Helping Undergraduates Find a Research Match Yields Stellar Retention Results

Susan Elaine Benzel, Colorado State University

Susan E. Benzel, PMP Scott Scholars Program Director Walter Scott, Jr. College of Engineering Colorado State University

Susan earned her Bachelor of Science in Electrical Engineering from Colorado State University, and after a 30-year career in high-tech working for Hewlett Packard (HP)/Hewlett Packard Enterprise (HPE), she returned to CSU in the fall of 2018 to work with both the Scott Scholars (recipients of CSU's most prestigious engineering scholarship) as well as the first generation engineering students. Her role includes mentoring, teaching leadership skills, connecting students with research opportunities, and many other activities to help ensure student success. Through this role, Susan assists students in engaging fully with the college of engineering, guides students in understanding their career options, helps place students in the best position possible to participate in the wide range of options available to them after they acquire their degree, and encourages students to use their powers for good by contributing to their communities and society in general.

Susan's 30 years at HP/HPE spanned many areas of high tech culminating in a final role working with Hewlett Packard Labs as the Execution Program Manager for The Machine, and helping them develop their artificial intelligence strategy. The Machine – the world's largest single-memory computer, located right here in Fort Collins – is reinventing the fundamental architecture of computers to enable a quantum leap in performance and efficiency, lowered costs over the long term, and improved security. Over her 30 years at HP/HPE, Susan also had the unique opportunity to work in almost every aspect of product development including marketing, support, training, certification, documentation, business development, and research and development program management. She had the privilege of working with HP/HPE's top customers, and helped many business units develop their value proposition and future direction.

In December 2016, Susan was honored to give the commencement address for the Colorado State University College of Engineering Fall commencement ceremony. She lives in Fort Collins with her wonderful husband of over 30 years, Randy, and they have two incredible children, Marcus and Miranda. All four, and even her son-in-law John, are proud Colorado State University graduates. Go Rams!

Helping Undergraduates Find a Research Match Yields Stellar Retention Results

Abstract

This evidence-based practice paper will detail how matching first- and second-year students with research faculty has not only produced outstanding results in terms of student engagement and desire to pursue an engineering degree but has also shown sustained improvements in retention of five to seven percent. Institutions of higher education have received increasing criticism for attracting students to campus, only to leave many students feeling they don't belong and looking for the exit shortly after arriving. Many factors contribute to a student's sense of belonging, which studies have shown has a positive impact on retention as well as mental health [1]. Significantly, this has been found to be true of not just traditional students, but also of underrepresented students who are first generation, low income, and racially minoritized [2]. As all universities and institutions of higher education face the enrollment cliff [3], increasing student sense of belonging and retaining students, which have always been important goals, are becoming more critical. R1 universities (and research universities at any level) have a unique opportunity to utilize undergraduate research to boost student sense of belonging and retention. This paper will look at both the practical side of creating an undergraduate research program – program justification, start-up, and ongoing operation – as well as the stellar results universities can achieve with an undergraduate research program. These "stellar results" encompass the ability to create tangible, measurable, and sustained results (so far, over a period of five years at the Walter Scott, Jr. College of Engineering at Colorado State University) for both students and faculty members.

Introduction/overview

Institutions of higher education have received increasing criticism for attracting students to campus, only to leave many students feeling they don't belong and looking for the exit shortly after arriving. "Fewer than two thirds of students who enroll in college finish their degree," however it has been shown that students who feel a sense of belonging are more likely to complete their first year [4]. Sense of belonging is one of many factors that can help with retention issues and when combined with the enrollment cliff predicted to hit in 2025 [3], institutional focus on sense of belonging and retention, which have always been important goals, are becoming even more critical. With the enrollment cliff, the number of traditional college students pursuing a higher education will decline, and every postsecondary institution will be pursuing the same goal – attracting and retaining students they typically have not attracted and have had trouble retaining in the past. But who will emerge successful if every institution is pursuing the same strategy and fighting for the same, ever-shrinking pool of candidates? While there is no crystal ball to definitively answer this question, it stands to reason that universities who play to their strengths and match these strengths with students' needs will most likely rise to the top as well as those who can address a top student concern – paying for college. While students acknowledge cost is not the only factor when considering college, they did rate it anywhere from 8.3 to 8.9 on a scale of 1 "not at all important" to 10 "extremely important [5].

