

Undergraduate Research at CSUCI

Examining the Data

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This report provides insights – and questions remaining – gleaned during an investigative study of CSU Channel Islands data focusing on undergraduate research access and outcomes. It examines questions within two categories:

1. Which students have had access to undergraduate research (undergraduate research) during their time as undergraduate at CSU Channel Islands?
2. Is there a relationship between participating in undergraduate research and the graduate or professional outcomes of students?

Context for the Study

We define what we consider to be “undergraduate research,” outline the history of undergraduate research at CSUCI leading into the early portion of the years covered by the data investigated, and detail the data sources to which the investigator had access.

Types of Undergraduate Research Considered

This report focuses on students who participated in at least one intensive research experience as documented through one of more of the following factors:

1. The student took a research course, that is, a course numbered 398, 494, or 498
2. The student participated in CSUCI’s Summer Undergraduate Research Program (SURF)
3. The student participated as a student researcher in CSUCI’s NSF-funded HSI-SMART program
4. The student was identified by a faculty member as having participated in an intensive research experience such as another institution’s Research Experience for Undergraduates (REUs, typically NSF-funded), a summer experience at CERN (Conseil Européen pour la Recherche Nucléaire, i.e., the European Organization for Nuclear Research), or a long-term research project with the faculty member not otherwise captured in the programs above

Some disciplines’ capstone courses require students to engage in research or research-like activities. As the quality and intensity of research experiences in such capstone courses couldn’t be assessed, a decision was taken to focus on research experiences other than in capstone courses. Yet, given the challenge of exposing a greater percentage of undergraduates to research, these capstone courses may play a critical role now and in the future.

The Timing of Undergraduate Research Activity Considered in this Report

This report focuses on the 10-year period from Fall 2014 through Spring 2023. By the beginning of this decade, undergraduate research was fairly well established at CSUCI, as detailed below. This decade includes both pre-pandemic, mid-pandemic, and (arguably) post-pandemic research experiences.

The faculty-initiated Student Research Steering Committee formed in 2008 with a goal of promoting and supporting undergraduate research at CSUCI. This grew from two strands: 1) a task force that worked to develop a new course, UNIV 498 “Faculty-Student Collaborative Research” (approved in AY07-08) and 2) a group sent to the Council on Undergraduate Research Symposium in Summer 2008 to bring back lessons learned. CSUCI first featured student research via a campus-wide poster session in Spring 2008; this became the SAGE Student Research Conference in 2009 and has been going strong (under various names) since. By 2010, CSUCI had its first Goldwater Scholar, with others to follow in the next decade. In 2011, the Keck Foundation provided funding to develop curriculum for a “research ladder” of courses culminating in the existing 498 courses. From 2012 through 2016, Project ACCESO (CSUCI’s first HSI-STEM grant) funded a summer research program in STEM. From 2010 on, LSAMP required its students to apply for externally funded REUs and provided small internal grants to students conducting undergraduate research and their faculty mentors. Throughout the first half of the 2010s, the success of LSAMP students in obtaining REU positions, the increasing number of CSUCI STEM students attending the SACNAS National Conference and the research opportunities they found there, and the development of a relationship with CSU Fresno leading to student opportunities to conduct research at CERN – among other factors – raised the visibility of and the demand for such opportunities. Simultaneously, more and more faculty were engaging undergraduates in their own research programs and labs.

Data Sources

Data on students was obtained through the following means:

1. Institutional Research (IR) provided data on all students enrolled from Fall 2014 through Spring 2023. This treasure trove of data included information in the following categories:
 - a. Academic information such as admit type (first-time full-time freshmen, transfer, other), high school or transfer GPA, first and final terms enrolled, outcome upon final term enrolled, majors, etc.
 - b. Demographic variables such as gender, race/ethnicity, Pell-eligibility, first-generation status, and other markers (most self-reported)
 - c. undergraduate research: if enrolled in any 398, 494 or 498 (research) course – which course(s), semester(s) enrolled & grade(s) in course(s).
 - d. Unique identifiers allowing students to be matched across other datasets
2. SURF personnel provided data on all students who participated in SURF from its inception in 2017 through Summer 2023. This data consisted of name, year of participation, and student ID.
3. HSI-SMART personnel similarly provided data (name, semester/ year of participation, and student ID) on all students participating in this program from its inception in AY21-22.

