OUR VISION

To create a more prepared STEM workforce in California that has acquired a variety of 21st century skills, which strengthens California's economic well-being.

STEM SERVICE LEARNING

SERVICE LEARNING

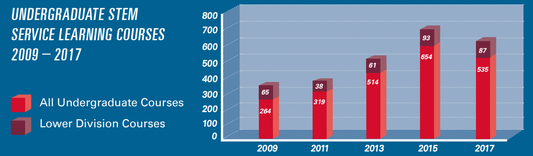
STEM

▶ For an interactive, in-depth look at our Keck STEM Service Learning Research findings, visit the full report at: **www.calstate.edu/cce/keck**

CSU STEM SERVICE-LEARNING STATS

Since 1998, the CSU has seen a 114% increase in service learning. For the 2016-17 academic year, this represents partnerships with 5,000 community organizations, the availability of 3,289 service-learning courses for more than 66,000 engaged students who contribute 1.3 million hours of service to their communities.

UNDERGRADUATE STEM SERVICE LEARNING COURSES 2009 – 2017



STEM DISCIPLINES IN THE STUDY

- Aerospace
- Engineering
- Biology
- Biotechnology
- Chemistry
- Computer Science
- Engineering
- Engineering & Management
- Environmental Studies
- Geography
- Information Technology & Communications Design
- Manufacturing Systems
- Marine Science
- Mathematics
- Mechanical Engineering
- Meteorology & Climate Science
- Nursing
- Nutrition
- Technology

The National Science Foundation's definition of what constitutes as STEM was used to recruit faculty participants; however, CCE does not include social sciences in its definition.

www.calstate.edu/cce https://www.facebook.com/CSUCOCCE/ https://twitter.com/csu_cce

Designed by: Phillip Huizing 2018

CSU The California State University
CENTER FOR COMMUNITY ENGAGEMENT

DISCOVER. UNDERSTAND. INNOVATE.

Bolstering a New & Diverse Generation of Civically Engaged Scientists, Mathematicians, Engineers & Tech Leaders

Research Findings from a Systemwide STEM Service-Learning Study
Fall 2014 – Fall 2016
Funded by the W.M. Keck Foundation

A MESSAGE FROM THE RESEARCH TEAM

A critical component to the future success of California's economy, worldwide competitiveness and societal well-being is supporting a diverse Science, Technology, Engineering and Mathematics (STEM) pipeline. As the largest and most diverse university system in the country, with nearly half a million students, the California State University (CSU) prides itself on providing not only an exceptional academic environment, but also valuable opportunities for our students to be in service with their universities and communities. In this spirit, service learning (SL) has become a cornerstone of the CSU experience, preparing 21st century graduates that are well-educated, informed and civically engaged.

From service-learning courses that address environmental justice along the California Coast to research with government agencies determining the impact of water quality on people's health, SL experiences afford students opportunities to immerse themselves in community issues.

In July of 2014, funding from the W. M. Keck Foundation laid the groundwork for the first national pilot study on SL in STEM disciplines on common measures of student success. This executive summary highlights the findings of the quasi-experimental design and mixed methods research approach conducted from fall 2014 through fall 2016. We hypothesized that SL experiences allow students to acquire technical skills, increase interest in STEM careers, and improve attitudes and behaviors around STEM and civic engagement and we set out to uncover the essential elements of high quality SL present in participating courses.

READ ON TO LEARN WHAT WE DISCOVERED!

Cathy Avila-Linn & Judy Botelho
CSU Center for Community Engagement
Long Beach, California

Rebecca Eddy & Nicole Galport
Cobblestone Applied Research & Evaluation, Inc.
La Verne, California

COBBLESTONE
APPLIED RESEARCH & EVALUATION, INC.

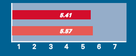
KEY DIMENSIONS OF QUALITY

A link to academic content emerged as a strong predictor of civic engagement attitudes, behaviors and STEM career interest.

ESSENTIAL ELEMENTS OF SERVICE LEARNING

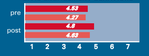
- Learning Objectives
- Community Needs
- Reflection
- Collaboration with Community
- Academic Content
- Values Focus
- SL Preperation
- Communication

CIVIC ENGAGEMENT ATTITUDES AT POSTTEST



Students who participated in SL courses reported significantly higher civic engagement attitudes at posttest than control students ($F(1, 927)=4.61$, $p<.05$).

CIVIC ENGAGEMENT BEHAVIORS

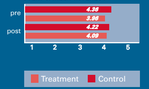


Student-reported civic engagement behaviors increased from pretest (M=4.29, SD=1.36) to posttest (M=4.64, SD=1.42) for both SL and control students, and this difference was statistically significant ($F(1,578)=9.94$, $p<.01$).

CIVIC ENGAGEMENT ATTITUDES

SL students increased in civic engagement attitudes from pretest to posttest, while control students slightly decreased.

STEM CAREER INTEREST



SL students' STEM career attitudes increased from pretest to posttest, while control students' STEM career attitudes decreased from pretest to posttest. This different is statistically significant ($F(1,526)=3.89$ $p<.05$).

RESEARCH OBJECTIVES & QUESTIONS

UNDERSTAND THE LANDSCAPE OF STEM SL COURSES IN THE CSU

- How is SL in STEM currently being implemented given the vast range of interpretations of SL?
- What are the common underlying elements in SL implementation?
- To what degree are the essential elements of high quality SL present in participating courses?