For research universities, leveraging the research knowledge, practices, and culture already prominent on their campus will help them recruit and retain students, if this strength is used

properly, as a research program can both increase sense of belonging and provide additional income to students to help them pay for college. Many research universities either already have an undergraduate research program in place or can fairly easily create one, and this type of program can greatly benefit students in many areas, from clarifying their career path to "promoting independence, collaboration, and innovation" [6]. This ability to leverage a key, defining strength for a research university to attract and retain potential students who previously had not considered higher education, offers a unique opportunity to research universities that other institutions cannot easily emulate.

This paper will provide information on the importance of finding unique ways to retain students, then take a detailed look at the Scott Undergraduate Research Experience (SURE) program put in place at the Walter Scott, Jr. College of Engineering (WSCOE) at Colorado State University (CSU). The initial creation and justification of this program will be explained, as well as some ongoing considerations. Most significantly, the results of the program will be discussed in detail, as the program has created tangible, measurable, and sustained results over a period of five years for both students and faculty.

Retention…and a bit of recruitment too

According to the National Center for Education Statistics (NCES) there are almost 4,000 degree granting institutions in the US [7], with just over 18.5 million students enrolled in degree-granting postsecondary institutions as of 2021 [8]. Projections illustrate enrollment is not expected to get back to the highs of 2010 and 2011 over the next ten years, and while projections for the number of degree granting institutions are not provided by NCES, this number has been steadily declining over the last ten years [7] [8]. These rather bleak numbers highlight the importance of developing not only new recruitment strategies, but also strong retention strategies as institutions fight to retain the students they worked so hard to recruit. For R1 universities, and truly research universities at any level, undergraduate research programs can support a strong retention strategy, and help set research universities apart from other institutions.

Every one of the almost 4,000 degree granting institutions in the US will be creating strategies to recruit and retain students who typically have not attended post-secondary education. If just a few institutions were creating such a strategy they might all be successful, but with virtually every degree granting institution trying to basically do the same thing, which universities will triumph? Institutions that can provide unique advantages that align with their core competencies and values are most likely to prevail, and undergraduate research is one of these unique advantages. However, even with unique advantages, institutions must also be mindful of the cost of obtaining a degree. Articles are coming out on a monthly, weekly, and even daily basis questioning whether a college degree is worth the cost [9], [10], [11]. A study conducted on the impact of undergraduate research, "The Impact of Undergraduate Research Experience Intensity on Measures of Student Success" [12] found that even Novice researchers (those with two semesters or less of undergraduate research), "are more likely to graduate in less time than non-research active students." Graduating in less time equates to a lower cost of obtaining a degree,

and when combined with added benefit of higher retention rates, undergraduate research programs offer research universities the double impact of helping recruit and retain students.

Of the almost 4,000 degree granting institutions, only 146 are classified as R1 universities [13] according to the Carnegie Classification of Institutions of Higher Education [14], and only 131 are designated as R2 universities [15]. For research universities, leveraging the research knowledge, practices, and culture already prominent on their campus will help them retain students, reduce the amount of time it takes students to graduate, and also provide great value to the students and research faculty. The significance here is that research universities can leverage this practice more effectively, and in a much timelier manner, than other institutions. Of course, this is only interesting if undergraduate research programs have been proven to improve student retention – which they have. Over ten years ago, the Association of American Colleges and Universities first published information on High Impact Practices (HIPs) [16], including undergraduate research. Since that time (and even prior to it), many papers and articles have been written about the importance of undergraduate research and other HIPs, and research has demonstrated that HIPs do increase the odds of retention [17]. In addition, the "significant educational benefits" of HIPS have been shown to extend to "those from demographic groups historically underserved by higher education" [18], and these are the groups institutions will be hoping to recruit and retain as we hit the enrollment cliff.

Information and research, like that shown in the previous paragraphs, are a small sampling of the data that inspired CSU to start the SURE program in the spring of 2019. Since that time, the SURE program has yielded stellar results, demonstrating increased retentions rates of over 7% in the WSCOE and increased retention rates of almost 5% at CSU when compared to a WSCOE reference group. In addition, students participating in the SURE program are better able to see themselves as an engineer, more likely to reach out to their faculty mentor in the future, and feel more connected to the WSCOE. In the last section of this paper, these results will be discussed in much greater detail. First, however, the initial creation and justification of the SURE program will be explained, as well as considerations for the ongoing execution of the program.

An undergraduate research program – justification, start-up, financial support, and ongoing execution

Justification & Start-up of an Undergraduate Research Program

Okay, an undergraduate research program has been proven to enhance the experience of students from many different angles, and could provide research institutions with a key differentiator to help them attract and retain students, but how do you justify such a program? Before diving in too deeply, it is important to step back and think about alternatives, and what is most appropriate given the scope of the program.

