations with small groups of faculty (<4) as well as office hours

- 1 individual office in Young Hall (room 3077C, 156 sq. ft., occupied by Senior Associate Director Shaked)

CEILS consistently utilizes several meeting spaces in six locations: Hershey Hall, Terasaki Life Sciences Bldg., La Kretz Garden Pavilion, Young Hall, Boelter Hall, and the Biomedical Research Library, with a combined total of 10,108 square feet:

- Hershey Hall, 3515 sq. ft. total (room 158, 2031 sq. ft.; room 164, 364 sq. ft.; and room 168, 308 sq. ft.) for events, meetings, and consultations. If available, we also occasionally use classroom 148, 812 sq. ft., as a breakout room for larger events.

- Terasaki Life Science Bldg., 1702 sq. ft. total (room 1100, 707 sq. ft., room 2100, 213 sq. ft., and room 4100, 215 sq. ft.) for events, meetings, consultations. We also occasionally use room 1000A, 227 sq. ft., and room 1020, 340 sq. ft., as

breakout rooms for larger events.

- La Kretz Garden Pavilion, 1295 sq. ft. total (room 100, 637 sq. ft., and room 101, 658 sq. ft.) for workshops and smaller events.
- Young Hall, 1010 sq. ft. total (common area for office suite, room 3077, 448 sq. ft.; and Cafe Commons, room 3037, 562 sq. ft.) for office hours and LA program activities.
- Boelter Hall, 2586 sq. ft total (Science and Engineering Library Learning Commons, room 8436, 1244 sq. ft.; and west half of the Research Commons, room 8251, 1342 sq. ft.)
- Biomedical Research Library, 777 sq. ft. (room 12-077Q) for CIRTL courses.

Maps of these spaces are provided in **Appendix G.4**. Despite having access to a range of conference rooms, meeting space can be a limiting factor for CEILS, most often during major events in which multiple conference rooms of differing sizes are needed to accommodate both large group activities and concurrent breakout sessions. The Dean of Life Sciences has been instrumental in minimizing this issue, giving CEILS permission (overriding existing administrative policies) to make reservations for the large conference room in Hershey Hall (room 158) up to a year in advance. This does not apply to smaller conference rooms in Hershey Hall, Terasaki, or the La Kretz Garden Pavilion, which sometimes cannot be reserved until weeks out from an event. Other large venues on campus charge for using their space; these costs are typically outside the scope of the CEILS annual budget and so, when necessary, we rely on grant funds or special requests to the Deans for supplemental funding to cover the room rental costs. We typically do not organize large events requiring these venues more than once or twice per year, depending on the availability of funds.

5. Overview of Programs, Services, and Resources

CEILS engages our campus stakeholders and regional partners in a range of professional development, curricular improvement, and outreach and engagement activities spanning seven areas: (I) Communication and Online Engagement, (II) Faculty Development, (III) Special Events, (IV) Faculty Learning Communities, (V) Graduate Student and Postdoctoral Support, (VI) STEM Curricular Initiatives Supporting Student Success (Undergraduate Education and Graduate Education), and (VII) Outreach and Community Connections. **Table B.5-1** lists CEILS' programs, services, and resources for each category, annotated to indicate the role CEILS plays. Roles of CEILS team members in each activity range from being consultants to formal participants in the development, administration, teaching, facilitation, and/or evaluation of a program, service, or resource. A detailed description of each activity and the associated assessment outcomes is provided in **Appendix G.5**.

Table B.5-1. CEILS programs, services, and resources*. Role CEILS team plays in each activity is denoted as C=consultant or P=participant with formal role in development (D), administration (A), teaching (T), facilitation (F), and/or evaluation** (E).

(I) Communication and Online Engagement
Newsletters and Announcements (P, A)
Website (P, A)
(II) Faculty Development
Annual Faculty Workshop on Best Practices in Teaching (P, F)
Bringing Theory to Practice (BTtoP) Workshops (P, F)
Summer Institute on Scientific Teaching (SI) (P, F)
Faculty Learning Program (FLP) (P, F)
Inclusive Excellence Workshop (C, P, E)
Learning Assistant (LA) Program in the Sciences (P, A, T)
(III) Special Events
Scholars in Scientific Teaching Seminars (P, A)
Symposia and Conferences (P, D, A)
(IV) Faculty Learning Communities
STEM Education Research Journal Club (P, A, F)
Chem 14A/B FLC (C)
Cross-campus Teaching Innovations Group (CTIG) (P, D, A)
Peer Observation of Teaching (C)
(V) Graduate Student and Postdoctoral Support
Teaching Assistant Consultant (TAC) Summer Academy (P, D, F)
Center for the Integration of Research, Teaching and Learning (CIRTL) Program (P, A, F)
UCLA Postdocs' Longitudinal Investment in Faculty Training (UPLIFT) IRACDA Program (P, A, F)
Aspire2Teach and Aspire2Lead Internship Program (P, D, A, F)
Discipline-based Education Research (DBER) Postdoctoral Fellowship Program (P, D, A, F)
(VI) STEM Curricular Initiatives Supporting Student Success
Undergraduate Education
Mathematics for Life Scientists (LS30AB) (C, P, A, E)
Introductory Biology Curriculum (LS7ABC, LS107) (C, P, E)
Career Exploration in the Life Sciences (LS110) (P, D, T, E)
Learning Assistant Pedagogy and Teaching Practicum (courses 192A-E) (P, D, A, T, E)
Enhanced Introductory Chemistry (Chem 14AE, 14BE) (C)
Introductory Physics Curriculum and Labs (Physics 5) (C)
Supported Calculus Course (Math 31AL) (C)

Graduate Education
Life Sciences TA Training (LS 495) (P, D, A, T)
Scholars in Teaching-as-Research (STAR) Program (Grad PD 496ABC) (P, D, A, F, T)
Career Readiness Inside and Outside the Academy (MolBio 497) (P, D, A, T)
(VII) Outreach and Community Engagement
NSF INCLUDES Aspire Project: Southern California Regional Collaborative (SoCal RC) (P, A)
Kayne Foundation Summer Bridge Program (P, F)

* Please see **Appendix G.5** for detailed descriptions.
** All activities are assessed. We distinguish program evaluation from our self-assessment here if the role for evaluation was a formalized and distinct component of a project/program collaboration.

C. Impact

1. Six-Level Evaluation Framework

Program evaluation is central to the development and evolution of a teaching and learning center. This accountability process is important for documenting a center's impact, collecting feedback from program constituents to inform improvements, gathering information about education challenges or goals for which there is a need for specific support (needs assessment), and justifying requests for more resources. Drawing upon research in educational and organizational development (Kirkpatrick, 1998; Guskey 2000; Marbach-Ad *et al.,* 2015; Beach *et al.* 2016; ACE 2017, AAU 2017), CEILS has embraced a six-level framework for evaluating the impact of our programming and services over the past five years, and together these data have been used to shape our strategic planning for the next five years. The six levels of our framework are as follows:

1. Participation
2. Change in affective measures (attitudes, interest, motivation, satisfaction)
3. Knowledge/skills attainment
4. Change in teaching practice
5. Student outcomes
6. Change in institutional culture

Participation in CEILS activities is tracked using RSVP and attendance records connected to demographic information to help us understand which constituents we are currently serving and identify where we need to focus future recruitment efforts. Self-report surveys and questionnaires are used to gather feedback from participants on affective, or non-cognitive, measures such as attitudes about teaching, interest/motivation for engagement, and satisfaction with programming activities; this helps us determine whether our pedagogical training strategies are achieving their goals. These same self-report instruments are often used to collect feedback from participants on changes in their awareness or knowledge levels about evidence-based instructional approaches and confidence or interest in adopting new practices.

Monitoring changes in teaching practices and documenting student outcomes are more challenging metrics to consistently measure and thus have been done on a more limited basis across our center's activities. Self-report surveys have been employed asking instructors to share which instructional strategies they have tried in their classrooms, but previous studies show that self-reported data about faculty teaching practices do not necessarily align with their actual teaching practices when verified with classroom observation data (Ebert-May *et al*., 2011). Conducting classroom observations of former faculty participants in CEILS programming would improve our measure of impact on teaching practices; we have done this occasionally upon request and offer services to support instructors (including TAs) in learning how to conduct peer observations of teaching (see **Appendix G.5, section IV**). Documenting student outcomes has been possible to some extent at both the undergraduate and graduate levels, in some cases leading to national conference presentations and publications in peer-reviewed journals. As described in **Appendix G.5, section VI** (STEM Curricular Innovations Supporting Student Success), all grant-funded projects are accompanied by rigorous assessment of student learning, persistence, and/or gains in non-cognitive measures; these studies are done in collaboration with campus assessment groups such as CAT's Center for Educational Assessment (CEA), faculty in the Graduate School of Education, and CRESST. The CEILS team has also worked directly with departments in the Life and Physical Sciences to support the administration of informal surveys and organized focus groups with students to clarify how any changes in teaching practices are affecting the classroom climate and perceived student learning experiences.

Lastly, in alignment with our goal to promote institutional transformation, CEILS engages campus, regional, and national partners to effect change in the teaching culture at UCLA. Both direct and indirect measures of our effectiveness have been utilized. As a direct measure, surveys were deployed in fall 2019 to solicit feedback from campus partners on our impact outside the Life and Physical Sciences with questions gauging our unique value and broader contributions to UCLA's teaching enterprise as well as on whether they envisioned their level of CEILS engagement changing in future. As an indirect measure, an overlay of our services, programs, and resources was created with the Henderson, Beach, and Finkelstein (2011) framework (**Figure C.1-1**), which categorizes change strategies into four quadrants each characterized as having different capacities to amplify impact. This is the same framework our campuswide teaching and learning center, CAT, is using to contextualize their new initiatives and predict their intended outcomes related to cultural change. This parallel analysis should be useful in informing campus leadership of CEILS' impact in a way that mirrors what CAT has done.

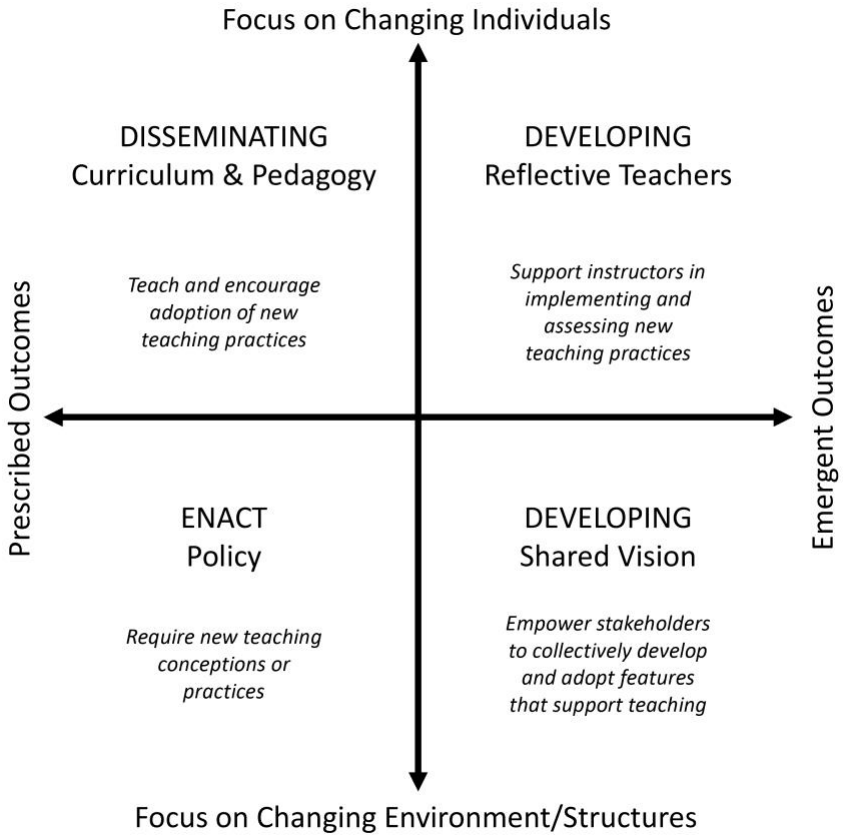

Fig. C.1-1. Four-quadrant framework for characterizing change strategies and predicting their impact as either prescribed or emergent and focused on individual or environmental/structural change (see Henderson, Beach, and Finkelstein, 2011).

CEILS has five main goals as described in **Section A.2** and recapitulated in **Table C.1-1** below. These goals became the basis for how we operationalized and measured the success of the CEILS over the last five years as well as identified areas where our programming efforts need to improve or expand in the next five years.

Table C.1-1. Metrics and data collected for assessment of CEILS goals

Goals	**Metric(s)**	**Data**
1. Lead initiatives that promote current and future faculty teaching development and create inclusive, student-centered classrooms	● Evolution of programming ● Reframing of CEILS professional development activities ● Contributions to EDI initiatives	● Timeline 2014-present ● Inclusive teaching framework ● 2015 EVC report, dashboards

Goals	Metric(s)	Data
2. Train instructors in innovative, validated teaching methods, assessment, and course design	● Participation ● Satisfaction (affective measure) and knowledge/ skills attainment ● Motivation (affective measure) ● Change in teaching practices ● Student outcomes	● Engagement tracker w/ participant information ● Self-report surveys for individual programs ● LS/PS Faculty Survey (quantitative item) ● LS/PS Faculty Survey (qualitative item), departmental feedback, COPUS ● Curricular initiatives assessment findings, student counts in courses taught by CEILS-engaged instructors
3. Create a community of instructors that advances the scholarship of teaching and learning in STEM education	● Learning communities ● Change agents ● Publications and conference presentations	● Participation ● Feedback from instructional consultants ● CVs for CEILS team
4. Partner with faculty to acquire grant funds to support undergraduate and graduate instructional initiatives in STEM	● Grant-funded projects ● Funding sources	● Engagement tracker w/ budget details and other project information ● Extramural and intramural agency information
5. Engage in collaborations and conversations across campus, regional, and national partners to promote multidisciplinary institutional transformation	● Campus engagement ● Regional and national outreach ● Change in teaching culture	● Campus partners survey, committee work records ● Membership tabulation, role summary ● Overlay of CEILS programming with 4-quadrant framework

LS = life sciences; PS = physical sciences; EDI = equity, diversity, and inclusion; EVC = executive vice chancellor

2. Assessment of the principal goals of CEILS

While there is currently no standard assessment framework for measuring the impact of faculty development efforts within the context of a teaching and learning center, it is recognized that methods undertaken to evaluate these efforts should align with the established goals of the unit as well as the mission of the university and the constituents a center serves (ACE 2017, Ch.3). These goals should be SMART (specific, measurable, achievable, relevant, and timely), thereby measurable using quantitative and qualitative evidence (Doran, 1981). Here we describe our assessment of CEILS' five principal goals, which were articulated in 2014 in collaboration with a steering

committee comprised of a subset of members of the inaugural Faculty Advisory Committee (FAC). Refer to **Table C.1-1** for a summary of the metrics and data collected in the assessment of these goals.

Goal 1: Lead initiatives that promote current and future faculty teaching development and create inclusive, student-centered classrooms

Over the past five years, inclusive teaching has shaped the evolution of CEILS resources, services, and programming, becoming the umbrella under which, the educational initiatives and pedagogical principles of faculty development efforts now fall. **Figure C.2-1** provides a timeline of CEILS programming by year, illustrating the incremental changes and broadening of services that roughly corresponds with increasing CEILS FTE count over time (see **Figure B.3-2**).