- Faculty reporting students who'd conducted research under other auspices shared names, time (semester(s)/ year(s)/ summer(s) of participation and some notes regarding the context to aid the determination of whether the research met the criteria for this report.

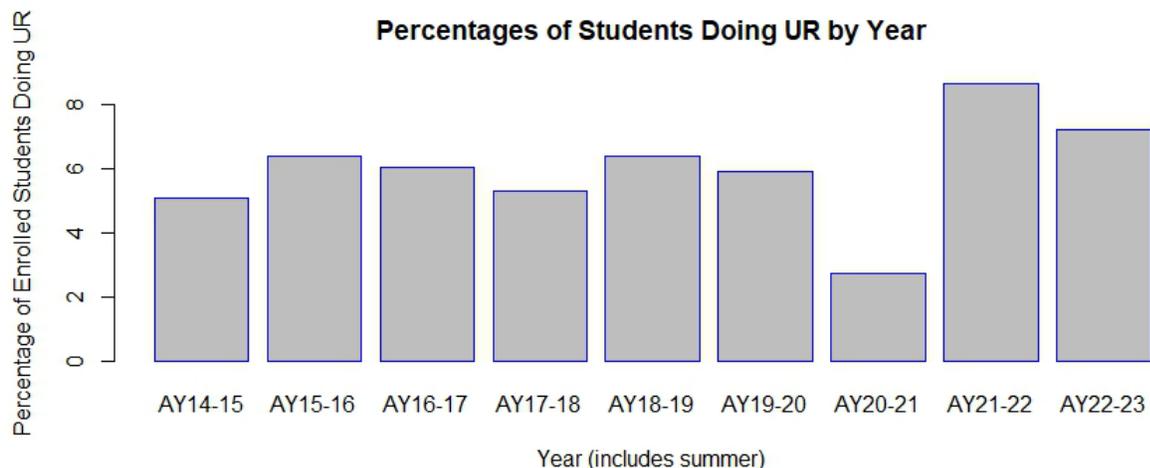
Institutional Research also provided data from two other sources, each of which could provide insights into correlations between participation in undergraduate research and student self-perceived outcomes or expectations.

- The Graduating Student Survey (GSS) contains questions relevant to this study around post-graduation plans, new or continuing employment, graduate school plans or acceptances, and career core competencies. These are all self-reported items. The GSS is optional for students and students' outcomes (e.g., grad school acceptance) may change after they complete it.
- The National Survey of Student Engagement (NSSE) is also an optional survey students may choose to complete in their first and senior years. IR provided data for responses to "Which of the following have you done while in college or do you plan to do before you graduate?" with the option "Work with a faculty member on a research project."

Who Does Undergraduate Research at CSUCI?

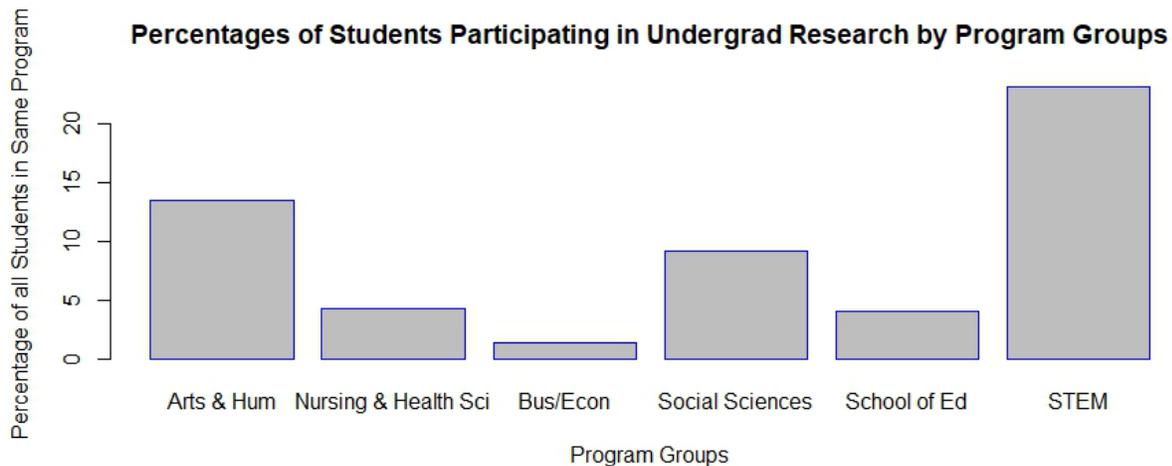
Between Fall 2014 and Spring 2023, 25,059 students enrolled at CSUCI for at least one semester. Of these, 9.2% took an undergraduate research course at least once. 231 students (0.92% of the total enrolled) participated in the SURF program at least once, and 200 students (0.80%) participated in the HSI-SMART research program. 35 students (0.14%) were identified by faculty as having participated in an intensive research experience through another means (not considering capstone courses). These categories of research participants intersect, as 114 (52%) of the SURF participants, 108 (68.0%) of the HSI-SMART participants, and 21 (61.8%) of the "unusual context" research participants took at least one research class.