While there could be many approaches, let's consider two basic approaches to justifying an undergraduate research program: the first is to spend nine months creating a theoretical basis, and the second is to run a pilot and assess the results.

- For the first approach, we will assume two people each spend 25% of their time doing research, meeting with stakeholders, and surveying students and faculty. If each person makes $100k per year and works on this project for 9 months, this amounts to a cost of $37,500 for the first approach.
- For the second approach, someone could do a bit of research (probably just for an afternoon), realize that undergraduate research programs have been proven to enhance the student experience and increase retention, then opt to run a pilot with 20 students. A program manager/coordinator making $100k would spend 25% of their time during nine months of the year working on the program including a survey at the end of the program, for a personnel cost of $18,750. The salary cost for the students would be roughly $22,000, so the total cost of the pilot would be $40,750.

The two approaches outlined above have a very similar costs, however the second approach has two significant benefits:

- 20 students get hands-on experience doing research
- You have data related to a program run at your specific institution, including information on how to improve the program going forward

With the first approach, you would have some theoretical data, but it may not be clear if the theoretical data will match reality when you try to start a program at your specific university. If you are considering a program that has a much larger price tag, doing a theoretical justification of the project may be warranted. And there are undergraduate research programs with much higher price tags, as discussed in "At these colleges, students begin serious research their first year" [19]. As noted in the first paper I created about the SURE Program, "*You Had Me at "Undergraduate Research": How One Institution Achieved Incredible Results in the First Year of a Formal Program to Place Freshmen (and Sophomores) in Research Labs, While Helping Students Chip Away at the Cost of College*" [20], I don't want to diminish higher price tag solutions as they have also proven to be very effective. I simply want to point out that there are many ways to approach the establishment of an undergraduate research program, and you should weigh your options of creating a theoretical basis/justification versus running a pilot. For the SURE program, we opted to run a pilot, and given the excellent results from the pilot in the spring of 2019, the SURE program is currently (as of the spring of 2024) being run for the sixth consecutive year.

One last note on starting an undergraduate research program – the support of college management (dean, associate dean, etc.) and faculty is key to the success of a such a program. As you determine the best way to justify and start up an undergraduate research program, take this into account, as it may influence your justification plan and could heavily influence whether the plan is viable at your institution.

Financial Support of an Undergraduate Research Program

The financial support of any co-curricular program is very important, and as university employees we have an obligation to fund the programs that will best benefit our students. The

SURE Program is currently supported by a combination of funding from the Suzanne and Walter Scott Foundation and the CSU Provost; the program was initially supported by the Dean's Innovation Fund prior to securing funding from the Provost. This combination of donor and institutional funding is key. Institutions should always be willing to fund the programs they believe are most beneficial to their students. With this being said, university budgets are always tight, and donor support is instrumental to offering many invaluable programs. The mission of the Suzanne and Walter Scott Foundation is, "to support charitable and educational projects that develop our community, invest in the next generation of leaders and empower youth through higher education." An undergraduate research program aligns very closely with this mission, and without the generosity of the Suzanne and Walter Scott Foundation, the SURE Program either would not exist, or would be implemented on a much smaller scale that would not impact nearly as many students.

Obviously, it is not required to have both donor and institutional support of an undergraduate research program. However, the creation of such a program can provide donors with a very clear way to contribute to undergraduate success and make a positive impact. By supporting the SURE program with donor and provost funds, faculty are not required to pay the salary of the undergraduate researchers. This is simply one financial model that can be used. If faculty are required to pay the student researchers from their funds, this could add complexity to the financial model and administration of the program.

Administration and on-going execution of an undergraduate research program

The example of a pilot program highlighted in the "Justification & Starting an Undergraduate Research Program" section provided a very high-level view of the financial resources required to start an undergraduate research program. In addition to a program manager/coordinator, running an undergraduate research program requires support from HR to hire student researchers, faculty to mentor and host the student researchers, and possibly other personnel to handle events like a poster fair at the end of the semester. In "*You Had Me at "Undergraduate Research": How One Institution Achieved Incredible Results in the First Year of a Formal Program to Place Freshmen (and Sophomores) in Research Labs, While Helping Students Chip Away at the Cost of College*" [20], the details of the administration and on-going support of the SURE program are covered. This paper should be helpful in guiding you if you do elect to start an undergraduate research program and provides in-depth information on topics such as sponsorship, determining the goals and scope of the program, budgeting, matching students and faculty, etc. that I won't duplicate in this paper.