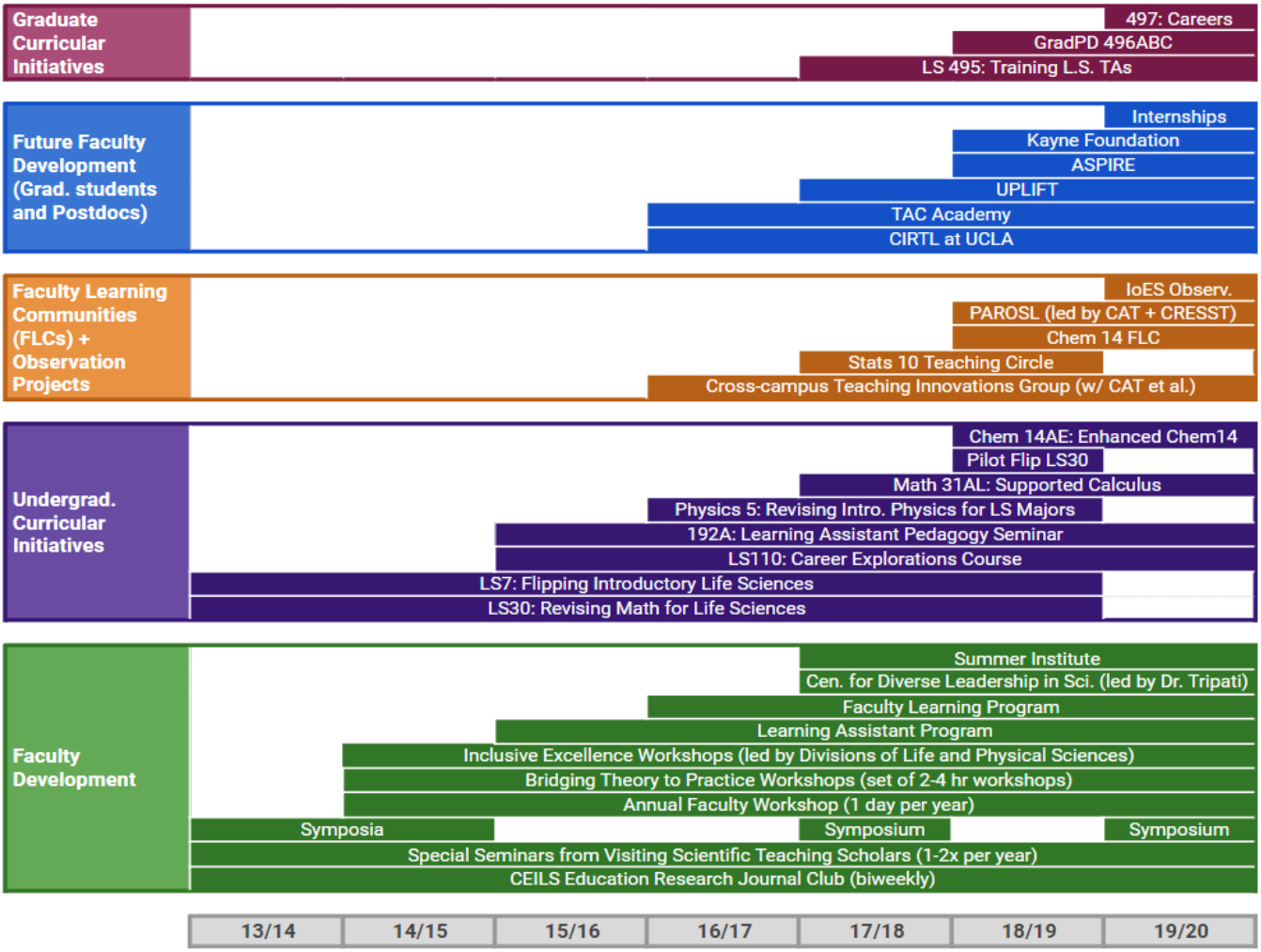

Fig. C.2-1. CEILS programming by year (2013-present) categorized as faculty development (green), undergraduate curricular initiatives (violet), faculty learning communities and classroom observation projects (orange), graduate student and postdoctoral scholar support (blue), and graduate curricular initiatives (maroon).

The programming and resources developed and implemented by CEILS that support inclusive, culturally-responsive teaching development are summarized as follows (see

Appendix G.5 for detailed descriptions of each program referenced). We also do individual consultations with faculty on inclusive teaching and high impact practices.

As part of our Bringing Theory to Practice (BTtoP) workshop series, CEILS developed and implemented a two-part workshop on *Creating Equitable Learning Environments & Teaching Inclusively*. Each part is approximately 2 hrs, amounting to a total of 4 hrs of training in inclusive pedagogy. These are challenging workshops to deliver thoughtfully and effectively. The framing of the content often varies by audience (faculty vs. graduate student TAs; new vs. experienced instructors). With iterative improvements based on feedback collected from workshop participants, we now have a robust set of slides, handouts, and worksheets to support workshop offerings for diverse audiences. Many of these materials are available to faculty members via our website, specifically in our Inclusive Teaching Guide. Another resource available to all UCLA instructors via the campus LMS, CCLE, is the CEILS Mid-quarter Questionnaire, a customizable survey that instructors may use to solicit feedback from students on their teaching mid-way through the quarter. Embedded survey items include classroom climate questions.

We have integrated our BTtoP workshop materials into shorter sessions that we offer as stand-alone modules or as components of longer workshops and institutes offered by CEILS. For example, we offer a module on barriers to student learning and another module on inclusive teaching practices during the CEILS annual, day-long Faculty Workshop on Best Practices in Teaching. Inclusive teaching is one of the three pillars of the educational framework (scientific teaching) around which our week-long Summer Institute on Scientific Teaching is designed. We dedicate a half-day session to this topic, and each participant team, as part of the institute, integrates aspects of inclusive teaching into their “teachable tidbit” project. Most recently we delivered a 1 hr 15 min workshop for new Assistant Professors in Psychology wherein we presented inclusive teaching through the lens of APM 210, Appendix 41, which was approved in August 2019 and specifies how UCLA faculty may carry out the requirements of the policy and describe their contributions to equity, diversity, and inclusion (EDI) in their dossier submitted for merit-based advancement/ promotion and tenure. Activities specified include the adoption of “pedagogical practices and learning theories that create inclusive learning environments and communities” and “curriculum development that enhances equity, diversity, and inclusion”. Thus, we framed the interactive teaching methodologies and other classroom practices presented during our workshop as strategies to create an inclusive learning environment. This policy provides an incentive for participation in CEILS pedagogical training activities. In support of this premise, a survey of LS/PS faculty indicates that the implementation of this policy affects the motivation to participate of 64% of respondents (*n*=124) (see **Figure C.2-2**).

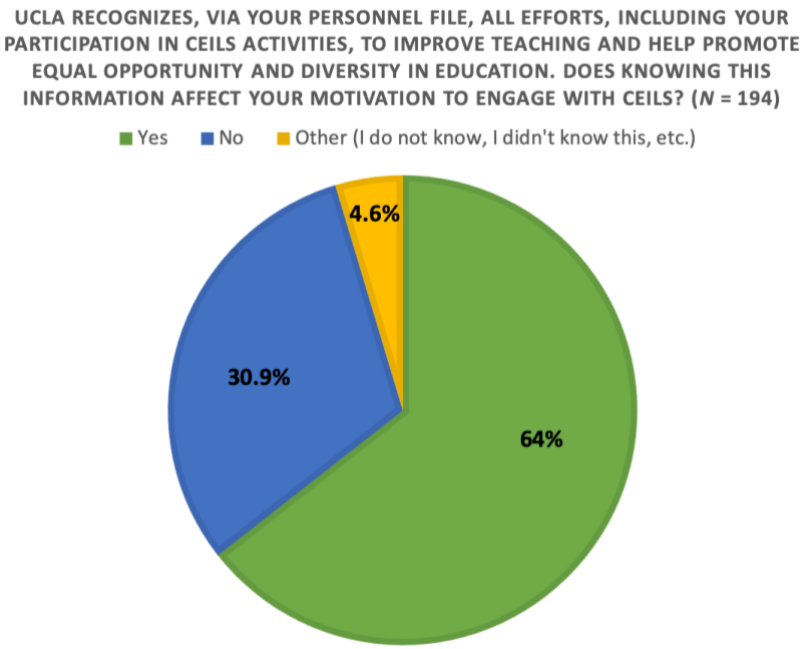

Fig. C.2-2. Percentage of faculty survey respondents who are motivated to engage in CEILS pedagogical training opportunities by UCLA policy, APM 210, Appendix 41. Source: LS/PS Faculty Survey, Fall 2019 (see **Appendix G.1**).

CEILS offers inclusive pedagogy workshops to audiences outside of Life and Physical Sciences. For example, in fall 2018 CEILS was invited by Professor Myung Hee, Associate Dean for EDI in UCLA's School of Theater, Film, and Television, to facilitate a workshop called "Fostering a Growth Mindset by Teaching Inclusively" during their day-long instructor orientation. For the past two years, we have also been asked by Professor Muriel McClendon, in her capacity as the Equity Advisor for Social Sciences, to deliver our inclusive pedagogy workshops to groups that include faculty in her department, other social equity advisors in her division, and members of the university library.

In collaboration with the Deans and Associate Deans of Life and Physical Sciences, CEILS provides support for the Inclusive Excellence Workshop, a two-day off-campus immersion retreat to which 35-40 LS/PS instructors have been invited to participate each year since 2015. CEILS Director (O'Leary) and colleagues (including LS Dean Sork and a research team in the Center for Educational Assessment led by M. Levis-Fitzgerald) have a manuscript under review with the *International Journal of STEM Education* entitled, "Creating Inclusive Classrooms by Engaging STEM Faculty in Culturally Responsive Teaching Workshops", describing the assessment of this inclusive pedagogy training intervention. This study helped us understand how to optimally implement this intervention, and also optimize our other inclusive teaching trainings, using a goal-oriented design framework aligned with other diversity training initiatives in both K-12 and higher education (Carnes *et al.* 2015; Booker *et al.* 2016, Killpack and Melon 2016, Moss-Racusin *et al.* 2016).

In addition to providing inclusive pedagogy trainings for faculty, we incorporate these principles into future faculty professional development and TA training. For example, CEILS Director (O'Leary) and Senior Associate Director (Kennison) teach the division-wide TA training course (LS495) to all graduate student TAs in Life Sciences. The course includes a 2-hour session dedicated to inclusive teaching principles and strategies. Our interdisciplinary CIRTL@UCLA course, *Introduction to Evidence-based Teaching* (Grad PD 496A), uses the LS495 materials to deliver a class session on inclusivity. CEILS collaborates with CAT and EPIC to deliver the TAC Summer Academy, helping to train graduate student instructors of 495 courses in departments across the campus to teach their TAs about inclusive teaching practices. Lastly, our undergraduate Learning Assistant (LA) Program administered by CEILS Senior Associate Director (Shaked) has training sessions on inclusivity integrated into the pedagogy course (192A) completed by all LAs as a requirement of the program. Taken together, CEILS ensures that the entire instructional team—from faculty to TAs to LAs—have opportunities to engage in programming that helps them to create inclusive, student-centered classrooms.

Lastly, we also wanted to call attention to the participation of CEILS Director (O'Leary) as a contributor to the Hurtado and Sork *et al*. 2015 report for the Executive Vice Chancellor, *Enhancing Student Success and Building Inclusive Classrooms at UCLA* This report was the result of an ambitious exploratory analysis of factors affecting UCLA undergraduate student success (defined as academic achievement, persistence in the major, and timely completion of an intended degree). Based on the findings of this self-study, a number of recommendations were made to improve the teaching enterprise at UCLA, one of which led to the development of campus dashboards (e.g., CODE). CEILS proactively engaged faculty in LS/PS departments in discussions of the grade data (and equity gaps) revealed in the dashboard dataset. The goal of these departmental discussions was to underscore the urgent need for pedagogical changes in teaching and grading practices. In this way, CEILS has been proactive in keeping faculty informed of initiatives and engaged in conversations affecting the education mission of the university.

Goal 2: Train instructors in innovative, validated teaching methods, assessment, and course design

To address the extent to which CEILS is accomplishing our goal to train instructors in innovative and evidence-based pedagogy, we have applied the six-level framework described in **section C.1**, wherein our metrics specifically reflect the first five of the six levels of the framework (1-participation, 2-change in affective measures, 3-knowledge/skills attainment, 4-change in teaching practice, and 5-student outcomes). Note that we address the sixth level of the framework (6-change in institutional culture) in summarizing assessment results for CEILS Goal 5.

1- Participation

To monitor participation in CEILS activities, we record both the **number of unique participants by year** (so each participant is only counted once per year) and the **total**

hours that all participants engaged with CEILS (in workshops, consultations, learning communities, journal club, seminars, symposia, through the LA program, etc.). Between 2013[2] and 2016, we tracked the total number of CEILS participants but did not systematically collect institutional data (rank/position, division/department). From 2016 onward, we began tracking attendance and consultations more than 90% of the time using online RSVP forms, paper sign-in sheets, and an online spreadsheet (referred to as the CEILS Engagement Tracker).

We define **participants** as any faculty member, instructor, staff, postdoctoral scholar, graduate student, or undergraduate who attended a CEILS event or consulted with members of the CEILS team. Our participant data does not include the CIRTL programming, which we track separately since it has its own funding stream. We track different **types of participants** as follows: **"TT"** refers to tenured or tenure-track faculty at UCLA (Assistant, Associate, Full Professors, LSOEs, LPSOEs), **"Non-TT"** refers to non-tenure-track faculty at UCLA (Unit 18 Lecturers, Academic Administrators and Academic Coordinators, Adjunct faculty), **"Other"** refers to UCLA postdoctoral scholars, graduate students, undergraduates, non-academic staff, and anyone who did not identify with the other categories, and **"Non-UCLA"** refers to participants not affiliated with UCLA, such as collaborators in regional 2-year and 4-year institutions.

Figure C.2-3 shows the total number of unique participants by year as well as the cumulative number of hours that these participants engaged with CEILS each year. Over time, we see an increase in the number of unique participants per year, reaching nearly 400 in 2018-19, and a corresponding increase in the amount of time that those participants engaged with CEILS, reaching just under 4000 hours by 2018-19. This increase in capacity was made possible with more CEILS staff (see FTE counts in **Figure 3.1-2**).

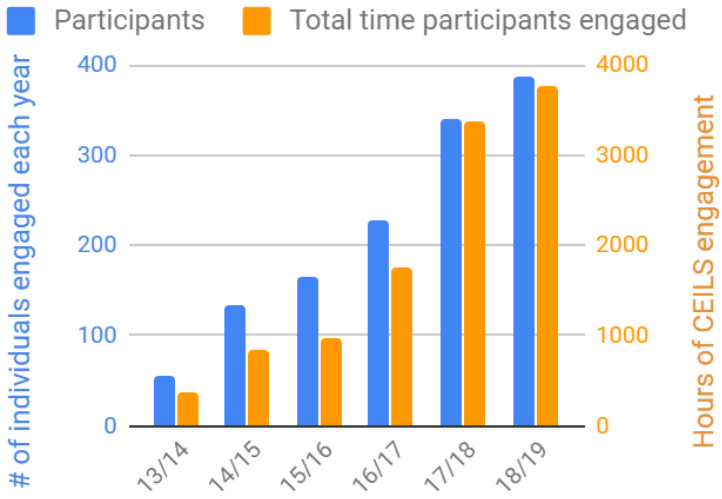

Fig. C.2-3. CEILS participation by number of unique individuals (blue) and cumulative time (hrs) engaged with CEILS (orange), 2013-14 through 2018-19. Source: CEILS Engagement Tracker.

[2] Note that although CEILS formally started July 1, 2014, efforts were initiated in 2013-14 fiscal year (FY) to acquire grant funds and pilot professional development activities such as workshops and consultations. Thus, some data tracking reflects this "pre-CEILS" year to more accurately capture CEILS impact.

We were interested in understanding how participants spend their time with CEILS. **Figure C.2-4** shows the number of hours per year that participants engaged in various CEILS activities (see **Appendix G.5** for detailed descriptions) and consultation services. These data demonstrate that participants engage in a variety of CEILS programs and services, underscoring the importance of offering instructors options in terms of levels of engagement such as individual consultations, shorter workshops to all-day, multi-day or year-long professional development opportunities.

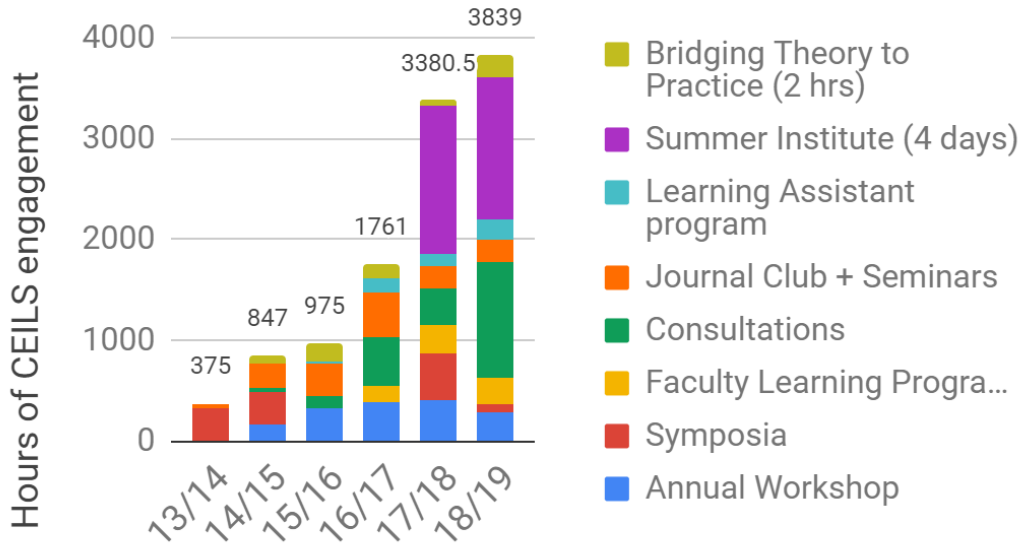

Fig. C.2-4. CEILS participation by program, 2013-14 through 2018-19. Source: CEILS Engagement Tracker.

From 2016 onward, we began recording institutional data for individuals who were participating in CEILS programs and services; this enables us to better understand our constituents and how they may be changing over time. To date, CEILS participation, when measured by hours of engagement and disaggregated by institution, is comprised of 94.1% UCLA and 5.9% non-UCLA constituents. Of the UCLA participants, 46.2% are in Life Sciences (LS), 32.4% are in Physical Sciences (PS) and 15.5% are in other UCLA divisions/schools. As shown in **Figure C.2-5**, participation by constituents in LS and PS have neared parity by 2018-19, reflecting the incremental broadening of support by CEILS for both divisions. Notably, there is sizeable engagement of UCLA participants outside LS/PS, reflecting an increasing demand for professional development from instructors across the campus.