The next figure indicates the percentage, by year, of all CSUCI students who engaged in n in that year.



Undergraduate Research and Major Groupings

To examine which fields of study have the highest access to undergraduate research, we calculate the percentage of students within related majors participate in at least one form of undergraduate research.



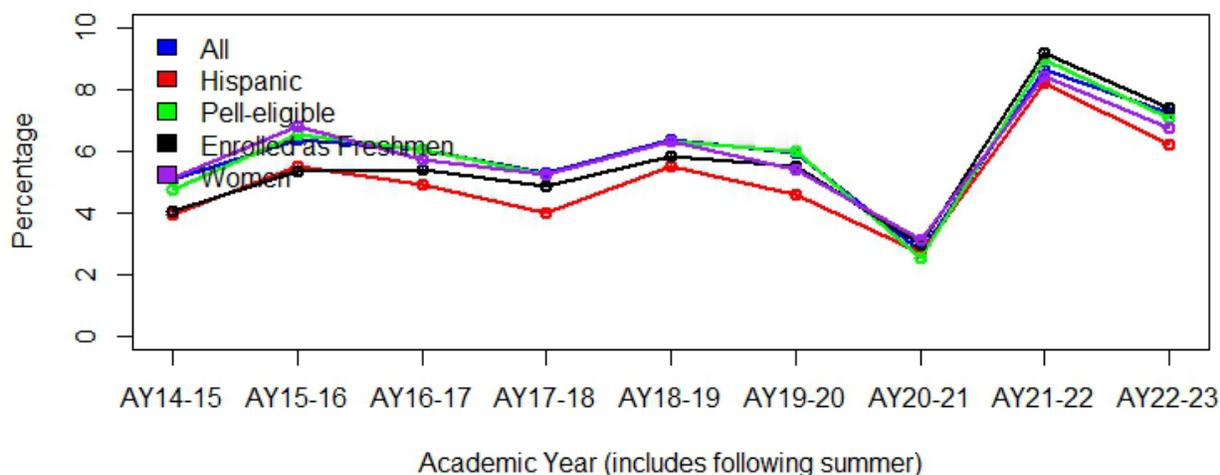
23.2% of STEM majors engage in undergraduate research, whereas only 1.4% of all Business and Economics majors do so. The other figures are 13.5% for majors in Arts and Humanities, 4.3% for those in Nursing and Health Sciences, 9.2% for those in the Social Sciences, and 4.0% for those in the School of Education. Some discrepancies are to be expected given disciplinary priorities, e.g., for internships over research experiences.

Undergraduate Research and Equity Across Demographic Groups

CSUCI values providing equitable access to opportunities. Accordingly, we examine how certain demographic subgroups – particularly those that have traditionally been provided lower access to higher education – have received access to undergraduate research at CSUCI.

The blue line shows the percentage of all CSUCI students who participated in undergraduate research in a given year. Any dots above blue dots indicate that the demographic group corresponding to that color was over-represented in undergraduate research participation that year. The discrepancies do not appear to be large overall, although attention should be paid to the fact that Hispanic students are consistently underrepresented in undergraduate research participation.

Percentages of Certain Demographic Groups doing UR



Repeated Undergraduate Research Experiences

SURF is arguably CSUCI's highest profile, and perhaps its highest cost-per-student undergraduate research experience. Between 2017 and 2023 (inclusive), 232 students participated in the SURF program. Of these, 219 students participated once, nine participated twice, and two participated three times.