One topic I will mention briefly is the matching of undergraduate students with faculty researchers. Undergraduate research can, and does, happen without formal programs. However, one of the compelling benefits of a formal program is that the matching of students with faculty becomes much more direct and less time-consuming, placing more students in labs where they are a good match. Many students are interested in doing research, but simply don't know how to get started, especially when they have no previous research experience. Many faculty researchers would like to mentor and work with undergraduate students, but don't know how to

find students who will be a good fit. A program like SURE not only helps overcome these problems but does so in a very efficient and effective manner.

Results & Discussion

When I wrote the first paper about the SURE Program [20], there was only one year of survey data available, and we had no retention data. We now have five years of survey data and four years of retention data to review, and I believe this data can provide a very strong justification for others who decide to start an undergraduate research program. I will present the data below, followed by a discussion of where we still need improvement.

Survey Data

Survey data has been collected for the SURE program each spring since 2019 with the exception of the spring 2020 semester. During the spring semester of 2020, many students did still complete their research, however given the additional stresses impacting students and faculty due to the COVID-19 pandemic, we opted to not do a survey. Separate surveys are administered for students and faculty/GRAs. The survey process is anonymous and is administered via SurveyMonkey by a person who's only involvement with SURE is to conduct the survey.

The graphs below show the survey results from the spring 2023 survey, as students are just beginning to work in labs in the spring of 2024 as this paper is being written. Each graph is labeled clearly at the top with "Students" or "Faculty/GRAs" (graduate research assistants) so you can easily determine the source of each graph. After the graphs, tables show the survey results from all previous years so you can view how results have fluctuated over time from the spring of 2019 to the spring of 2023. A discussion of these results follows the tables.

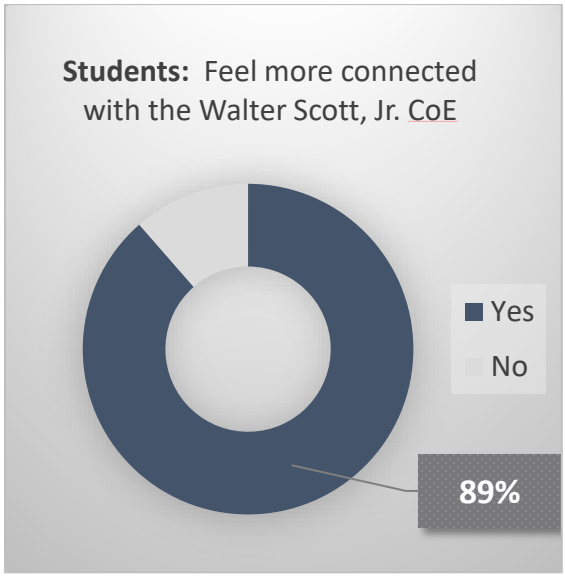

Figure 1: % of students who feel more connected with the Walter Scott, Jr. College of Engineering after participating in SURE

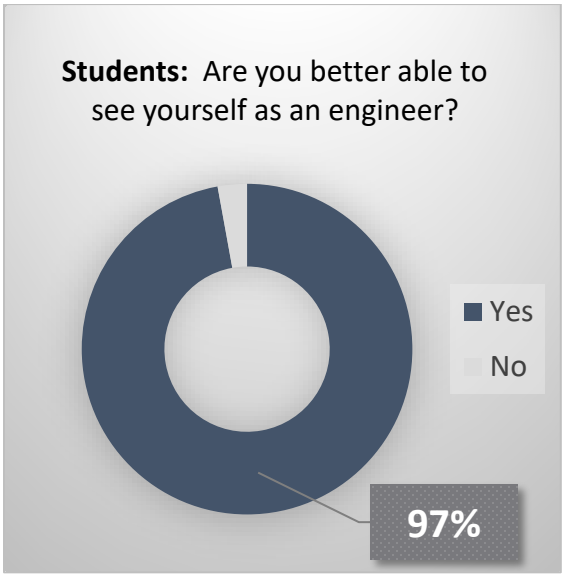

Figure 2: % of students better able to see themselves as an engineer after participating in SURE