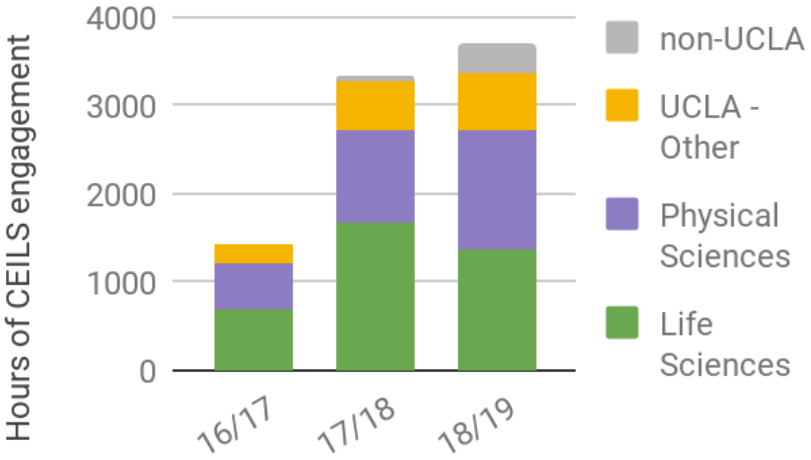

Fig. C.2-5. CEILS participation by affiliation, 2016-17 through 2018-19. Source: CEILS Engagement Tracker

We were interested in understanding how UCLA instructors in different ranks and positions interacted with CEILS. Beginning in 2016, with this additional institutional data for each individual engaged with CEILS, we could disaggregate by participant type. As shown in **Figure C.2-6**, one pattern that emerges for tenured or tenure-track faculty (TT) is their overrepresentation in shorter workshops compared to extended workshops, which tend to engage comparatively more non-tenure-track faculty (Non-TT). This result is consistent with feedback from LS/PS departments that we received as part of our needs assessment, in which faculty indicated that time (or lack thereof) is the biggest barrier to CEILS engagement and that offering shorter workshops would help faculty overcome this barrier (see **Appendix G.2-2**).

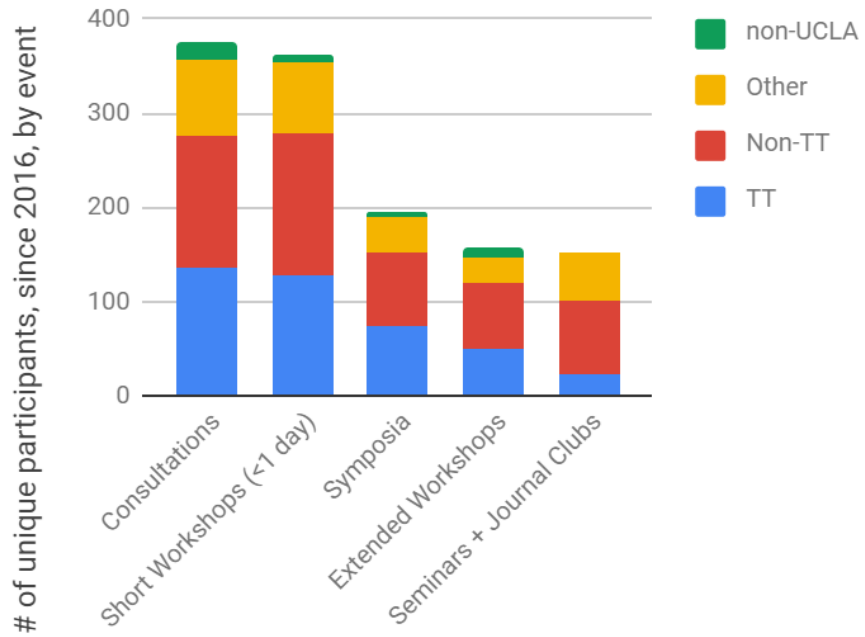

Fig. C.2-6. CEILS participation by type (rank/position), 2016 to present. TT (blue), tenured or tenure-track faculty at UCLA; Non-TT (red), non-tenure-track faculty at UCLA; Other (yellow), anyone else at UCLA who is not in the TT and non-TT categories; and Non-UCLA (green), participants not affiliated with UCLA. Source: CEILS Engagement Tracker.

Among all LS/PS faculty and instructors, CEILS has engaged with 41% of the 411 TT faculty and 50% of the 210 non-TT faculty (see **Table C.2-2**). The median number of hours of CEILS engagement for TT faculty is 5 hours, indicating that more than 20% of TT faculty have engaged with CEILS for a total of more than 5 hours since 2016. For non-TT faculty, the median number of hours of CEILS engagement is about double that of TT faculty at 9 hours.

Table C.2-2. Departmental abbreviations, full names, number of faculty, % engaged with CEILS, and median total hours of engagement. Source: CEILS Engagement Tracker.

		# of faculty		**% of faculty engaged w/ CEILS**		**Median hrs of engagement, of those engaged (2016-2019)**	
Dept	Full Name	**TT**	**non-TT**	**TT**	**non-TT**	**TT**	**non-TT**
AOS	Atmospheric and Oceanic Sciences	19	1	68%	100%	12	5
Biomed	Biomedical Research		3		100%		17
Chem	Chemistry and Biochemistry	51	27	51%	88%	33	30
EPSS	Earth, Planetary and Space Sciences	27	4	41%	25%	28	4
EEB	Ecology and Evolutionary Biology	25	10	72%	70%	13	45
IoES	Institute of the Environment & Sustainability	14	11	64%	36%	29	57
ISG	Institute for Society and Genetics	11	3	36%	33%	18	34
IBP	Integrative Biology and Physiology	19	7	68%	71%	18	38
LS Core	Life Sciences Core		12		92%		76
Math	Math	51	76	14%	34%	19	9
MIMG	Microbio., Imm. & Molec. Gen.	27		26%		32	
MCDB	Molecular, Cell, and Developmental Biology	25	8	36%	25%	25	54
Neuro.	Neuroscience		2		100%		23
Physics	Physics & Astronomy	60	12	33%	17%	38	2
PIC	Program in Computing		6		17%		4
Psych	Psychology	64	15	36%	40%	17	36
Stats	Statistics	18	13	44%	69%	8	41
	Across all departments:	**411**	**210**	**41%**	**50%**	**5**	**9**

Figure C.2-7 depicts the breadth and depth of this engagement for TT and non-TT faculty in each LS/PS department. Notably, faculty across all LS/PS departments are not equally engaged and thus benefiting from CEILS programming and services. This analysis reveals which departments CEILS should try to more proactively engage with in future.

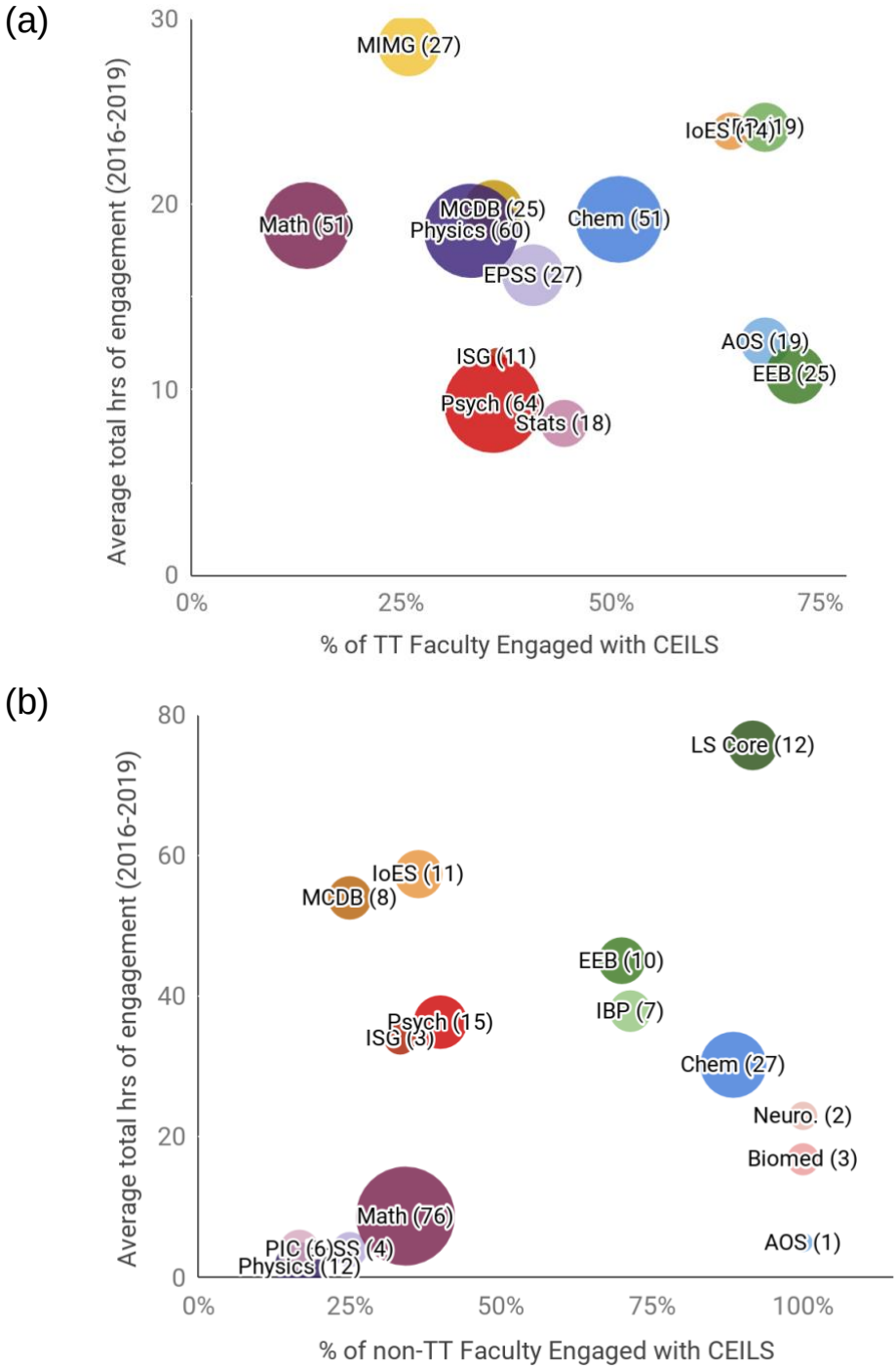

Fig. C.2-7. CEILS participation by department for (a) TT faculty and (b) non-TT faculty, 2016-2019. The percentage of departmental faculty who have engaged with CEILS reflects the breadth of engagement (x-axis), and the total number of hours of engagement, averaged for all faculty within a given department who engaged with CEILS during the three-year timeframe, reflects the depth of engagement (y-axis). The (size of each bubble corresponds to the total number of faculty in a given department, with the absolute number in parentheses. See **Table C.2-2** for full departmental names corresponding to the abbreviations. Source: CEILS Engagement Tracker.

To further explore how LS/PS faculty have been interacting with CEILS over the last five years, we administered a survey in fall 2019 to nearly 600 faculty members across the two divisions. The overall response rate to this survey was approximately 30%.

Figure C.2-8 shows a summary of responses to a question asking faculty to identify the various ways in which they engaged with CEILS. Many have participated in CEILS events/activities either a few times (35.9%) or more regularly (35.4%) or have participated in one event or had a consultation with a CEILS team member (27.2%). These self-report data are consistent with trends identified in the analysis of our Engagement Tracker data. The survey also revealed that faculty read the monthly newsletter (35.9%) and utilize the website resources (33.3%). These latter forms of participation are not captured by our CEILS Engagement Tracker and indicate that there are multiple modalities by which faculty are engaging with CEILS, both in person and via online resources.

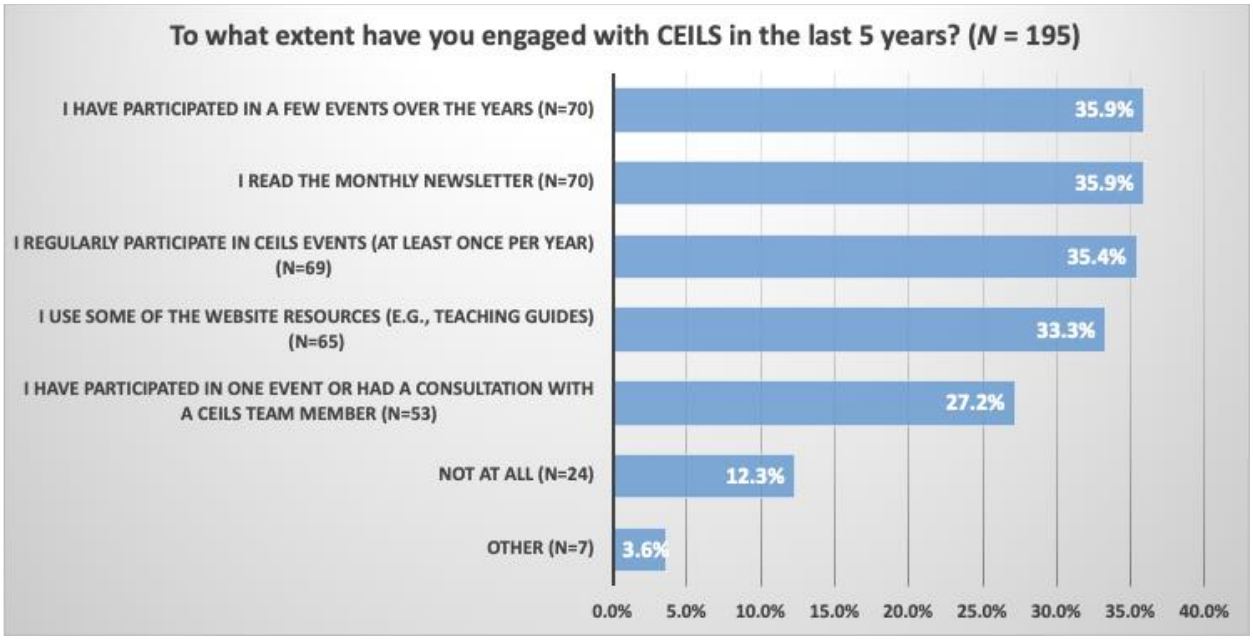

Fig. C.2-8. CEILS participation in person and online. Source: LS/PS Faculty Survey, Fall 2019 (see **Appendix G.1**). Response rate was approximately 30% with 195 faculty, out of a total of 592 TT and non-TT faculty, responding to this question.

2/3- Change in Affective Measures (satisfaction, motivation) and Knowledge/Skills

Self-report surveys, informal questionnaires, and interviews are used to gather feedback from participants on affective measures such as motivation for engagement and satisfaction with programming activities. These assessments typically contain a combination of questions addressing affective measures and knowledge or skills gains related to a particular activity; thus, we report findings addressing both of these levels of the evaluation framework in this section of the report.

Survey data is collected from participants for all CEILS faculty development programs including the Annual Faculty Workshop on Best Practices in Teaching, Bringing Theory to Practice (BTtoP) Workshops, the Summer Institute on Scientific Teaching (SI), Faculty Learning Program (FLP), the Inclusive Excellence Workshop, and the Learning Assistant (LA) Program. See **Appendix G.5, section II** for highlights from assessments of each program.

CEILS also uses surveys and interviews to gather feedback from graduate students and postdocs participating in our future faculty programs. These include the TAC Summer Academy, CIRTL@UCLA, the UPLIFT postdoctoral fellowship program, and the Aspire2Teach and Aspire2Lead internship program. See **Appendix G.5, section V** for descriptions of key survey results available for select programs.

Many of our curricular initiatives in undergraduate and graduate education also utilized self-report data for both formative and summative assessment purposes. See **Appendix G.5, section VI** for descriptions of program evaluations.

Results from the LS/PS faculty survey administered in fall 2019 reveals a multitude of strategies motivating participation in CEILS events and consultation services. Recommendation from a colleague (51.5%) and email invitation from CEILS staff (48.5%) ranked the highest among strategies listed. Notably, when sending email invitations, we address each message to recipients by name, intentionally personalizing each message by mail merge with faculty and instructor data, which we obtain annually from our Deans' offices.