DETERMINE HOW THE QUALITY OF SL RELATES TO STUDENT OUTCOMES

- Does SL in STEM disciplines promote access to the professional realm for students or bring about meaningful change to the structure of undergraduate training, particularly for underserved populations?
- Are there differential results with respect to these outcome areas for students depending on the quality of the SL course experience?
- Does SL in STEM disciplines have a positive impact on student success in 3 outcomes areas: academic achievement, career development and civic engagement?

PARTICIPANTS FALL 2014 – FALL 2016

47 FACULTY MEMBERS

10 CSU CAMPUSES

- DOMINGUEZ HILLS
- FRESNO
- LOS ANGELES
- MONTEREY BAY
- NORTHRIDGE

78 COURSE CLUSTERS

- POMONA
- SACRAMENTO
- SAN JOSE
- SAN MARCOS
- STANISLAUS

2,152 STUDENTS

Multiple measures were used to assess implementation of SL STEM courses including Faculty and Student Pre and Posttests (Treatment and Control), Faculty Course Logs and a Student Service Learning Survey for students in the treatment group.

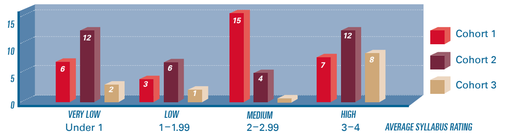
- Of the total number of student respondents, 2,065 were unique students (i.e., participated in the study one time), about 80% of whom were in the treatment group.
- Study participant demographics reflected CSU demographic composition, with 40% of study participants identified as underrepresented minority (URM) students[1] and 49% as Pell Grant eligible.
- Forty-seven faculty members were recruited, some of whom taught multiple sections of the same course during the same term; therefore, faculty and student data across courses were combined, or clustered together, resulting in a total of 78 course clusters.
- Of those, 32 were lower division and 46 were upper division. The study included a broad spectrum of STEM disciplines, 19 in total, ranging from biology and marine science to engineering, technology and computer science programs.

[1]URM populations include African American/Black, American Indian/Alaska Native, and Hispanic/Latino populations

QUALITY OF SERVICE-LEARNING CLUSTERS

The research study aimed to better understand how service learning is being implemented across the CSU campuses, if there are common underlying elements in implementation, and the overall quality of these elements. The quality of these elements was addressed through the analysis of 1) course syllabuses, and 2) student and faculty ratings on the service learning posttest questionnaire.

QUALITY OF SERVICE-LEARNING COURSE BY SYLLABUS: COHORTS 1-3



QUALITY OF SERVICE-LEARNING COURSE BY STUDENT RATINGS

Comparison of Mean Student-Reported Civic Engagement Attitudes, Civic Engagement Behaviors, and STEM Career Interest by Service-Learning Clusters Based on Assigned Quality of SL Experience (Low, Medium, High)

	Low Quality (n = 296)	Med. Quality (n = 213)	High Quality (n = 215)	*F* (df)
Civic Engagement Attitudes	5.44[a]	5.56	5.77[a]	2.91 (2,718)[+]
Civic Engagement Behaviors	4.58[b]	4.81	4.92[b]	2.88 (2,718)[+]
STEM Career Interest	4.09	4.06	4.15	0.72 (2,722)

Note: (+) Indicates a marginally significant result; means with superscripts (i.e.,a,b) indicate that pair-wise comparisons are significantly different from each other. a:$p<.01$; b:$p<.05$.

Students in the high-quality clusters reported, on average, significantly more positive civic engagement attitudes and behaviors than students in the low quality clusters.

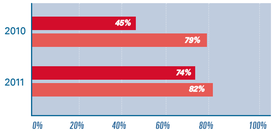
SECONDARY DATA ANALYSIS

Due to low response rates from the control group, the research team added a secondary data analysis component to the research study which was conducted through the CSU's Student Success Dashboard to examine specific key variables and other demographic information for all eligible students of the study (e.g., for all students who were recruited to be part of the study). Non-participating, eligible students that served as study control students that were identified through a propensity score matching approach.

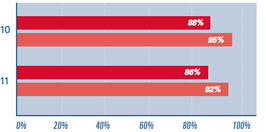
RETENTION & GRADUATION: FIRST TIME FRESHMEN

For both the 2010 and 2011 cohorts, treatment students were retained at a slightly higher percentage rate (6-7 percentage points) than control students.
(2010 Cohort: Control N=84, Treatment N=85;
2011 Cohort: Control N=226, Treatment N=183)

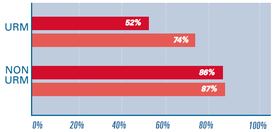
6 YEAR GRADUATION RATES



6 YEAR RETENTION RATES



6 YEAR GRADUATION RATES (2011 COHORT)



GRADUATION BY URM: FIRST TIME FRESHMEN

Non-URM treatment and control students in the 2011 Cohort performed similarly; however, URM students in SL courses had higher 6-year graduation rates than their matched peers in non-SL courses, indicating that SL coursework may benefit URM students.
(URM: Control N=86, Treatment N=68;
Non-URM: Control N=140, Treatment N=115)