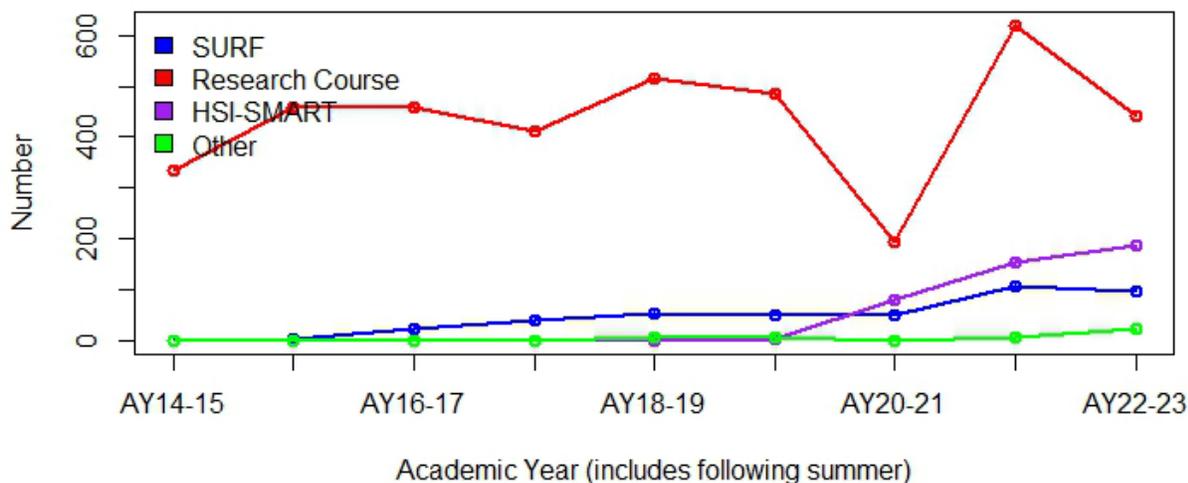
Recommendation: Consider limiting students to participating in SURF at most once during their time as CSUCI undergraduates to provide more students opportunities to this program. Students who participated with at least one summer remaining prior to graduation could be encouraged to apply to externally funded undergraduate research programs post SURF-participation.

Undergraduate Research by Time and Type

The next graph shows that most of the students participating in undergraduate research at CSUCI do so through research courses.

The dip in students in research course enrollment in AY20-21 is likely due to pandemic-related remote learning. It's possible the rise in AY21-22 represents some pent-up demand. However, the drop in AY22-23 doesn't have an obvious explanation. The mean of the AY21-22 and the AY22-23 numbers is only 496, still significantly below AY18-19 and AY19-20 mean.

Numbers of Students Doing UR by Category



Recommendation: Continue to observe the number of students taking research courses in AY23-24 and beyond. This aspect of undergraduate research at CSUCI is particularly important, due to the large role research courses provide in providing opportunities for undergraduate research.

Undergraduate Research Participation and Outcomes

Graduation Rates

Overall, graduation rates are markedly better for students who participated in undergraduate research.

For those who enrolled as first-time full-time freshmen at least six years before Spring 2023, 93.1% of those who participated in undergraduate research graduated within 6 years (99.2% for SURF participants). This compares to a 6-year graduation rate of 60.8% for those who did not participate in undergraduate research.

The difference in 4-year graduation rates for those who enrolled as transferred students is also quite large. Of those who enrolled as transfer students at least four years before Spring 2023, 86.4% of those who participated in undergraduate research graduated in four years (81.4% for SURF participants). The comparison set had a 76.3% 4-year graduation rate. We note that a much higher percentage of transfer SURF participants had either graduated or were still enrolled at the end of the study (95.1%) than were their counterparts (80.2%).

NSSE Self-Reporting vis-à-vis Undergraduate Research Data

Cleaning the NSSE data and comparing it to the comprehensive IR dataset (“Course” – described as Data Source #1 in Context, above) yielded some interesting observations. There are 5713 datapoints in the NSSE file of which 5223 have unique IDs. 633 of those do not appear in the Course dataset. Most of those could be neglected as they took NSSE prior to the Fall 2014 semester (Spring 2013 and Spring 2014) and were presumably not enrolled after Spring 2013. The table below

indicates some unexplained data anomalies in Spring 2016, 2017, and 2023. While students have the option of taking the NSSE survey both as freshmen and as seniors, nothing in the dataset indicates their course status when they took it.

NSSE Timing	Count from NSSE	Count from NSSE & not in Course
Spring 2013	421	302
Spring 2014	497	318
Spring 2016	703	19
Spring 2017	727	1
Spring 2018	754	0
Spring 2020	1338	0
Spring 2022	821	0
Spring 2023	452	21

The one question in the NSSE survey pertaining to undergraduate research asks whether students a) plan to do it, b) have not decided whether they will do it, or c) whether they are in the process of doing undergraduate research or have already done it.