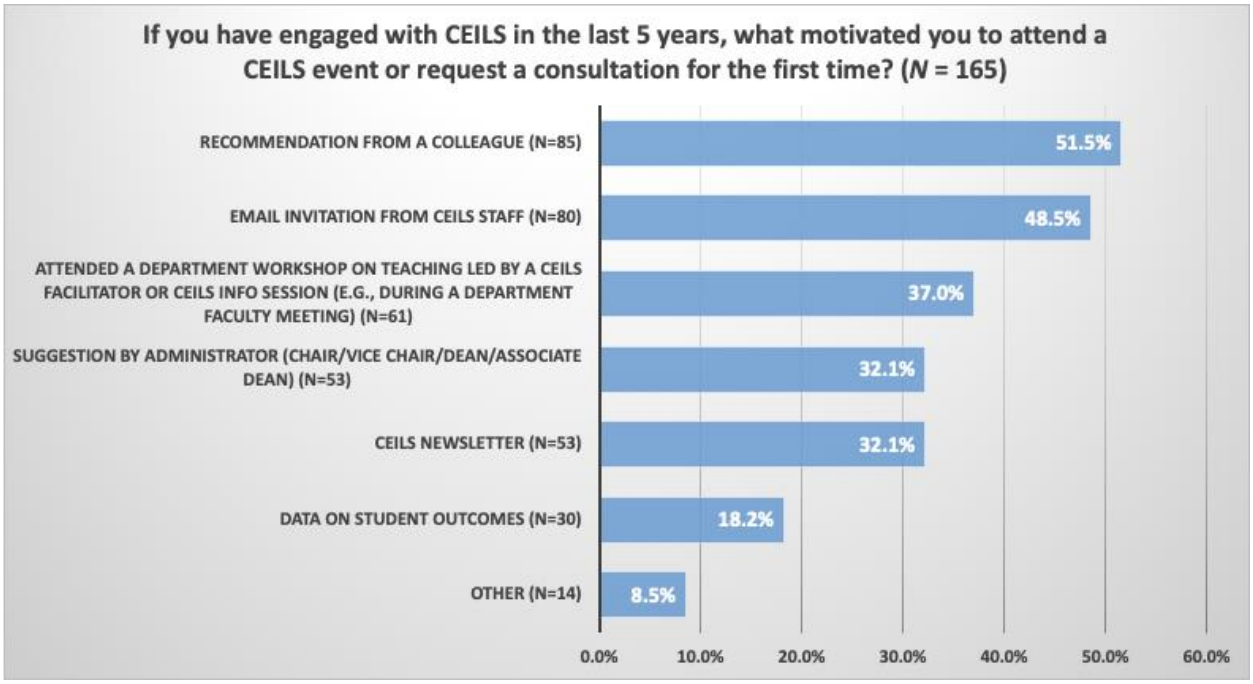

Fig. C.2-9. Motivation for first time engagement with CEILS. Source: LS/PS Faculty Survey, Fall 2019 (see **Appendix G.1**). Response rate was approximately 28% with 165 faculty, out of a total of 592 TT and non-TT faculty, responding to this question.

4- Change in Teaching Practice

Results from the fall 2019 LS/PS faculty survey provide insights into the myriad ways CEILS engagement has impacted teaching practices and attitudes about teaching. **Table C.2-3** summarizes the themes that emerged from analysis of qualitative data.

Table C.2-3. Qualitative results to survey question (Q4) asking faculty, "If you have engaged with CEILS in the last 5 years, what impact has your engagement had on your teaching practices and/or your attitudes about teaching?". Source: LS/PS Faculty Survey, Fall 2019 (see **Appendix G.1**), N=83 respondents.

Themes	n	Frequency (%)	n`	Frequency (%)
Overall impact:	50	34%		
Improved teaching			25	50%
Improved student learning and engagement			18	36%
Little or no impact			7	14%
New or improved classroom practices:	49	34%		
Active learning			11	22%
New tools and ideas			8	16%
Learning objectives			7	14%
Revised syllabus			6	12%
Backward design			4	8%
Group work			4	8%
Flipped classroom			2	4%
Clickers			1	2%
Discussion sections			1	2%
Journal articles			1	2%
Learning assistants			1	2%
Other course activities			3	6%
Equity and inclusion:	16	11%		
Inclusive classrooms			13	81%
Institutional support			3	19%
Useful and valuable impact:	14	10%		
Positive impressions			7	50%
Evidence-based approaches			4	29%
Improved attitude			3	21%
Assessment of and feedback on student learning:	10	7%		
Exams			4	40%
Assessment and grading			3	30%
Student feedback			1	10%
Teaching evaluations			1	10%
Assignments			1	10%
Engagement:	7	5%		
Community of practice			7	100%
Total N:	146	100%		

Among those faculty reporting positive impacts of CEILS engagement, one respondent states, "[CEILS] helped me identify concrete changes I can make to my teaching to

improve student outcomes and morale". Another states, "[CEILS] made me more aware that I may not be reaching all students". A third respondent says, "[I] increased my awareness of creating a more inclusive environment and understanding how bias can enter into the classroom". Another pointed out that their participation has "given [them] the perspective that UCLA encourages and rewards good teaching practices". These comments highlight the diverse ways in which CEILS is positively affecting change in teaching practices.

To complement the individual LS/PS faculty survey data, we also asked CEILS Faculty Advisory Committee (FAC) members to spend 15-20 min during a departmental faculty meeting in fall 2019 discussing a series of questions (see **Appendix G.2.1**) about potential impact of CEILS engagement. Of the 16 LS/PS departments and interdisciplinary programs, 11 completed and returned responses to the questions to the CEILS team (69% response rate). Full responses provided to CEILS from departmental discussions and themes emerging from qualitative analysis of text is provided in **Appendix G.2.2**. Similar themes were collapsed and are summarized for two questions in **Tables C.2-4** and **C.2.5**. Examination of these themes reveals many positive impacts of CEILS engagement on individual faculty members and departments as a whole. Underscoring this broader departmental impact, faculty recognized that their participation in CEILS programming counts in their dossier for advancement/promotion and tenure and acknowledge that the existence of CEILS in and of itself sends a positive message to faculty that teaching is valued by the leadership in LS/PS.

Table C.2-4. Qualitative results to discussion question (Q1) asking, "For those who have engaged with CEILS, what impact has your engagement had on your teaching?" (*N* = 10 departments) Source: LS/PS Departmental Discussion Questions, Fall 2019 (see **Appendix G.2**).

Themes
Changed the way faculty think about teaching (adopting new teaching techniques, making teaching more interactive, transforming to using student-focused teaching and active learning, more awareness of how students approach learning, introducing learning assistants, or LAs)
Changed the way faculty think about diversity/retention in STEM fields (providing support for underrepresented students, introducing teaching techniques to improve classroom inclusivity)
Knowledge that participation counts in academic personnel dossiers
Value the crucial support to new faculty
Value expertise in grant proposal development
Appreciate support for teaching (encouragement, motivation, camaraderie, community)

Table C.2-5. Qualitative results to discussion question (Q2) asking, "For those who have engaged with CEILS, what impact has CEILS had more broadly on your attitudes about teaching or students in your department?" (*N* = 8 departments) Source: LS/PS Departmental Discussion Questions, Fall 2019 (see **Appendix G.2**).

Themes
More aware of student dynamics, increased understanding of the perspectives of UCLA students, belief that students are capable of succeeding and faculty can help them do so with the right teaching approach
Knowledge of course design and assessment methods, how to scaffold student learning and maximize student engagement, aligning student learning and assessment when teaching, learning outcomes and grading rubrics
Changed attitudes about teaching process to value student-centered approach, more inclusive and student focused
Existence of CEILS sends positive message to faculty that teaching is valued

Other evidence of change in teaching practices can be seen in CEILS' work with departments on curricular revisions across the sciences. One example includes the NSF-funded revision of the introductory biology series (LS7A/B/C) to become highly structured and taught in a flipped format. Dozens of Life Science faculty now teach these courses using this blended learning modality. Another example is in Physical Sciences wherein CEILS worked with the Chemistry & Biochemistry department to obtain Provost grant funding to implement Chemistry 14AE, an enhanced introductory chemistry course that will be taught starting spring 2020 using a highly-structured format that involves Learning Assistants (LA) who facilitate a form of peer-led team learning called POGIL. The LA program itself has had a large impact on pedagogical practices in large-enrollment STEM gateway courses. Of the more than 10,000 enrolled students per quarter who are served by the LA program, we estimate that, in the absence of the LA program, 30-50% would have otherwise experienced "traditional" discussion sections, with the TA lecturing or reviewing course material almost the entire time with little to no collaborative learning.

One final way in which changes in teaching practice have been monitored is using the classroom observation protocol for undergraduate STEM, or COPUS (Smith *et al*., 2013). As a component of our assessment of curricular initiatives funded by an NSF grant, this observation instrument was utilized to substantiate self-report data by comparing teaching practices before and after flipping the introductory biology courses and a pilot math course (LS30A). It has also been used to gauge the effectiveness of facilitator training implemented for the collaborative learning workshops offered by UCLA's STEM retention program PEERS (Program for Excellence in Education and Research in the Sciences) (Toven-Lindsey *et al.*, 2015). The observation data collected for some of these projects was incorporated into a large, multi-institutional dataset used in a national study examining the extent to which lecture-dominated teaching modalities were still being used in American universities; this study, led by Marilyne Stains at the University of Nebraska-Lincoln, was published in *Science* and included six UCLA co-

authors (Stains *et al.,* 2018). In addition to using this protocol to document changes in teaching practices as part of grant-funded assessment projects, CEILS provides COPUS training to campus constituents interested in using this protocol for peer observations. As described in **Appendix G.5, section II**, CEILS uses a variety of strategies (e.g., teaching circles) to support faculty and departments in developing a system for peer observation aimed at providing instructors feedback to improve teaching.

5- Student Outcomes

Assessment of student outcomes resulting from pedagogical or curricular changes has been tightly associated with course transformation projects funded by grants. This work involves collaborations either with campus units that specialize in assessment such as CAT's Center for Educational Assessment (CEA) or with individual faculty in UCLA's Graduate School of Education who have expertise in education research. These collaborations rely on partnerships with campus data stewards who provide access to institutional data (IR offices such as Academic Planning & Budget). It is important to point out that **assessment services are not free**; grant funds are used to support personnel who work on the projects. And oftentimes these assessment projects, when sufficient rigor is applied, lead to publications in discipline-based education research journals. The results of such efforts connected to CEILS are summarized in **Appendix G.5, section VI**.

Briefly, one example is assessment of the new math curriculum in life sciences, LS30A/B, in which we see improvements in student performance in subsequent science courses relative to students who take traditional Calculus. For the pilot of our Calculus course integrating supplementary instruction (Math 31AL), we found that the students who took Math 31AL rather than precalculus (Math 1) persisted through Math 31B at similar rates, suggesting that Math 31AL decreases time-to-degree. Another example is with assessment of the life sciences career exploration course, LS 110, in which the analysis of quantitative and qualitative post-survey results showed that students completing the course feel more confident about proactively exploring career interests and setting achievable goals, and in their choice of major and degree, suggesting they are more likely to persist in STEM careers. Lastly, a number of studies have been done or are underway to evaluate the impact and efficacy of the LA program. For instance, findings from a 2017 study of an LA-supported introductory biology course suggest that LAs provide additional learning benefits to students beyond the use of active learning, especially for URM students (Sellami *et al*., 2017). Another study conducted in 2017 examined the impact on learning among students in LA-supported introductory physics courses. A preliminary analysis of course sections with and without LAs finds that LA presence is generally associated with decreased DF rates, and this difference is generally greater for URM DF rates (Shaked *et al.,* 2018). As part of this same study, analysis of responses to surveys administered to LAs shows that as the pedagogy training and practicum courses incorporated more discussions around inclusivity, LAs reported feeling increasingly more prepared to help students from different backgrounds.

We would like to point out that there is demand from faculty and departments for access to data on student outcomes. With respect to institutional data, campus dashboards do exist that provide information about average course grades and DF rates for students disaggregated by various demographic characteristics, and we have previously shared and discussed these data with individual faculty and/or presented an overview at departmental meetings. Other forms of assessment, such as survey development and administration, quantitative and qualitative data collection and analysis, focus groups and interviews, and access to course data linked to specific students or student groups, is not a service that CEILS currently has the capacity to provide individual faculty or departments. As noted above, we partner with specialized campus units who provide these services in exchange for grant funds or as in-kind support (e.g., CAT's IIP and Provost's grant programs). We believe that these partnerships make sense, and should continue, for larger-scale curricular initiatives requiring substantial resources and diverse expertise in assessment. However, CEILS would benefit from having a dedicated assessment expert (data scientist) on staff who has direct access to institutional data, experience in mixed-methods assessment and education research, and interest in consulting with faculty and departments (including Chairs, Vice Chairs, and Advisors) on course and program evaluation as it relates to LS/PS student outcomes. This type of data and feedback are essential levers in motivating instructors to sustain course improvement efforts as well as their engagement in CEILS professional development that supports their teaching (Shadle *et al*., 2017).

Another way in which CEILS looks at impact in terms of student outcomes is by examining the count of students enrolled in courses taught by instructors who have engaged with CEILS via workshops, consultations, and other pedagogical training opportunities. **Figure C.2-10** shows the percentage of students in STEM gateway courses being taught by instructors participating to various extents (range of 1 to 81+ cumulative hours) in CEILS activities, from just under half of enrolled students in 2016-17 to almost three quarters of enrolled students in 2018-19. This last year, more than half of enrolled students were taught by an instructor who had engaged with CEILS for at least 7 cumulative hours between 2016-2019. These data underscore the potential for CEILS to effect change in classroom practices and improve student outcomes at scale.

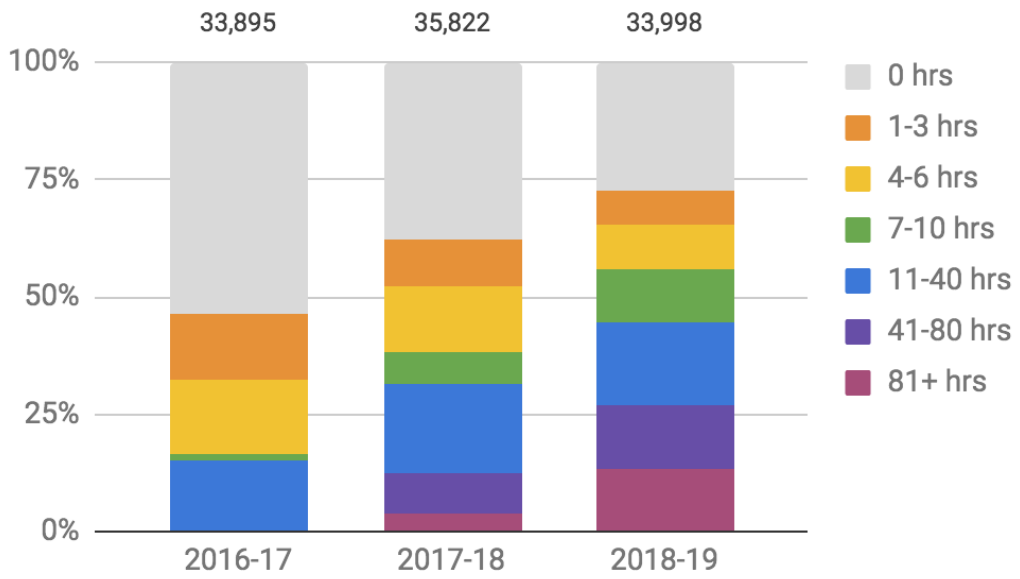

Fig. C.2-10. Percentage of gateway STEM students being taught by instructors engaged in CEILS activities. STEM gateway courses: Chem14A-D, Chem14BL/CL, Chem17, Chem20A/B/L, Chem30A/B/L, Chem30C/B/L, LS1-4, LS7A-C, LS20, LS23L, LS30A/B, Math1, Math3A-C, Math31A(L)/B, Math32A/B, Math33A/B, Phys1A-C, Phys5A-C, Phys6A-C, Stats10, Stats13. At the top of each bar is the total enrollment count for these courses in the academic year indicated; students are counted multiple times if they enrolled in multiple STEM gateway courses that year. The color of the bar indicates the extent of instructor engagement with CEILS, as of that academic year. Source: CEILS Engagement Tracker and UCLA College.

Goal 3: Create a community of instructors that advances the scholarship of teaching and learning in STEM education

Towards the goal of creating a community of instructors, CEILS supports a number of faculty learning communities (FLCs) composed of current and future faculty, instructors, education leaders, and even undergraduates whose shared mission is to improve instruction. Most are STEM-focused but some FLCs engage educators from across the campus. See **Appendix G.5, section IV** for descriptions of current FLCs affiliated with CEILS, including STEM Education Research Journal Club (96 members spanning all ranks and multiple disciplines), Chemistry 14A/B FLC (10 members from the Chemistry & Biochemistry department), and the Cross-campus Teaching Innovations Group (CTIG; 35 members from across the campus).The LA Program (see **Appendix G.5, sections II and VI**) has given rise to an FLC comprised of STEM instructors who are teaching LA-supported undergraduate courses (67 members). Two programs supporting UCLA graduate students and postdocs are learning communities in and of themselves: CIRTL@UCLA (736 members) and UPLIFT (12 members).

CEILS also works to cultivate change agents who are embedded in the LS/PS departments and thus positioned to catalyze educational improvement from within the department (Coleman *et al*., 2019). These change agents are educators who have subject-matter expertise, knowledge of effective teaching practices, and experience incorporating evidence-based pedagogies into their classrooms. CEILS serves to

elevate these individuals as change agents in the area of teaching and supports their professional development in a couple of ways. One is by fostering and helping to sustain FLCs that bring together individuals with shared interests and goals. Another is by collaborating with faculty on education research, oftentimes the result of successful grant proposals and associated curricular improvement projects. A third is by enlisting alumni of the Summer Institute on Scientific Teaching as mentors who return to co-facilitate the training sessions and guide team projects in subsequent institutes. Lastly, CEILS formally engages a cadre of UCLA instructors as Instructional Consultants (9 total to date). These individuals are not financially compensated for their role; instead, their engagement reflects a full and authentic commitment to supporting the successful adoption of evidence-based teaching practices at UCLA. Those holding the honorary title of "CEILS Instructional Consultant" are highlighted on our website along with a bibliography and their specified pedagogical area of expertise.

We surveyed our Instructional Consultants and received positive feedback about their experiences in this role. They reported that CEILS creates a community that allows them to meet other faculty from other departments who share an interest in good teaching (building community), yields opportunities to share ideas for instructional practice and education technology that they otherwise would not have known about (exchanging knowledge), and provides exposure to UCLA leadership including Deans and Chairs that now recognize their dedication to teaching (embracing a leadership/expert role within their departments). Their engagement as Instructional Consultants also increases their personal feeling that the work they do as instructors at UCLA is meaningful and has impact (sense of belonging).