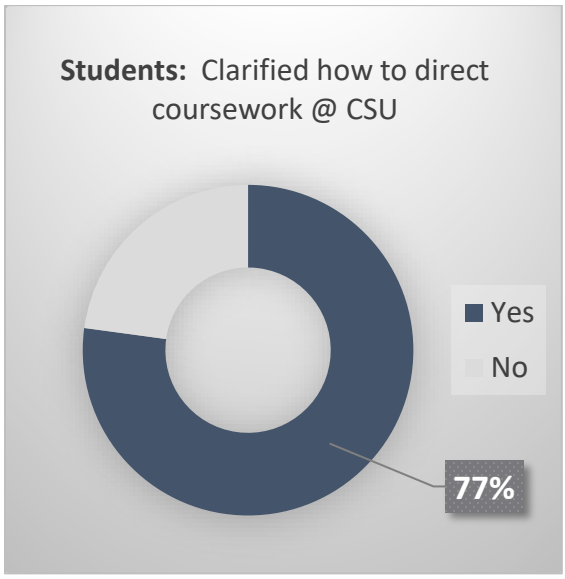

Figure 3: % of students who feel the SURE program helped clarify how they will direct their coursework while at CSU

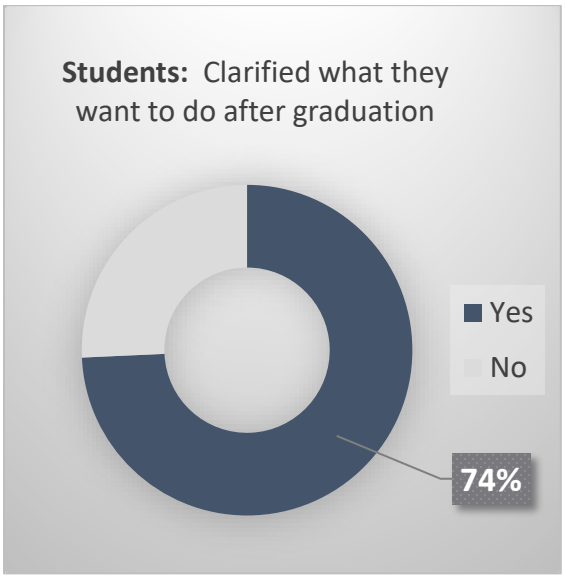

Figure 4: % of students who feel the SURE program helped clarify what they want to do after graduation

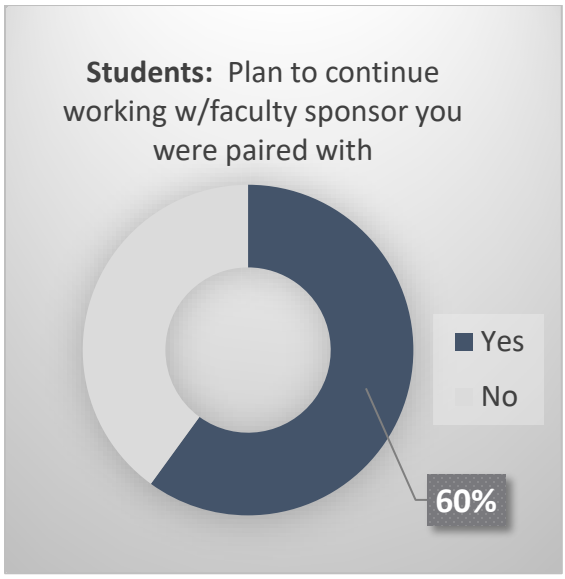

Figure 5: % of students who plan to continue to work with their SURE faculty sponsor after the SURE program ends

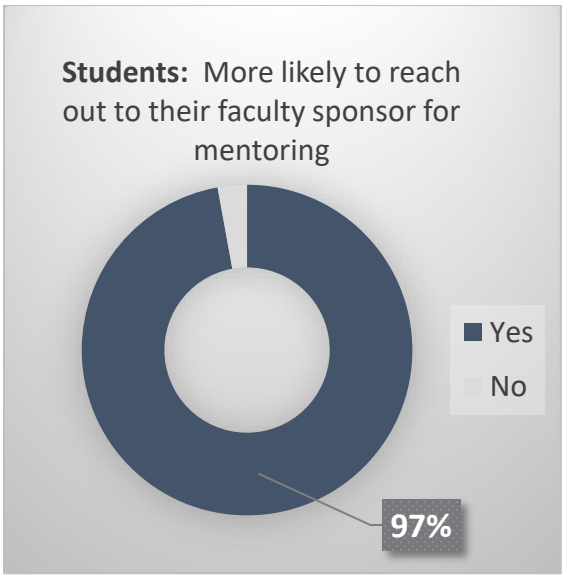

Figure 6: % of students more likely to request mentoring from their SURE faculty sponsor in the future