The table below gives the intersection of students' NSSE responses with the records of whether they actually took an undergraduate research course at CSUCI. The most curious entry is the intersection of "Done or in progress" – meaning students self-reported that they'd done undergraduate research or were currently doing it – with "Did not take undergraduate research" as determined from the IR data. 433 is far more than can be explained away by counting other contexts for undergraduate research! This is emphasized by considering the 740 students who indicated they planned to do undergraduate research but had not taken a research course by Spring 2023. The best hypothesis seems to be that students are defining "research" more loosely than practitioners are likely to do.

NSSE/ undergraduate research course	Do not plan to do	Have not decided	Plan to do	Done or in progress
Did not take undergraduate research	1328	1024	740	433
Took undergraduate research	77 (5.5%)	123 (10.7%)	234 (24.0%)	711 (62.2%)

Recommendation: Avoid using NSSE survey responses to assess research participation

The Graduating Student Survey vis-à-vis Undergraduate Research Data

There are 8776 responses to the Graduating Student Survey (GSS) in the data provided, with the earliest submitted in Spring 2017 and the latest in Spring 2023. Of these, there are 8681 with unique student IDs. There were 331 GSS submissions for which the student ID submitted did not correspond to any student ID in the IR data; these submissions had to be omitted.

The next table indicates how many students submitted the GSS in each of the survey terms present and the number of students who graduated that same term. Where the number submitting the GSS

is greater, we presume that some students who graduated the previous term also submitted the survey. Anecdotally, we also know that some students expect to graduate one term (and thus might submit the GSS) but then graduate later or not at all. Finally, the data shows that 94 students submitted more than one GSS (typically in different years).

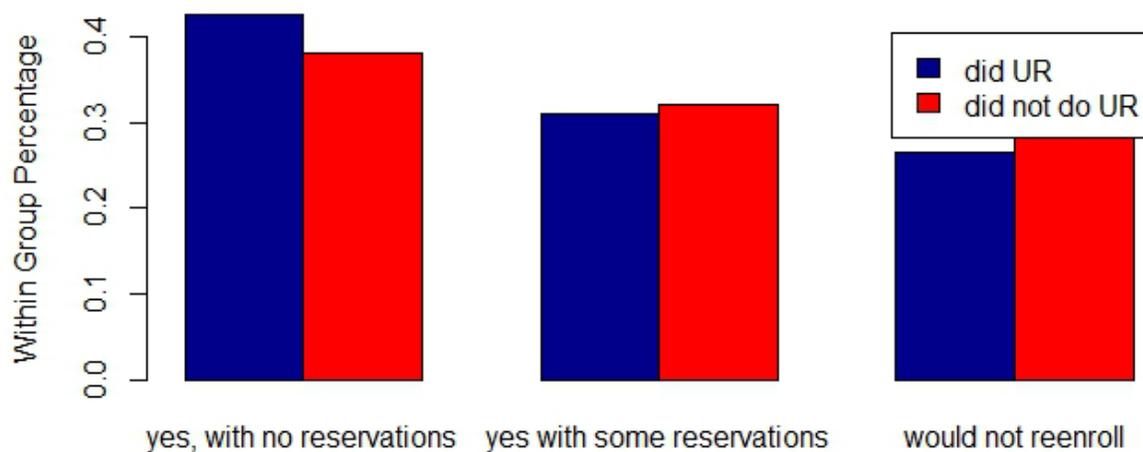
Semester	Submitted GSS	Graduated Same Term
Spring 2017	1325	1254
Spring 2018	1506	1430
Spring 2019	1718	1547
Spring 2020	1360	1607
Fall 2020	121	574
Spring 2021	396	1475
Spring 2022	1155	1412
Spring 2023	883	1139

Student errors or varying interpretations of questions leads to some challenges in interpreting the GSS data. For instance, when queried as to plans for employment post-graduation, 398 respondents indicated **both** that they would start new employment and that they would continue current employment.

The GSS includes the question “If you had a chance to start over, would you enroll at CSUCI again?”

42.5% of those who participated in undergraduate research responded “yes, with no reservations” as compared to 38.1% of those who did not participate in undergraduate research. Overall, the “yes” (with or without reservations) percentages were 73.6% and 70.1% for those who engaged in undergraduate research as compared to those who didn’t.