Towards the goal of advancing scholarship in STEM education research, the CEILS team consistently participates in regional and national conferences as presenters and workshop facilitators, sharing innovative curricula and programs being implemented at UCLA. A list of conference presentations is provided in the CVs of CEILS team members (see **Appendix G.6**). Since 2014, the four directors have been authors/ co-authors on nearly 50 conference presentations (e.g., posters, presentations, workshops), with another five planned for 2020.

Starting in 2014, members of the CEILS team have contributed to the publication of six peer-reviewed manuscripts in science education with another five in preparation or currently in review, listed as follows. Co-authors on all of these publications include members of the broader CEILS community with whom the CEILS directors collaborated on these projects.

IN PREPARATON

1. **Sanders O'Leary E**, Shapiro C, Toma, S, Levis-Fitzgerald M, Johnson J, and Sork VL (under review). Creating Inclusive Classrooms by Engaging STEM Faculty in Culturally Responsive Teaching Workshops. Submitted to the *International Journal of STEM Education*.

2. **Kennison RL**, Shapiro C, Gregg J, Liu A, Levis-Fitzgerald M, and **Sanders O'Leary E** (in preparation). Scaling Up a Career Course to Drive STEM Persistence: Impact on Undergraduate Student Self-Awareness, Confidence, and Self-Efficacy in Pursuit of

Diverse Science Careers. Intended for submission to the *Journal of Career Development.*

3. Amin S, Sellami N, Toven-Lindsey B, Shapiro C, Levis-Fitzgerald M, and **Shaked S** (in preparation). Students enrolled in the same physics course: those with undergraduate learning assistants learned more. Intended for submission to *CBE-Life Sciences Education*.

4. **Sanders O'Leary E**, Eagan MK, Fregoso J, Conley W, Garfinkel A, Shevtsov J, Hasson T, and Van Valkenburgh B (in preparation). Reimagining the Introductory Math Curriculum for Life Science Majors. Intended for submission to *CBE-Life Sciences Education*.

5. **Sanders O'Leary E**, Wahl K, Sellami N, Hurtado S, and Sork VL (in preparation). Norm-referenced Grading Practices Widen the Performance Gap for College Students Underrepresented and Underserved in Science, Technology, Engineering, and Math (STEM). Intended for submission to *PLOS ONE*.

PUBLISHED

1. Lee CJ, Toven-Lindsey B, Shapiro C, Soh M, Mazrouee S, Levis-Fitzgerald M, and **Sanders ER** (2018) Error-Discovery Learning Boosts Student Engagement and Performance, while Reducing Student Attrition in a Bioinformatics Course. *CBE-Life Sciences Education* 17(3): 1-13. DOI:10.1187/cbe.17-04-0061.

2. Stains M, Harshman J, Barker MK, Chasteen SV, Cole R, DeChenne-Peters SE, Eagan Jr. MK, Esson JM, Knight JK, Laski FA, Levis-Fitzgerald M, Lee CJ, Lo SM, McDonnell LM, McKay TA, Michelotti N, Musgrove A, Palmer MS, Plank KM, Rodela TM, **Sanders ER**, Schimpf NG, Schulte PM, Smith MK, Stetzer M, Van Valkenburgh B, Vinson E, Weir LK, Wendel PJ, Wheeler LB, and Young AM (2018) Anatomy of STEM Teaching in North American Universities. *Science* 359(6383): 1468-1470. DOI: 10.1126/science.aap8892.

3. Sellami N, **Shaked S**, Laski F, Eagan MK, and **Sanders ER** (2017). Implementation of a Learning Assistants Program Improves Student Performance on Higher-Order Assessments. *CBE-Life Sciences Education* 16(4): ar62. DOI: 10.1187/cbe.16-12-0341.

4. **Sanders ER**, Moberg-Parker J, Hirsch AM, Lee PY, Shapiro C, Toma S, and Levis-Fitzgerald M (2016) Transforming Laboratory Education in the Life Sciences: A Scalable Framework for Designing Authentic Undergraduate Research Experience-based Courses Benefits Both Students and Faculty. *Microbe* 11(2): 69-74.

5. Shapiro C, Moberg-Parker J, Toma S, Ayon C, Zimmerman H, Roth-Johnson EA, Hancock S, Levis-Fitzgerald M, and **Sanders ER** (2015) Comparing the Impact of Course-based and Apprentice-based Research Experiences in a Life Science Laboratory Curriculum. *J. Microbiol. Biol. Educ.* 16(2): 186-197.

6. **Sanders ER** and Hirsch AM (2014). Immersing Undergraduate Students into Research on the Metagenomics of the Plant Rhizosphere: A Pedagogical Strategy to Engage Civic-Mindedness and Retain Undergraduates in STEM. *Front. Plant Sci.* 5: 157.

Goal 4: Partner with faculty to acquire grant funds to support undergraduate and graduate instructional initiatives in STEM

Since its inception, CEILS has pursued and successfully acquired both internal and external sources of grant revenue to support projects in curriculum and professional development. The role of CEILS and its directors in these projects varies from PI, Co-I/Co-PI, Senior Personnel, Key Personnel, and Consultants (see **Figure C.2-11**). For more than 75% of all awards, CEILS team members were PIs, Co-I/Co-PIs, or Senior Personnel.

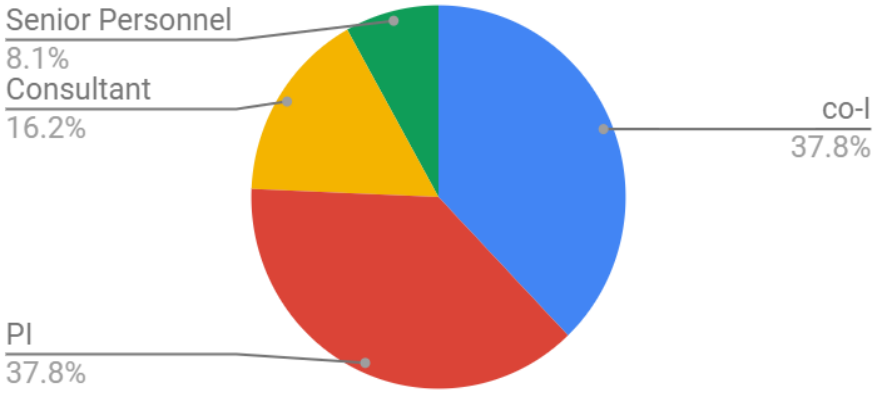

Fig. C.2-11. Distribution of grant funds by CEILS role in the grant-funded projects. Shown is role distribution by grant count. Source: CEILS Engagement Tracker.

In total, CEILS has helped to generate $15.8M in grant revenue from 2013 to present of which the vast majority ($15.4M) is from external funding agencies including NSF (WIDER, IUSE, CAREER, INCLUDES, Alliance, Noyce, NRT-INFEWS), NIH (R25, IRACDA), HHMI, AAU, and private foundations such as Doris Duke Foundation and Silicon Valley Community Foundation. These grants (*N*=37 total) have supported many of CEILS services and programs providing professional development for faculty, graduate students, and postdoctoral scholars. They have helped CEILS to build resources to support instruction, including seed funding to launch the highly successful LA program. These grants have funded major events such as symposia and workshops. Their biggest impact is in curricular development and education research studies wherein grants have provided resources for large-scale, complex and rigorous assessment of student outcomes not otherwise possible within the operational budget of CEILS and departments. Notably, a large fraction of federal funding has been used to support training grants and fellowships for graduate students and postdocs (e.g., NSF NRT-INFEWS, NIH IRACDA), scholarships for undergraduate students (e.g., NSF Noyce), and research for early career faculty (e.g., NSF CAREER).

Figure C.2-12 shows the total number of grants and the associated amount of funding that CEILS has collaborated with UCLA faculty to bring into UCLA between 2013 and 2019. Since 2016 (when we began detailed tracking of engagement), the CEILS team has interacted with at least 68 unique individuals on grant proposals and projects,

serving as collaborators and consultants and spending over 477 hours engaged in this type of work.

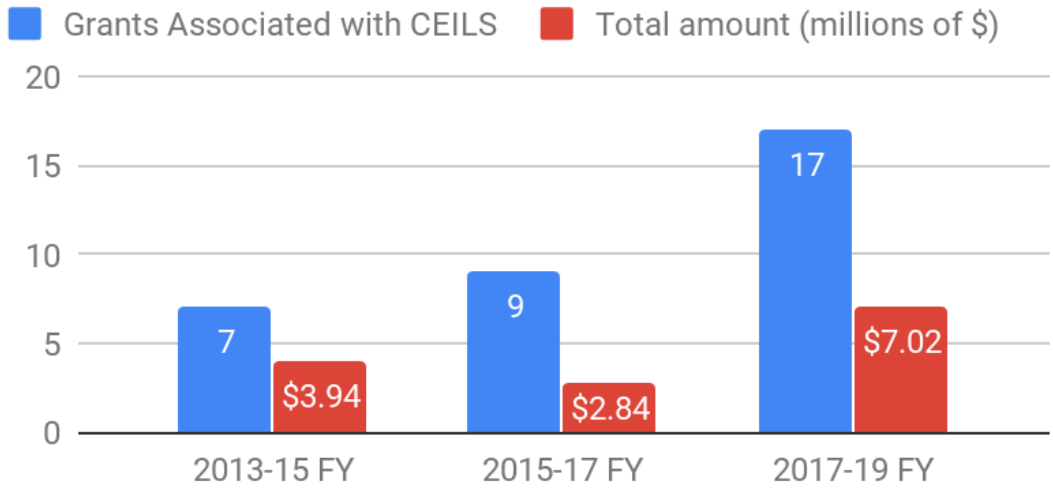

Fig. C.2-12. Tallied every two years from 2013 to 2019, total number of grants (blue) and the total amount of funding brought in by these grants (red). A total of $13.8M in grant funds was awarded to UCLA during this timeframe. Source: CEILS Engagement Trackers.

Goal 5: Engage in collaborations and conversations across campus, regional, and national partners to promote multidisciplinary institutional transformation

CEILS interacts with many individuals in various capacities and in diverse units across campus, our Los Angeles region, and nationally. We provide a list of our partners on the CEILS website.

Campus partners: Towards the goal of engaging campus partners in collaborations that promote institutional transformation, we conducted a survey in fall 2019 of our campus partners (see **Appendix G.3.1**) to examine how individuals are interacting with CEILS, what motivated their engagement with our Center, and the benefits realized from this connection to our work. Although we did not survey all campus partners, we attempted to sample individuals representing numerous units on our partners list, the Cross-campus Teaching Innovations Group (CTIG) membership list, and other learning communities associated with CEILS. A summary of the findings from this survey are in **Appendix G.3.2**. We were most interested in understanding how CEILS was uniquely benefiting individuals, campus academic and administrative units, and the campus more broadly. **Table C.2-6** provides a summary of the themes that emerged from qualitative analysis of the question, “How does CEILS uniquely benefit you and/or your unit?”. Respondents (*N*=50) cited many strengths of CEILS including pedagogy expertise, relevance beyond STEM, advocacy for student success, and accessibility to so many different constituents (e.g., graduate students, faculty, alumni, and departments). As one respondent states, “[CEILS has] built incredible trust and support among faculty

and administrators—not just in STEM but all across the campus." Another says, "[CEILS is a] great partner for all kinds of initiatives. There is no question in my mind that [CEILS] drives teaching and learning initiatives on campus." A third goes on to state, "CEILS offers unparalleled expertise in how to create and sustain impactful learning environments on our campus." Respondents also indicated that CEILS' many programs and resources are useful and applicable beyond the sciences. As stated by one respondent, "The website alone is worth several pedagogy courses… [a] one-stop training site".

Table C.2-6. Qualitative results to survey question (Q3) asking, "How does CEILS uniquely benefits you and/or your unit?". Source: Campus Partners Survey, Fall 2019 (see **Appendix G.3**), N=50 respondents.

Themes	n	Frequency (%)	n`	Frequency (%)
Benefits to campus constituents	28	35%		
Faculty			16	57%
Departments			5	18%
Graduate students			5	18%
Alumni			2	7%
Strengths	21	26%		
Pedagogy expertise			12	57%
Broad relevance			4	19%
Advocacy			3	14%
Accessible			2	10%
Programs and Resources	24	30%		
Resources (website, consultants, ed tech)			6	25%
Professional development activities			7	29%
Learning assistants			7	29%
Career development			2	8%
TA training			2	8%
Personal benefits	7	9%		
Mentors			2	29%
Grants			2	29%
Other			3	43%
Total	80	100%		

Table C.2-7 summarizes the findings from qualitative analysis of the question, "How does CEILS uniquely benefit the campus?". From 71 responses, three broad themes emerged, including teaching impact (65%), educational impact (32%), and a general perception of the CEILS team as hard-working (3%). As one respondent states, "CEILS has succeeded through their sheer grit, persistence, positivity, and hard work."

As regards teaching impact, respondents most valued the instructor pedagogy training (41% of 46 responses), recognized cultural change (20%) occurring on campus with respect to teaching, and appreciated the campus leadership (15%) that CEILS provides through their collaborative work. Citing one respondent, "CEILS benefits UCLA by pushing cutting-edge and research-based teaching strategies. They do not say, 'do active learning', they guide faculty members in the process of best teaching practices". Another respondent says, "[CEILS is] changing the teaching culture little by little. Their

reach goes beyond the sciences—faculty and staff with responsibilities related to teaching look to them for expertise, guidance, workshops, website resources, etc. They have truly been a transformative force for teaching excellence at UCLA." A third respondent states, "CEILS is a campus model of faculty development, innovation in teaching, and the scholarship of teaching."

With reference to educational impact, our partners recognize the importance of having a STEM-specific center for teaching and learning, with one stating, "Their focus on STEM disciplines is particularly valuable, because the research that has been conducted on campus regarding underrepresented student persistence in these disciplines has shown how important classroom interventions are for this population's success." Respondents value the impact CEILS is having on both undergraduate and graduate student success. One partner says, "... the impact of CEILS extends to doctoral programs in the School of Medicine, Engineering, College of Life and Physical Sciences encompassing at least 600 PhD students as well as postdoctoral scholars in the departments associated with the doctoral programs."

Table C.2-7. Qualitative results to survey question (Q4) asking, "How does CEILS uniquely benefit the campus?". Source: Campus Partners Survey, Fall 2019 (see **Appendix G.3**), N=47 respondents.

Themes	n	Frequency (%)	n`	Frequency (%)
Educational impact	23	32%		
STEM Education			9	39%
Learning assistants			4	17%
Undergraduate student success			7	30%
Graduate education			3	13%
Teaching impact	46	65%		
Community of practice			5	11%
Instructor pedagogy training			19	41%
Cultural change			9	20%
Model Center for Teaching and Learning			4	9%
Cross-campus leadership			7	15%
National reach			2	4%
General perceptions	2	3%		
Hard working			2	100%
Total	71	100%		

Overall, these survey results indicate that CEILS is having a positive impact on constituents outside the Life and Physical Sciences. When our campus partners were asked if they anticipated their level of engagement with CEILS changing in the next five years, of 51 respondents, 55% saw their engagement increasing, 43% expected their engagement to stay the same, and 2% (one individual) figured their engagement would decrease because, as they so kindly articulated, "Like any good program, CEILS changes you from within, the transformations last a lifetime, and it readies you to be on your own. One is not the same after participating ... in CEILS programs."

Committee service: In addition to engaging campus partners as described above, the CEILS team serves on numerous committees, task forces, and advisory boards (see

CVs of directors in **Appendix G.6**). Examples include 10 search committees since 2017 and four Academic Senate committees [General Education Foundation of Scientific Inquiry (GE FSI) *Ad Hoc* Committee, Diversity Education *Ad Hoc* Committee, Steering Committee for Online Teaching and Learning (SCOTL), and the Mentoring and Evaluation of Graduate Academic Progress (MEGAP) Implementation Workgroup; see **Appendix G.7** for supporting letters]. As noted by one of our campus partners, "... via the program review process, many units have expressed the benefits of working directly with CEILS. By working with individual instructors on course development, offering innovative TA training, and developing and expanding the use of Learning Assistants, CEILS has a direct impact on the education of thousands of students each year." **Table C.2-8** lists the various campus committees on which CEILS team members have served since 2014.