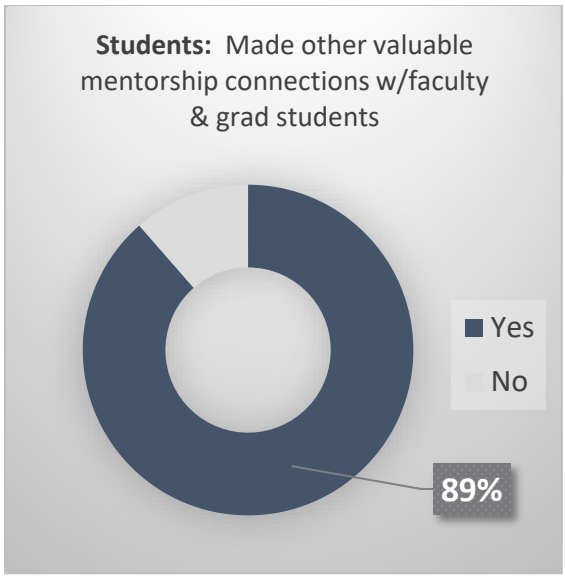

Figure 7: % of students who made valuable mentorship connections with faculty and graduate students through the SURE program

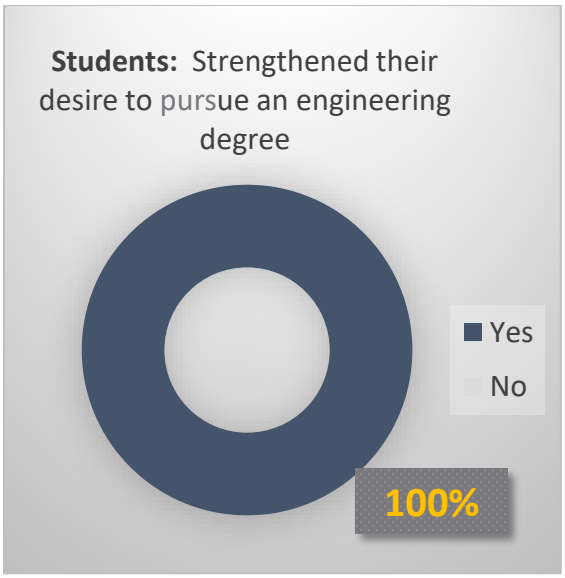

Figure 8: % of students who said their desire to pursue an engineering degree was strengthened by the SURE program

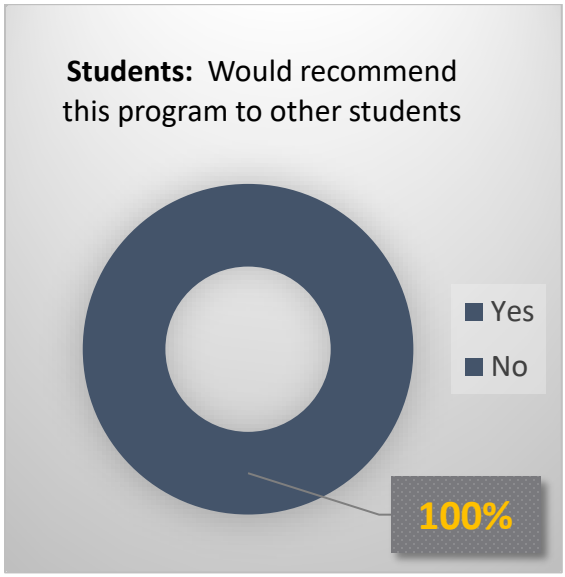

Figure 9: % of students who would recommend the SURE program to their fellow students

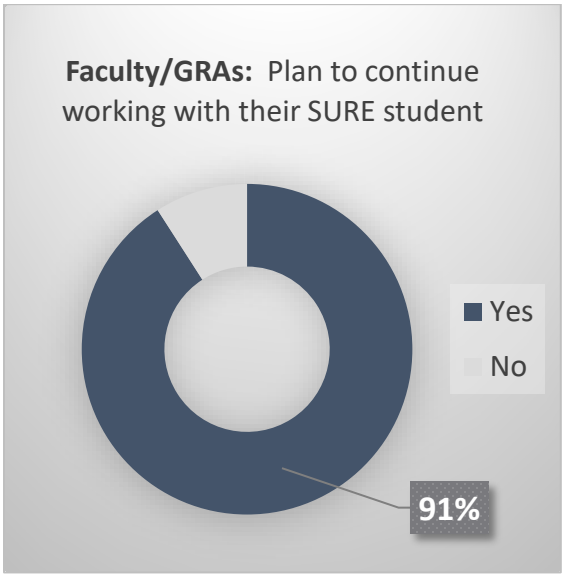

Figure 10: % of faculty/GRAs who plan to continue working with their SURE student in the future.