Undergrad Research and Attitudes towards Re-Enrollment



Aspiring to graduate degrees, gaining acceptance to graduate programs, and completing graduate degrees are thought to be potential benefits of engaging in undergraduate research. Successful

post-graduate outcomes also include finding new employment, particularly employment that is related to the field of study.

The following table indicates how responses to questions related to graduate study and to new employment compared according to whether respondents had engaged in undergraduate research.

Gist of Question	Engaged in UR	Did not engage in UR
Questions Pertaining to Graduate Study		
Accepted to or enrolled in graduate school	10.4%	5.3%
Research experience influenced choice to apply to grad school “some” or “a lot”	55.9%	32.9%
Applying to or will apply to graduate school, but not yet accepted/enrolled	46.6%	35.7%
Questions Pertaining to Employment		
Will begin a new employment position and will start within the next 6 months	21.8%	21.6%
New employment is either “directly related” or “somewhat related” to major or minor	19.68%	19.34%
Continuing employment is either “directly related” or “somewhat related” to major or minor	12.5%	19.19%

It appears that participation in undergraduate research has a significant impact in terms of applying to and receiving acceptance to graduate school, but there is no or negative impact on questions pertaining to new employment. Meanwhile, undergraduate research participation corresponds to a lower percentage of perceiving that one’s continuing employment is related to the field of study.

The GSS also asks students to assess their achievement of the National Association of Colleges and Employers’ “Core Competencies,” competencies that collectively measure “career readiness.” The last table summarizes CSUCI students’ self-assessment of their level of preparation for each of these competencies.

Note: responses are grouped as indicated; many respondents also skipped one or more questions.

The question, in matrix choice format, reads “The National Association of Colleges and Employers (NACE) has identified seven key competencies for career readiness. To what degree did your academic experience prepare you in the following areas.”

Teamwork/ Collaboration	Engaged in UR	Did not engage in UR
Poorly Prepared or Unsure	0.56%	1.3%
Adequately Prepared	6.5%	6.5%
Well Prepared or Extremely Prepared	29.8%	31.7%

Professionalism/ Work Ethic	Engaged in UR	Did not engage in UR
Poorly Prepared or Unsure	1.3%	1.3%
Adequately Prepared	5.5%	5.8%
Well Prepared or Extremely Prepared	30.2%	32.3%

Oral/ Written Communication	Engaged in UR	Did not engage in UR
Poorly Prepared or Unsure	0.6%	1.1%
Adequately Prepared	7.0%	6.8%
Well Prepared or Extremely Prepared	29.4%	31.7%

Leadership	Engaged in UR	Did not engage in UR
Poorly Prepared or Unsure	2.2%	2.7%
Adequately Prepared	8.8%	8.8%
Well Prepared or Extremely Prepared	25.5%	27.6%

Digital Technology	Engaged in UR	Did not engage in UR
Poorly Prepared or Unsure	2.4%	3.2%
Adequately Prepared	11.0%	10.7%
Well Prepared or Extremely Prepared	22.1%	25.5%

Critical Thinking/ Problem Solving	Engaged in UR	Did not engage in UR
Poorly Prepared or Unsure	0.7%	1.0%
Adequately Prepared	5.0%	5.5%
Well Prepared or Extremely Prepared	31.1%	33.2%

Career Management	Engaged in UR	Did not engage in UR
Poorly Prepared or Unsure	5.6%	4.8%
Adequately Prepared	11.0%	10.4%
Well Prepared or Extremely Prepared	20.1%	23.9%

Global/ Intercultural Fluency	Engaged in UR	Did not engage in UR
Poorly Prepared or Unsure	5.8%	5.4%
Adequately Prepared	12.0%	11.4%
Well Prepared or Extremely Prepared	17.6%	21.4%

We do not substantive advantages to having done or not done undergraduate research in terms of students' perceptions of their career readiness related to these core competencies.

Final Thoughts

The “outcomes” aspects of this investigation are at best tentative, relying on self-reporting prior to graduation. If individuals' undergraduate records can be directly connected to their graduate study, employment, and “was it worth it?” outcomes five, ten or more years post-graduation, a better sense of the relative merits of undergraduate research could be pursued.

General Recommendation: If there is long-term university interest in assessing outcomes vis-à-vis participation in undergraduate research, develop a common understanding of what CSUCI means by this and developing a mechanism to track student engagement in this high-impact practice.