Table C.2-8. Campus committees with CEILS representation

Year service began#	Count per year	Campus Committee (CEILS representative)
2014	2	● Minority Access to Research Centers (MARC) program advisory board (O'Leary) ● MIMG Laboratory Safety Steering Committee (O'Leary)
2015	2	● CCLE Instructional Development Program Proposal Review Committee (O'Leary) ● Physics for Life Sciences Revision Committee (Shaked)
2016	4	● Cross-campus Teaching Innovations Group (CTIG) (all) ● Math 1 Revision Committee (Shaked) ● Physical Sciences Diversity Committee (Shaked) ● Honors Summer Research Scholarship Selection Committee (Kennison)
2017	6	● Design of Teaching Space in Botany Building Committee (O'Leary) ● *Diversity Education *Ad Hoc* Committee (O'Leary) ● *GE FSI *Ad Hoc* Committee (O'Leary) ● **UCLA Education Innovation Strategic Plan Task Force (O'Leary) ● PEERS Advisory Board (Shaked) ● IEI Working Group on Data and Learning Analytics (Gregg)
2018	6	● **Student Outcomes/Bottleneck Course Identification, TTD Initiative (O'Leary) ● CAT Advisory Launch Committee (O'Leary) ● UC Systemwide Online Grading Solution RFP Project Team (O'Leary) ● PEERS Advisory Board (O'Leary) ● Life Science Excellence Award Committee (O'Leary) ● *Steering Committee for Online Teaching and Learning (SCOTL) (Gregg)
2019	7	● *Mentoring and Evaluation of Graduate Academic Progress (MEGAP) Implementation Workgroup (O'Leary) ● GE FSI Assessment Steering Committee (O'Leary) ● **Degree Attainment and Student Success Task Force (O'Leary) ● CAT Advisory Board (O'Leary) ● Masters of Applied Statistics Advisory Board (O'Leary) ● Mechanobiology Workshop Advisory Board (O'Leary) ● Steering Committee for Online Teaching and Learning (Gregg)

Service may have been for one year or multiple years; year coincides with when committee service began and counts per year only include new committee service.
* Asterisk denotes the Academic Senate Committees for which we provide letters documenting service; see **Appendix G.7**. Two asterisks (**) denotes task forces to which members were appointed by the EVC/P.

Regional and National Outreach: Towards the goal of advancing outreach both regionally and nationally, CEILS is involved in several collaborations and networks that are bringing broader visibility to UCLA's work in STEM education. As a steering committee member of the Network of STEM Education Centers (NSEC), Senior Associate Director Shaked contributed to discussions about the future of this NSF-funded network, including synergies and combined programming with the Professional and Organizational Development (POD) Network in Higher Education. As a Co-Chair for the Reinvention Collaborative's Specialized Network in the Science of Learning/Pedagogical Innovation, Director O'Leary engaged in conversations and projects aimed at improving connections among R1 institutions that are leading initiatives aimed at improving undergraduate education. Through our NSF-funded Aspire initiative, Director O'Leary (PI) and Associate Director Gregg (Co-PI) attend regular meetings with national leaders from the Association from Public Land Grant Universities (APLU) and the Center for the Integration of Research, Teaching, and Learning (CIRTL). Additionally, in forming the Southern California Regional Collaborative (SoCal RC), both regularly network with faculty and administrative leaders in local 2-year and 4-year institutions. These national and regional meetings aim to further the dissemination of evidence-based, inclusive teaching practices and to support and scale up pathways to teaching careers in higher education. Senior Associate Director Kennison leads the CIRTL@UCLA program, which is one of 35+ CIRTL programs in research universities across the U.S., and both she and Director O'Leary regularly engage with national leadership. Additionally, all four CEILS directors have been trained through the national network for the Summer Institutes on Scientific Teaching to offer this high-impact professional development experience at UCLA.

In addition to the leadership roles described above, each of CEILS' team members participate regularly in various STEM education conferences and initiatives (as members, attendees, and presenters) including the Society for the Advancement of Biology Education Research (SABER), Accelerating Systemic Change Network (ASCN), Association of American Colleges and Universities (AAC&U STEM), and the Professional and Organizational Development Network (POD).

Evidence for Change in Institutional Culture: Towards the goal of promoting institutional transformation, which aligns with the sixth level of our evaluation framework (6-change in institutional culture; see **section C.1**), we employ an indirect measure to gauge impact. Specifically, we examined the extent to which CEILS interactions span the four change strategy quadrants of the Henderson, Beach and Finkelstein (2011) framework. **Figure C.2-13** overlays CEILS services, programs, and resources onto this framework, a visual exercise that helps us to consider how we invest our time and resources relative to their potential for impact, which varies by quadrant. For example, those change strategies that focus on changing environments and organizational structures (lower quadrants) may have more sustainable impact or be more transformational than those focusing on changing individuals (upper quadrants). Moreover, strategies that are more emergent generally lead to increased sense of ownership from the individuals and organizations involved. As summarized by

Henderson and colleagues (2011), a review of the literature shows that "a successful change strategy should allow for a mixture of emergent and prescribed outcomes and pay attention to multiple levels of context, from the individual faculty to the environments and structures within which faculty work." And it is by coordinating instructional improvement at multiple levels—multi-category, multi-disciplinary, multi-institutional—that institutional transformation is most likely to occur (Henderson, Beach and Finkelstein, 2011; Borrego and Henderson, 2014).

One change strategy that is particularly relevant at UCLA and that we would like to point out is superimposed on the lower left quadrant, "Enact Policy". CEILS does not create or enforce institutional policies, but we are positioned to support faculty and instructors by leveraging policies to incentivize engagement in professional development activities that promote inclusive and effective teaching. For example, citing the UCLA Academic Personnel Manual (APM 210, Appendix 41), in our workshop invitations we highlight that participation can be included in one's dossier: *"Should you choose to participate in this program, please record your participation in your dossier as evidence of your efforts to improve teaching and as an activity that helps promote equal opportunity and diversity in education. Such efforts in both categories, on behalf of all faculty, are a recognized component of the promotion and tenure process at UCLA (see APM 210)."*

CEILS has tried to foster and support conversations related to enacting policy that would incentivize the improvement of the evaluation of teaching by organizing a symposium in 2018, "Exploring Practical Ways to Inspire and Reward Teaching Effectiveness and Instructional Innovation" and a follow-up Scientific Teaching Scholars Seminar presented by UC Berkeley Professor Philip Stark entitled, "Student Evaluations of Teaching: Managing Bias and Increasing Utility." These two events attracted around 240 participants from across UCLA (see **Appendix G.5, section III**), underscoring the common vested interests of campus stakeholders in this issue. The speakers at these events influenced the campus committee piloting a revised student evaluation form (Chairs: Associate Dean Al Courey and Psychology Professor Elizabeth Bjork), and inspired a collaboration initiated by CRESST and Humanities, and grew to include CAT and CEILS, on developing and implementing a new peer observation protocol called PAROSL, or Peer-Assisted Reflections on Student Learning (see **Appendix G.5, section II**).

Overall, in examining **Figure C.2-13**, it becomes clear that CEILS programming and services and intentional connections to campus policy and activities, represent change strategies that span all four quadrants of the framework and thus are collectively ensuring institutional transformation is occurring at UCLA among the stakeholders that CEILS serves in Life and Physical Sciences and beyond (Henderson, Beach and Finkelstein, 2011; Borrego and Henderson, 2014).

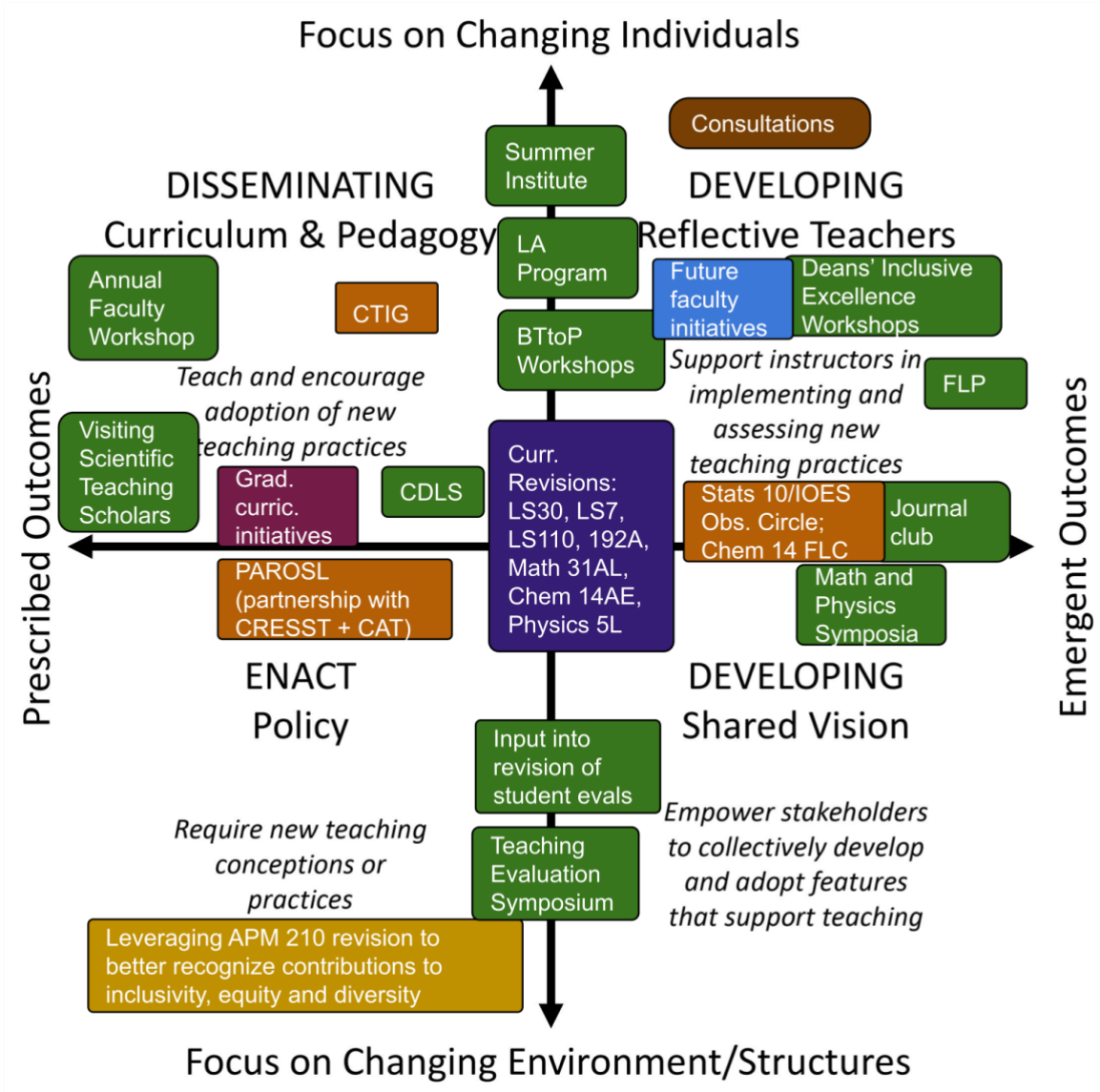

Figure C.2-13. Four-quadrant framework by Henderson, Beach and Finkelstein (2011) for characterizing change strategies with CEILS resources, services, and programming as well as associated campus policies and practices superimposed on the framework.

D. Resources

1. CEILS operational budget and grant support history

CEILS was first conceptualized in FY 2013-14 and efforts to acquire grant funding to support this unit were pursued before the Center's official launch July 1, 2014. At that time, there was a single Director (O'Leary) supported by a part-time undergraduate assistant and a part-time graduate student; grant funds covered about 35% of personnel costs and the Dean of Life Sciences covered the remaining 65% the first year (2014-

15). As depicted in **Figure D.1-1**, personnel costs have gone up incrementally as FTE counts increased (see **Figure B.3-2**), and the biggest leap in personnel costs occurred between 2015-16 and 2016-17.

In 2016, CEILS officially expanded to support educational initiatives and faculty development in the Division of Physical Sciences, thus signifying an increase in scope for CEILS from a single division (Life Sciences) to two divisions within the College. This change necessitated an amendment to the name, wherein the *Center for Education Innovation in the Life Sciences* became the *Center for Education Innovation and Learning in the Sciences* (same CEILS acronym). That same year, CEILS also began formally collaborating with Graduate Division to coordinate pedagogical training and professional development of UCLA graduate students (including Teaching Assistants) and postdocs by leveraging our institutional membership in the Center for the Integration of Research, Teaching and Learning (CIRTL). Vice Provost for Graduate Education, Robin Garrell, worked with Director O'Leary to secure institutional funding that allowed CEILS to hire a dedicated CIRTL program director (0.5 FTE).

Subsequent increases in payroll expenses for CEILS can be accounted for as follows: (1) salary adjustments due to merit increases and/or promotions, (2) transitioning part-time appointments within CEILS to full-time, and (3) occasional staff-turnover resulting in less than full-time employment for a given year. Now with funding from the Chancellor, the Life and Physical Sciences Divisions, and Graduate Division, the CEILS budget supports a full-time administrative assistant and 4 directors who collaborate in providing pedagogical training opportunities for current and future faculty (UCLA graduate students, including teaching assistants, and postdocs) across the campus.

Both personnel and materials/event costs make up the entire CEILS operations budget. Materials costs have steadily increased from year to year and have now reached a near steady-state (see **Figure D.1-1**). The amounts rise over time primarily due to fewer grant funds being available to offset event costs and increased efforts on the part of full-time CEILS staff to expand professional development activities supporting current and future faculty in ways that align with needs and demand.

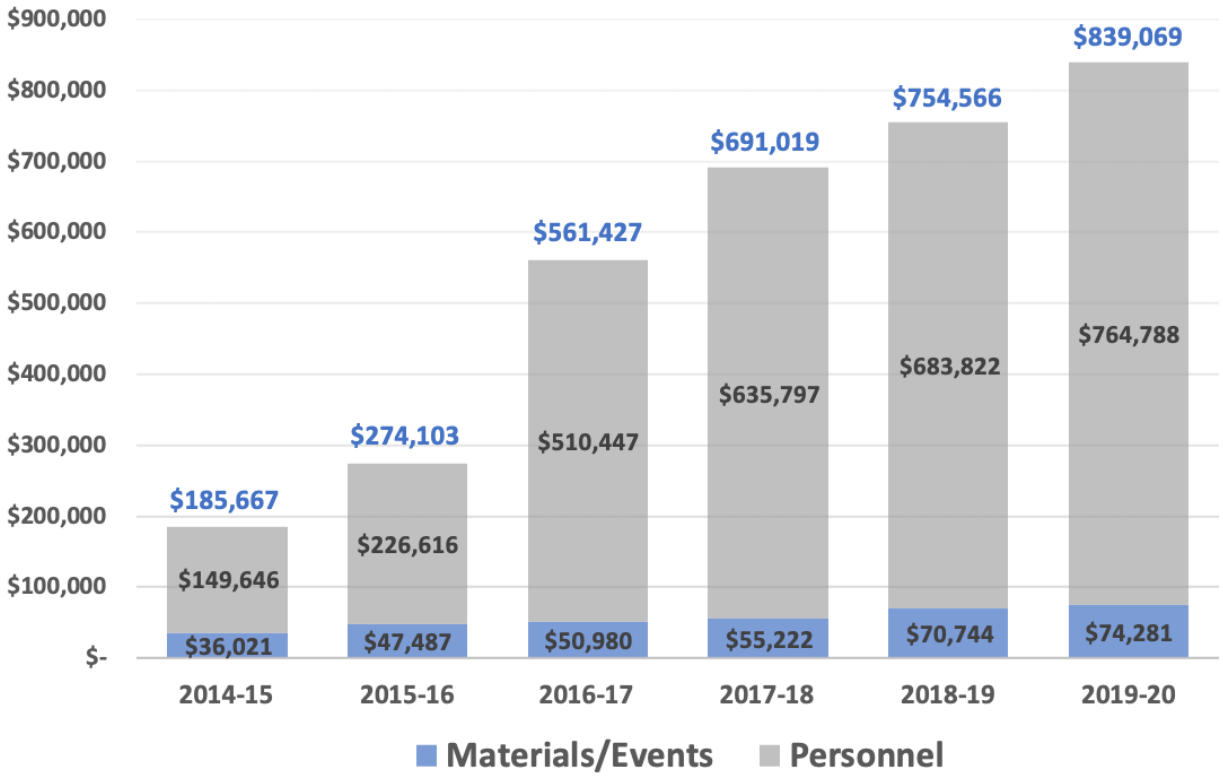

Fig. D.1-1. Total CEILS budget by year from 2014-15 through 2019-20. The grand total for payroll expenses (salary + benefits) plus operations costs for each year is provided above each bar.

Grant funds have been a consistent source of revenue for CEILS since the Center was founded in 2014 (see **Figure D.1-2**). These funds support project-specific personnel (lecturers, DBER postdocs, TAs, undergrads), curricular and professional development activities including events, and CEILS personnel for their project-related efforts in capacities that include project management, assessment coordination, and instructional development and teaching. Sources of intramural and extramural grant funds are described in **Section C.1-2**.