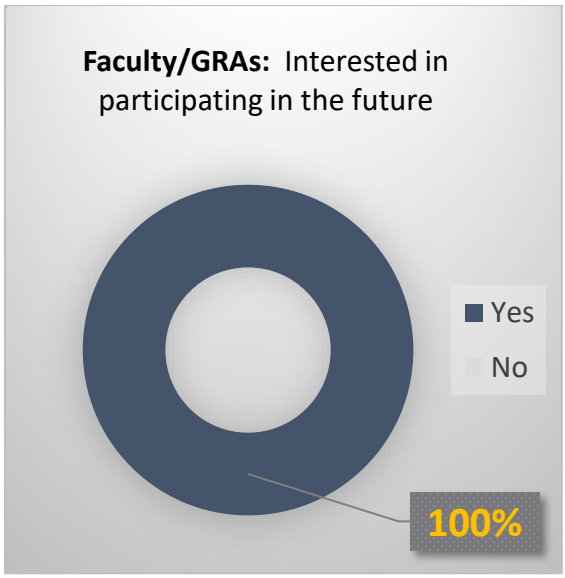

Figure 11: % of faculty/GRAs who are interested in participating in the SURE program in the future

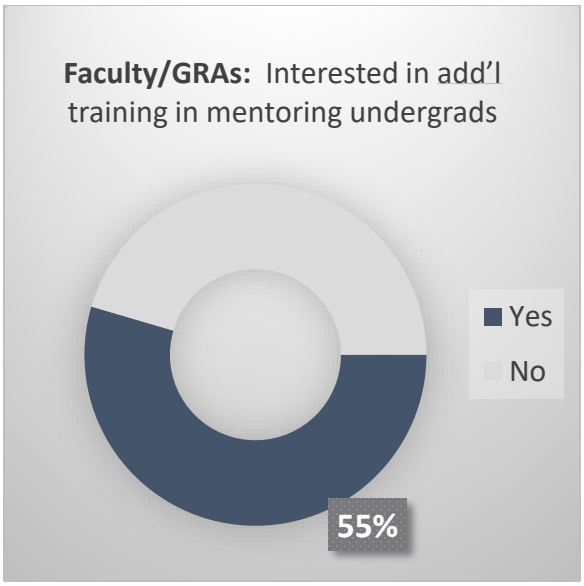

Figure 12: % of faculty/GRAs interested in addition training in mentoring undergraduate students

The twelve graphs above highlight the survey data collected at the end of the Spring 2023 SURE program. Similar data was collected in 2019, 2021, and 2022, and all data from 2019 to 2023 is summarized in the charts on the following page in the interest of saving space, however the I wanted to present the graphs above for readers who process data more effectively in picture format. A few observations related to the above twelve graphs for the 2023 SURE program:

- The graphs for previous yeas are very similar, with a few exceptions that are noted after the tables on the following pages.
- The survey data shows positive results in all areas, with no "red flags." This does not mean there is no room for improvement, rather, that there is no reason to pause the program in order to address critical issues. Instead, the plan is to move forward with the SURE program making continuous updates and improvements.
- Surveys are only conducted at the end of the SURE program and not at the start; this is an area for improvement that is being considered for future years thanks to the inputs from paper reviewers.
- While surveys were not conducted at the start of the SURE program so that we have comparative data, many questions in the student survey at the end of the program are worded in a way that asks students to rate their skill/interest level as a result of participating in the SURE program.
- Students are not asked specifically about their sense of belonging and if it increased due to the SURE program, as "sense of belonging" is vague and may not mean a great deal to first and second year students. Instead, students are asked about many other areas that are indicators of sense of belonging or closely related to sense of belonging, and these indicators all show positive improvement.