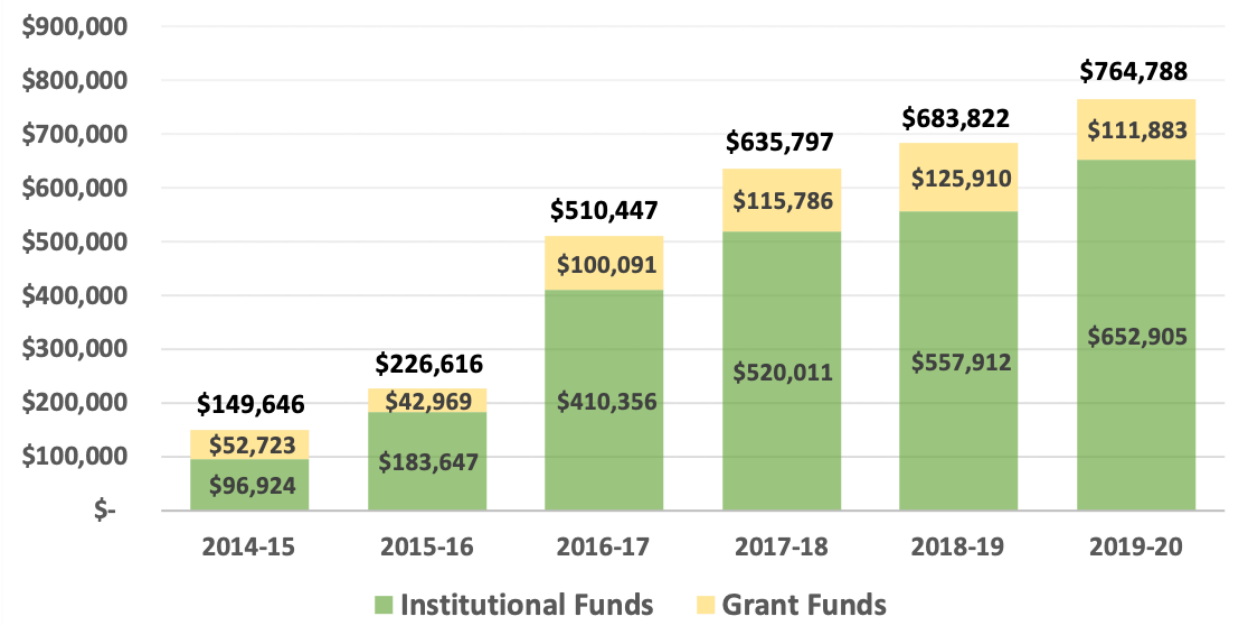

Fig. D.1-2. CEILS funding for personnel differentiated by institutional sources and grant support. The grand total in payroll expenses (salary + benefits) for each year is provided at the top of each bar.

Since 2014, the majority of the CEILS budget has been funded by institutional sources, primarily with support provided by the Deans of Life and Physical Sciences and CIRTL funding provided by the Dean/Vice Provost of Graduate Division. Starting in 2019-20, CEILS was the beneficiary of Chancellorial funding in the amount of $596,639, of which $371,036 was allocated in salary, $165,603 in benefits, and $60,000 in operations costs. Another $115,000 was provided by the Chancellor's office via Graduate Division to support the CIRTL@UCLA program, of which $70,683 was allocated to cover salary/benefits for the program director (Kennison); the remainder of this allocation supports CIRTL programming costs, which are separate from the CEILS budget and not discussed further here. Thus, a total of $607,322 in Chancellorial support was provided to offset the total of $652,905 in payroll expenses currently covered by institutional funds. When taking grant funds into account, which also act to offset the total personnel costs ($764,788), the breakdown for 2019-20 is as follows:

- 79% funded by the Chancellor ($607,322)
    - Total allocation = CEILS ($536,639) + CIRTL ($70,683)
- 15% funded by grants ($111,883)
- 6% funded by the Deans in Life and Physical Sciences ($45,583)

Notably, the CEILS Director (O'Leary) and two Senior Associate Directors (Kennison and Shaked) all teach undergraduate or graduate courses during the year, allowing the Deans to use Undergraduate Academic Incentive Funds (UAIF) to cover their portion of the payroll expenses this year.

Expenses for materials/events in FY 2019-20 are projected to total $74,281. The Chancellor's funding will cover only 81% of these costs ($60,000). Funding to cover

overages will be requested of Life and Physical Science Deans during the FY 2019-20 budget presentation and report meeting, which is expected to take place in Feb/March.

CEILS Budget Projections and Concerns: Budget projections for the next fiscal year are provided in **Table D.1-1**. Increases in payroll expenses between FY 2019-20 and 2020-21 are primarily due to anticipated merit increases for CEILS personnel. To account for inflation, a 5% adjustment to the materials/events costs is incorporated into FY 2020-21 budget projections.

Table D.1-1. CEILS budget projections

	FY 2019-20				**FY 2020-21**			
	CEILS (LS+PS)	Other UCLA*	Grants	Total	CEILS (LS+PS)	Other UCLA*	Grants	Total
Salaries/ Benefits	$430,157	$222,748	$111,883	**$764,788**	$661,547	$77,911	$61,776	**$801,234**
Materials/ Events	$74,281	---	---	**$74,281**	$77,995	---	---	**$77,995**
Total	**$504,438**	**$222,748**	**$111,883**	**$839,069**	**$739,542**	**$77,911**	**$61,776**	**$879,229**

* In FY 2019-20, other UCLA funding included Graduate Division support for 50% of R. Kennison's salary/benefits and Physical Sciences support for 100% of S. Shaked's salary/benefits. In FY 2020-21, S. Shaked's salary/benefits was moved to LS/PS category.

Notably, there will be a major transition off NSF grant funding occurring (effective August 2020), resulting in an increased need for institutional support to sustain payroll costs. A total of $739,542 will be requested for CEILS via Life and Physical Sciences and another $77,911 will be requested for CIRTL via Graduate Division. We anticipate these requests going forward to the Chancellor or EVC/P since the institutional support provided by the Chancellor's office in FY 2019-20 was not issued as permanent funding but as temporary funding. Our concern with this funding model is its lack of stability or reliability, especially in light of recent or imminent changes in leadership occurring at the EVC/P and Deans levels. The sustainability of CEILS relies on a commitment from the institution for permanent funding. Incremental growth then becomes possible with new grant funding, new temporary institutional funding, and other sources of revenue.

Learning Assistant (LA) Program Budget and Concerns: The undergraduate Learning Assistant (LA) program is administered through CEILS. A budget separate from the CEILS operations budget is submitted to the Deans of Life and Physical Sciences for LA program funding requests. The total annual budget for this program, excluding the Director's payroll expenses (Shaked's compensation is folded into the CEILS personnel budget) and Graduate Student Coordinators paid by departments, amounts to just over $110,000 per year. Per academic term, the LA program employs 20-30 head LAs (undergraduates) to manage 300-400 credit-earning LAs enrolled in 192 pedagogy training courses. The majority of the funding covers salary/benefits of

head LAs (~65% of the total budget). In summer, tuition for 192 course enrollments is waived but funding is needed to cover fees at $180/LA (less than $3,200 total). Funding is also used to support instructors and TAs who assist Director Shaked in teaching multiple sections of the 192A pedagogy course, with enrollments now exceeding 300+ students in all three academic terms.

The LA program has expanded rapidly and successfully, with LAs supporting more than 12,000 enrolled students per quarter in approximately half of all STEM gateway courses. In addition to positive student impacts (see **Appendix G.5, section VI**), the LA program was commended as part of the 2019 UCLA WSCUC Accreditation site visit and it was highlighted by the Chancellor as part of a UCOP initiative, “One-Time Funding for LCFF Outreach and Support Services for Low-Income Students and Students from Underrepresented Minority Groups” (see report in **Appendix G.8**).

The total cost of running the LA program (including department-specific TA and instructional support) amounts to approximately $6 per supported student (for each quarter); for comparison, TAs for these courses are paid $50-$100 per supported student. LAs are associated with decreasing DFW rates by 4-14% (Alzen *et al.,* 2017). Moreover, 500 LAs per year take a 1-unit pedagogy seminar (course 192A); and 1,000 students per year take additional 2 to 4 units of practicum credit (courses 192B-E). **This amounts to approximately $2 million per year in tuition revenue for UCLA**.

Our main concern is that the sustainability of this program is in jeopardy as we have been informed that the Deans may not have the resources to continue to support it beyond the current academic year. Due to its breadth, this would not only decrease support for students, but faculty across departments in the Life and Physical Sciences have indicated that LAs are critical to their current gateway course structure (see report in **Appendix G.8**). Institutional funding is an absolute necessity since the multitude of existing publications on the success of the LA program result in it no longer being considered an “innovative” practice that could attract external federal funding and support from many foundations.

E. Goals and Plans

1. Needs assessment

As a requisite to strategic planning for the next five years, CEILS administered a survey to faculty and instructors in Life and Physical Sciences asking respondents to indicate their most pressing needs in support of undergraduate and graduate education as well as resources to support teaching and learning more generally. As shown in **Figure E.1-1**, a majority of respondents expressed a desire for more interactive teaching methods (67.5%) and inclusive teaching practices that close performance gaps (62.2%). Many called for additional assistance with assessment design (46.5%). When disaggregated by division, faculty from both LS/PS were near agreement as far as ranking these needs (according to response frequency).

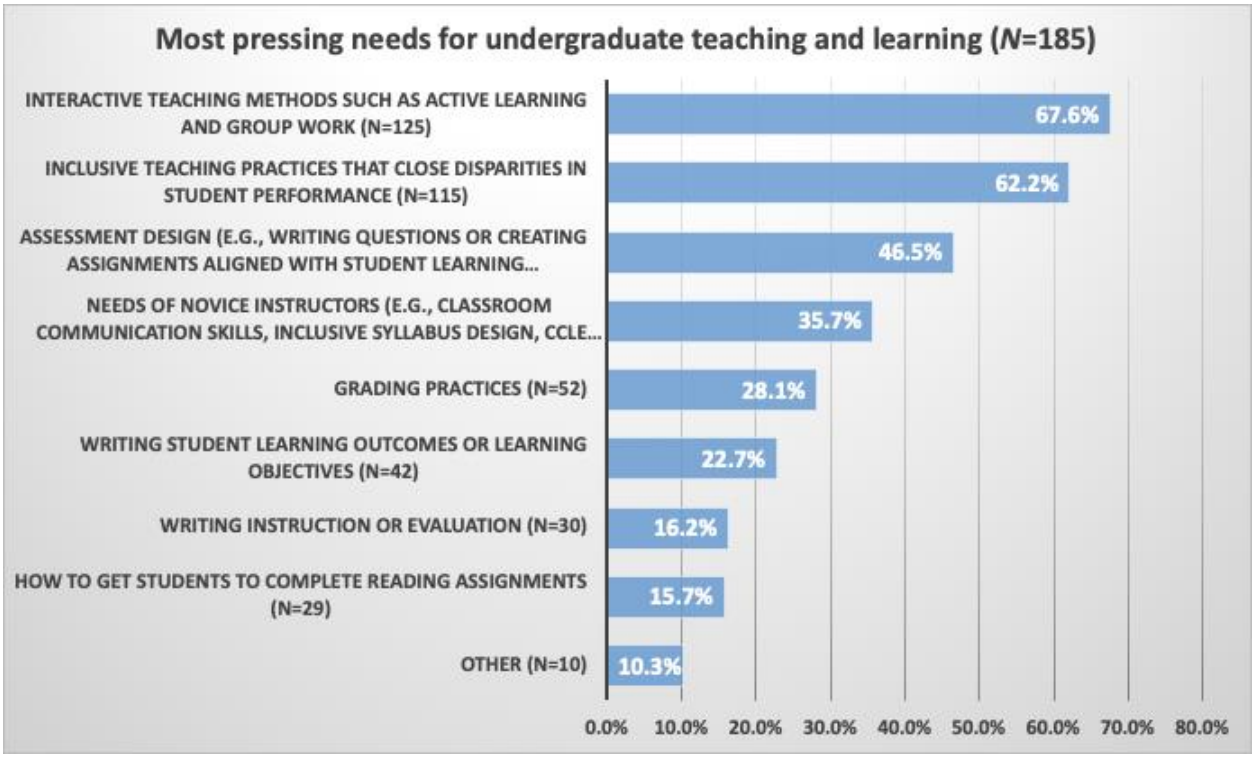

Fig. E.1-1. Needs assessment: undergraduate education. The overall response rate for this survey item was 31%, with 185 of 592 total TT faculty and non-TT instructors in the LS/PS divisions responding. 57% of the sample was comprised of LS faculty/instructors (111 respondents) and 43% of PS faculty/instructors (83 respondents). Not every respondent answered every question in the survey, so the data is reported as the percentage of total respondents to the survey item. Source: LS/PS Faculty Survey, Fall 2019.

Figure E.1-2 ranks the most pressing needs for graduate education, ordered from highest to lowest. Over half of respondents called for improvements in TA training (56.3%). Nearly half reported a pressing need for more training in effective mentoring (47.9%). And just over a third indicated a need for professional development supporting careers both inside (38.2%) and outside (36.8%) the academy. Again, the LS and PS divisions were in near agreement as far as prioritizing these survey items.

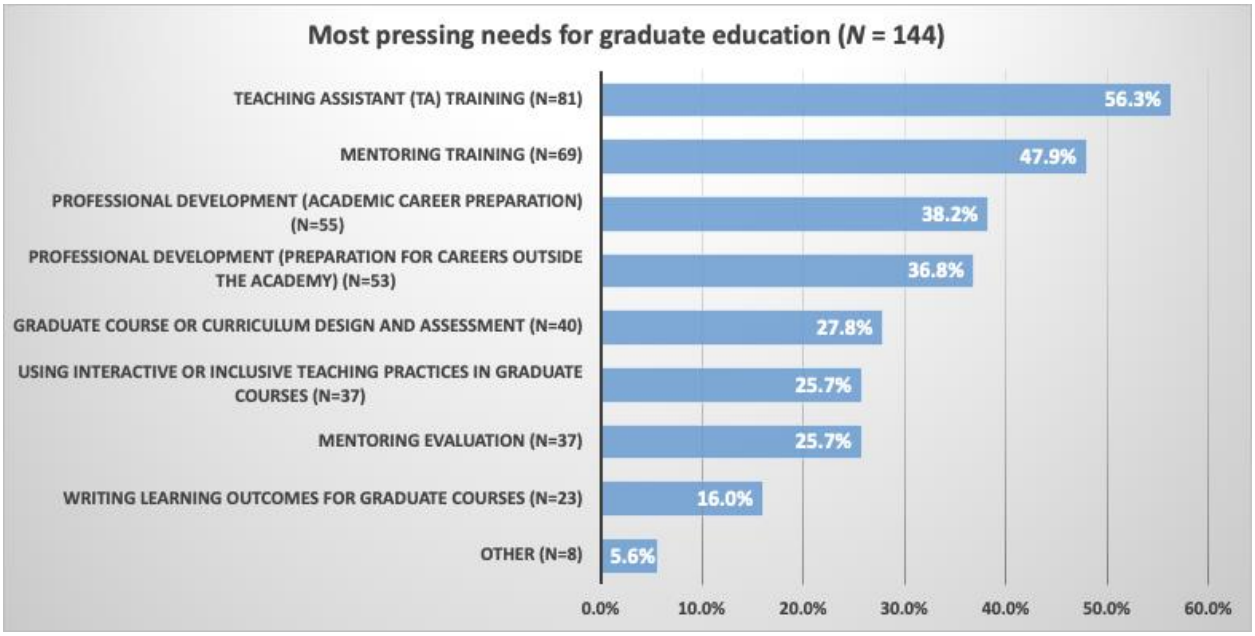

Fig. E.1-2. Needs assessment: graduate education. The overall response rate for this survey item was 24%, with 144 of 592 total TT faculty and non-TT instructors in the LS/PS divisions responding. The data is reported as the percentage of total respondents to the survey item. Source: LS/PS Faculty Survey, Fall 2019.

LS/PS faculty and instructors also were asked to indicate from a list of possible resources that CEILS could potentially develop and provide in future, which they felt would be most helpful in supporting their teaching. As shown in **Figure E.1-3**, a little more than half of respondents expressed interest in workshops (55.8%). Many requested online teaching resources (43.6%), which we interpret to mean resources such as video tutorials and teaching guides made available via a website. Respondents may also benefit from more resources to support online (or blended) teaching modalities. Notably, we did not distinguish between these two possibilities in the survey response options. More than a third of respondents indicated a need for facilitated discussion about teaching (39.8%) as might occur at a workshop or departmental meetings and videos showcasing instructors using active learning in the classroom (38.1%).

Feedback from the LS/PS departmental discussions (see **Appendix G.2-2**) provides additional and important insights into faculty responses to this survey item that can translate into improvements to CEILS pedagogical training workshops in future. During the departmental discussions, two major barriers to engagement with CEILS were identified. The biggest barrier is lack of time (mentioned by 4 of 7 departments), especially for longer workshops (all-day), institutes (week-long), and programs (year-long). Another barrier (mentioned by 3 of 7 departments) is timing of CEILS workshops, particularly those offered in summer or during the academic year amongst competing priorities for research-focused faculty. Suggestions were to offer workshops (such as those in the BTtoP series) over multiple dates per year, deliver shorter workshops (1 hour max) during departmental meetings or annual retreats, and video record workshops and then make them available as asynchronous online resources for

instructors who cannot make the in-person training event. Another suggestion was to improve advertising at the beginning of each academic year to make clear the ways faculty and instructors may engage in programming that fits their schedule but also is attuned to teaching experience level, with notations for topics considered more basic and appropriate for novice instructors to more advanced or specialized topics of interest to instructors with more teaching experience and/or unique pedagogical needs for a given course (e.g., lab versus lecture, introductory/gateway versus upper-division).

Notably, this same survey item was administered by Associate Vice Provost, Adrienne Lavine, to department Vice Chairs for undergraduate education representing academic units across the entire campus. The feedback provided by LS/PS faculty and instructors, depicted in **Figure E.1-3**, very much aligns with the campus-wide survey results. This suggests a coordinated effort by CAT, CEILS, and other administrative units serving the campuswide teaching community at UCLA (see **section B.2**) to develop and disseminate these types of resources could benefit all educators at UCLA.

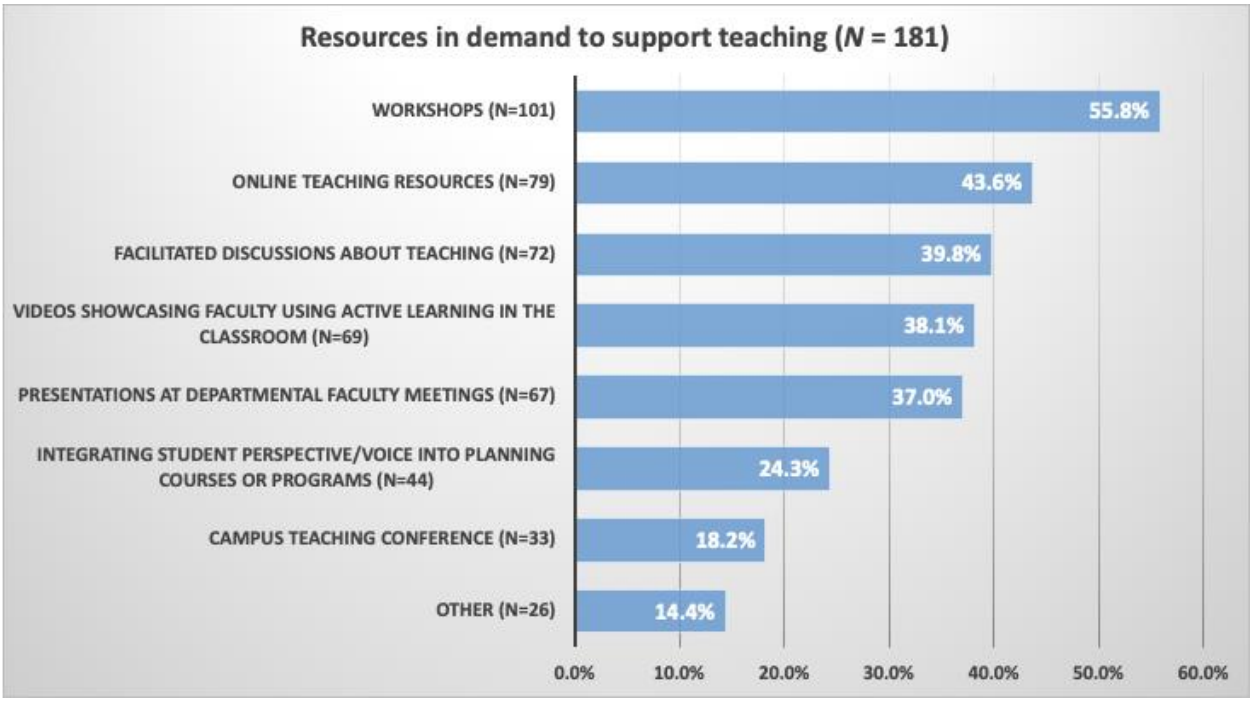

Figure E.1-3. Needs assessment: resources to support teaching. The overall response rate for this survey item was 30%, with 181 of 592 total TT faculty and non-TT instructors in the LS/PS divisions responding. The data is reported as the percentage of total respondents to the survey item. Source: LS/PS Faculty Survey, Fall 2019.

One final question that was posed during the LS/PS departmental discussions was in regard to the value perceived in sustaining a STEM-specific center for teaching and learning at UCLA (see **Appendix G.2-2**). Specifically, faculty were asked, "... what advantages do you see in CEILS continuing to provide targeted instructional support for faculty in Life and Physical Sciences?". A total of 8 out of 11 departments provided responses summarized as shown in **Table E.1-1**. In general, LS/PS faculty expressed

several benefits to a STEM center, noting the STEM student population experiences inequities in student success that are not as prevalent in other disciplines (see **Figure B.1-1**). Thus, the pedagogical training provided by CEILS addresses an urgent and pervasive problem that is fairly unique to STEM. Faculty also had positive responses to the data-driven pedagogical training approaches used by CEILS as it resonated with the way they teach science to students, using evidence to contextualize concepts and theories and evaluate hypotheses.

In addition to these benefits, faculty pointed out a number of considerations to a campus with decentralized support for educational development. They would like to see resources for teaching and learning coordinated more centrally and not duplicated in multiple places across campus. Fortunately, UCLA's Center for the Advancement of Teaching (CAT) is taking on this task and creating an online "teaching commons", where faculty can visit and readily identify resources and programming relevant to their disciplines or epistemological interests. Some instructors also expressed value in interdisciplinary training and the opportunity to cross-disseminate ideas about teaching and learning. The Cross-campus Teaching Innovations Group (CTIG; see **Appendix G.5, section IV**) provides an ideal forum for these types of conversations and collaborations. The feedback from departmental discussions suggests there would be interest from LS/PS faculty in engaging with this learning community.

Table E.1-1. Qualitative results to discussion question (Q6) asking, "UCLA has historically been a campus with decentralized resources and support for teaching and learning. For example, in addition to CEILS, there is a campuswide unit called the Center for the Advancement of Teaching (CAT) and a discipline-specific unit in the Humanities called the Evidence in Pedagogy and Innovative Classrooms (EPIC) program. Given this context, what advantages do you see in CEILS continuing to provide targeted instructional support for faculty in Life & Physical Sciences? (*N* = 8 respondents) Source: LS/PS Departmental Discussion Questions, Fall 2019 (see **Appendix G.2**).

Themes
Benefits to STEM-specific center
Epistemology of teaching science is perceived as different from other subjects
Sciences have a unique student population; addresses special challenges in STEM (e.g., disparities in access, achievement, and retention of URGs); dedicated space for conversations and training to help faculty address equity issues specific to STEM
Faculty respond positively to data-driven approach to pedagogical training; perceived as more relevant to constituents in STEM disciplines
CEILS good in working with skeptical faculty and building relationships with STEM faculty
Other considerations
Good to have resources for teaching and learning more centrally coordinated
Avoid duplication
Added value for interdisciplinary training and cross-dissemination of ideas

2. Strategic plan

Analysis of CEILS impact using the six-level framework (see **section C**) shows that we are achieving our goals; our programs, services, and resources largely reflect the concerns and needs of our constituents in Life and Physical Sciences; and our presence and leadership is recognized and valued in campus, regional, and national education communities. Taken together, we hope these results demonstrate how CEILS is supporting a campuswide priority to support teaching excellence.

Resource needs: Based on our needs assessment (**section E.2**), there are several programmatic changes we will focus on to better support and engage more LS/PS instructors. First, we will re-examine our professional development programs (see **Appendix G.5, section II**) and design workshops in formats and frequency that better serve research-focused faculty. In particular, we will work with our Faculty Advisory Committee (FAC) to arrange dates where we can deliver 1-hour workshops, focused on interactive and inclusive teaching practices, during departmental meetings or annual retreats. Second, we will develop a library of asynchronous online resources for instructors (e.g., videos of faculty teaching who are using active learning or educational technology, self-paced training modules on different pedagogical topics). Third, we will continue to work with Life Science departments to improve TA training and engage in this effort with Physical Science departments where there are opportunities for growth. Fourth, we recognize that departments have expressed interest in improving mentoring training, but this type of professional development has not been a priority for CEILS. Recently, Director O'Leary was invited to serve on the MEGAP implementation workgroup, jointly appointed by the Graduate Council and Graduate Division (see **Appendix G.7**), to identify and examine campus resources to support effective and inclusive mentoring and advising of UCLA graduate students. In addition, evaluation of effective mentoring practices is oftentimes a component of rubrics used to evaluate teaching more broadly (e.g., KU's benchmarks for teaching effectiveness rubric). Thus, further engagement with campus conversations and action taken to improve mentoring, or an assessment of mentoring practices, seems within the purview of CEILS. In which case, we would propose expanding our goals to encompass evidence-based mentoring as well as teaching. Lastly, as identified in the results of our needs assessment as it relates to graduate education, we will continue to support the professional development of graduate students and postdoctoral scholars as participants in our CIRTL@UCLA program. Our CEILS Senior Associate Director and CIRTL@UCLA Program Director (Kennison) has developed a course, "Career Readiness Inside and Outside the Academy" (MolBio 497), in collaboration with UCLA's Career Center that is poised to fill this need starting spring 2020.

New resources are needed to implement many of these programmatic changes as follows:

- Funding to support instructional designers and video curators/editors to assist with the development of online resource library.
- Dedicated, full-time instructors (not temporary lecturers) to support expanded teaching needs as they relate to TA training and career development.

- Staff to support expansion into mentoring training in collaboration with other campus units.

Other areas in which there are opportunities for growth include assessment, educational technology support, and communication/marketing.

Assessment needs: In our assessment of CEILS impact, we made clear that our ability to evaluate the fifth level of the framework, which focuses on assessment of student outcomes, is challenging to accomplish without substantial funding from grants or in-kind support from the Center for Educational Assessment (CEA) awarded via CAT's internal grant competitions. Studies have shown that a lack of assessment support can be a barrier to shifting teaching norms in STEM departments to include more active learning strategies (Shadle *et al.* 2017). Given this need for student outcomes assessment more broadly and in a manner that does not rely on grants, LS/PS instructions would benefit from having a dedicated CEILS staff member with expertise in data science who focuses on assessment and tracking measures of student success not only for LS/PS faculty and instructors, but also for departmental counselors who advise students in their progress through a major. This individual would need to collaboratively engage with the campus IR community, have access to requisite databases, and ability to develop visualizations relevant to this work. Working with members of the CEILS team, this individual would contribute directly to professional development efforts aimed at fostering faculty learning communities (FLCs) within departments that engage instructors in inquiry about student success through a view of the student experience provided by thoughtful and contextualized analysis of institutional data (Rehrey *et al.* 2019). Notably, making assessment support available to departments in this manner is consistent with EVC Carter's vision for UCLA to make more data-driven decisions by incorporating big data expertise to analyze complex problems such as those driving or impeding student success.

Educational technology support needs: Another area of support that CEILS would like to augment is in providing faculty resources and services that help with adoption of educational technology such as iClicker and other polling tools, grading platforms like Gradescope, and LMS tools (CCLE integrated and LTI-associated). Currently, UCLA does not have a proactive strategy for engaging instructors with technology to support inclusive and effective pedagogical practices. For example, in the Summer & Fall 2018 and Winter & Spring of 2019, there were 256 courses that used iClicker. However, the representative assigned to UCLA (Kristin Strong) does not have a point-of-contact at UCLA that will support her coming to provide in-person workshops and trainings despite her attempts to work with other centers. CEILS is currently serving this point-of-contact role. In addition to arranging workshops, around the start of each quarter we manage requests for technical support for setting up iClicker for Life and Physical Science faculty. While we have shifted to simply directing them to the iClicker representative and providing a clicker kit from our office rather than walking them through installation (due to the number of requests), we would prefer to have an on-campus resource as we see this as an important service. As educational technology improves and additional interest arises in tools such as Gradescope, Mentimeter, Poll Everywhere, H5P, and others, we have concerns around the dedication of our time to technical support and set-up.

The interest in using innovative education technology is growing and is especially relevant and critical to engaging students in large gateway courses in STEM where we see higher attrition and failure rates as well as large achievement gaps (Hurtado, Sork *et al.,* 2015). These tools allow instructors to get feedback from all students, regardless of class size, and foster interaction and engagement. At this time, CEILS does not have the capacity to stay on top of new tools and offer the support for learning about these tools and supporting instructors with initial set-up and pilot experiences.

When we have raised these issues with CAT and others, the response has been to work with the departmental computing services to manage these needs. This seems unrealistic given their own staffing resources and demands, and a distributed model for supporting innovation in educational technology at UCLA does not seem efficient. If no centralized resource can be provided to more proactively engage with both the third-party individuals as well as UCLA users and potential users, then CEILS will need to start incorporating this into our own professional development training and work responsibilities. While supporting instructional technology adoption is not mis-aligned with our goal to support instructors in their use of innovative pedagogy, it will inevitably overlap with technical support requests (as is currently the case), which is not an effective use of our time. Future budget requests will include a position that is at least partially dedicated to technology support if this is not something that gets addressed at the campus level. LS/PS instructors would benefit from training and technological support for implementation of these tools, which CEILS could offer given additional staffing dedicated to this effort.

Communication/marketing needs: Survey results demonstrated that there is a demand for improved marketing strategies and communication about CEILS programming and services, tailored to the needs of LS/PS instructors. Currently, CEILS does not have a permanent Program Representative dedicated to this task who is funded as part of the CEILS operations budget. Instead, we are utilizing an NSF grant (95%) and CIRTL funding (5%) to employ a Program Representative to support CEILS, CIRTL@UCLA, and NSF Aspire grant-related communications, marketing, and branding (e.g., email, newsletters, websites, social media). We are finding that this position is increasing in importance, as effective communication with our diverse stakeholders is critical to the success of CEILS, and would like to be able to sustain the position with institutional funding once the grant expires.

Strategies for growth: Looking ahead, we propose three scenarios by which to position CEILS for future work (growth) and sustainability. The first requires no additional financial resources, the second only a modest increase in resources, and the third a substantial increase in resources. We hope that this review of our Center makes a data-driven case to request further financial support from the institution, which would support a pathway to sustain, augment existing, or implement new CEILS programming and services central to our success in the next five years.

NO ADDITIONAL RESOURCES: In this scenario, CEILS will continue doing the programming as well as providing services and resources deemed successful by our impact analysis. We will prioritize delivery of short workshops during LS/PS departmental meetings or annual retreats as the primary need for new support. The focus of our programming will continue to be in LS/PS only with no capacity to expand

engagement with campus partners beyond existing levels, despite the demand for further engagement by 55% of survey respondents. One major assumption with this scenario, however, is that CEILS institutional funding becomes permanent and supports a plan to decrease our reliance on external funding (grants) and continue core operations of the Center in the absence of external revenue. The acquisition of grants and other sources of revenue (including temporary institutional funding) would instead allow for incremental growth aligned with project-based work. **Our impact analysis has shown CEILS to be successful in achieving its goals, and so we ask the institution to commit permanent resources to sustain CEILS and its associated programs such as the Learning Assistants (LA) program and CIRTL.**

MODEST INCREASE IN RESOURCES: In this scenario, with support from permanent institutional funds to expand programming, services and resources, CEILS would acquire additional FTE and augmentation of our non-personnel budget as follows:

- 1 FTE (Academic Administrator/Data Scientist) to serve as dedicated, full-time Associate Director for Assessment and Faculty Engagement. This individual will facilitate assessment/data access and mining at department/course level, work with departments/counselors to help inform curriculum and advising efforts based on evidence, and lead faculty learning communities (FLC) focused on data inquiry related to student success (Richlin and Cox, 2004; Rehrey *et al.,* 2019).
- 0.5 FTE (Program Representative III) to serve as full-time Media and Communications Coordinator who supports website/online resource development, social media, communication/marketing/branding, etc.
- 0.5 FTE (Computing Resource Manager) who serves as an educational technology support expert for CEILS (in the absence of a centralized resource).
- Funding to support OTLI instructional designers and video curators/editors to assist CEILS team in developing an online resource library.
- Funding for small grants awarded by CEILS to faculty and instructors to cover costs such as DBER/SoTL publication costs (in open-access journals), education conference travel support, and professional development funds for contingent faculty. Awards covering these types of costs, to our knowledge, are not available from other units on campus.

SUBSTANTIAL INCREASE IN RESOURCES: In addition to the above, in this third scenario, CEILS would acquire additional FTE and augmentation of our non-personnel budget as follows:

- Increase Program Representative III position from 0.5 to 1.0 (full-time) FTE
- 1 FTE (Academic Administrator III) to serve as dedicated, full-time instructor to support expanded teaching needs (TA training, career development) and augment mentoring training activities for and in support of UCLA graduate students and postdocs' professional development. Due to a lack of funding, we currently have a vacant AA III position for which the job description could be modified to fit this programmatic need.
- 1 FTE (Academic Coordinator II or Academic Administrator II) to serve as Assistant Director for Outreach, leading efforts to build relationships and expand collaborations with non-UCLA academic partners (e.g., 2-year and 4-year institutions, K-12 schools) as well as private and public organizations in the Los

Angeles community. We imagine this individual playing a role in fund-raising or other (non-federal) revenue-generating efforts connected to CEILS.
- Space: Dedicated conference room spaces (active learning classrooms) located on south campus for CEILS workshops and faculty trainings to use active learning spaces.

One additional possibility to incorporate into this third scenario would be an expansion of CEILS disciplinary representation to include engineering and computer sciences, thereby creating a true STEM Education Center, or SEC, that supports education innovation and inclusive teaching in all STEM fields here at UCLA. Retaining the same acronym (CEILS), this expansion would necessitate a name change again, for example, to the *Center for Education Innovation and Learning in STEM*. If there were sufficient interest from leadership in UCLA's Samueli School of Engineering, then CEILS would like to consider exploring this option together. This expansion would, at minimum, require a commitment on the part of the institution of one additional full-time FTE as follows:

- 1 FTE (Academic Administrator IV) to serve as Associate Director for Faculty Development in Engineering and Computer Sciences Education who would collaborate with the CEILS team to expand all programming, resources, and services in ways that align with and support student success in UCLA's Samueli School of Engineering.

F. References

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G. Appendices

1. **Life and Physical Science Departments**
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