	2019	2021	2022	2023	Cumulative	
Students	Yes %	Yes %	Yes %	Yes %	Yes	No
Feel more connected with the Walter Scott, Jr. CoE	95.2%	96.7%	100.0%	88.6%	94.5%	5.5%
Are you better able to see yourself as an engineer?	N/A	100.0%	91.3%	97.1%	96.6%	3.4%
Clarify how you want to direct your coursework at CSU?	66.7%	86.7%	78.3%	77.1%	78.0%	22.0%
Clarify what you want to do after graduation?	71.4%	86.7%	65.2%	74.3%	75.2%	24.8%
Plan to cont. to work w/faculty member you were paired with?	76.2%	50.0%	56.5%	60.0%	59.6%	40.4%
More likely to reach out to your faculty sponsor as a mentor?	85.7%	86.7%	78.3%	97.1%	88.1%	11.9%
Make other valuable mentorship connections with faculty & GRAs?	76.2%	93.3%	87.0%	88.6%	87.2%	12.8%
Strengthen your desire to pursue an engineering degree?	90.5%	93.3%	100.0%	100.0%	96.3%	4.6%
Would you recommend this program to other students?	100.0%	100.0%	100.0%	100.0%	100.0%	0.0%

Table 1: Comparison of SURE data collected from students, 2019 – 2023

	2019	2021	2022	2023	Cumulative	
Faculty	Yes %	Yes %	Yes %	Yes %	Yes%	No%
Do you plan to continue to work with the student you were matched with for this program?	81.8%	85.7%	63.2%	90.9%	78.2%	21.8%
Are you interested in participating in this program in the future?	100.0%	100.0%	89.5%	100.0%	96.4%	3.6%
Would you be interested in additional training to strengthen your mentorship skills when working with undergraduate students?	72.7%	28.6%	57.9%	54.5%	52.7%	47.3%

Table 2: Comparison of SURE data collected from faculty/GRAs, 2019 – 2023

	Student Responses	Students in SURE	Response Rate	Faculty Responses	Faculty in SURE	Respopnse Rate
2019 SURE Survey	21	24	87.5%	11	24	45.8%
2021 SURE Survey	30	36	83.3%	14	23	60.9%
2022 SURE Survey	23	34	67.6%	19	29	65.5%
2023 SURE Survey	35	50	70.0%	11	34	32.4%

Table 3: SURE survey response rates

A few observations about the data shown on the previous page:

- There are fairly consistent results across the years with a couple of notable exceptions:
    - The percentage of students who plan to continue working with the faculty member they were paired with in the future took a large dip in 2021 and is still not back up to the level it started at in 2019. The dip in 2021 may be attributable to COVID, however we feel this effect should have been mitigated by now. There will be closer follow-up with students after the spring 2024 SURE program to see if we can increase this number going forward.
    - The percentage of students willing to reach out to their faculty sponsor has varied widely; this is another item we hope to understand better after closer follow-up with students in the spring of 2024.
    - The percentage of faculty sponsors and graduate research assistants who are interested in more mentoring training has also varied widely. This is an area we need to investigate from a WSCOE perspective, as this topic is of broad interest.
- 100% of students have said they would recommend SURE to a friend. Each year as we get results, I hold my breath. I am sure we won't stay at 100% forever, but five years is a very impressive run!
- The results for students feeling more connected with the WSCOE were down just slightly in the spring of 2023, however overall, this number is very impressive. This result is significant because connection is one thing that boosts a student's sense of belonging, which is directly tied to higher retention.[21]
- Faculty survey response rates are rather low; thus, we will be working to increase these rates in future years.
- Spring 2023 had a dip in student response rates; we also saw a dip in student participation in other events during the 2022-2023 academic year. It is not clear if there is a relationship between these two items, however during the fall 2023 semester we have started to be more mindful about how we engage students and we are seeing positive results. We are working on a strategy to increase spring 2024 survey response rates.
- The students who participate in SURE must apply to the program, thus, there is selection bias. I do want to make it clear, however, that just over half of students who participate in the SURE program are first generation students whom I have never met. I do not know their GPAs, family history, study habits, etc. These students are matched with professors simply based on their interests. So, while it is clear we have not eliminated selection bias as students do need to opt into this program, the SURE program has included a significant percentage of students from underrepresented backgrounds. The "Retention Data" section that follows provides detailed data around participation by students from underrepresented backgrounds. First-generation students are informed about the SURE program via email and presentations that are given in all first year engineering classes (because everyone gets too much email.) All first-generation applicants have been given a spot in the SURE program over the last five years, with no previous experience required, thus providing research experience for many students who would not otherwise have had the opportunity to participate in undergraduate research.

Overall, the survey results for the SURE program have been excellent, however one could argue that retention rates are where the rubber truly hits the road, thus why this information has its own section below.

Retention Data

Retention rates have always dominated the conversation at institutions of higher education, and now that "enrollment cliff" has become a part of our vocabulary, retention (and recruitment) command even more attention. As institutions spend a great deal of resources struggling to raise retention rates by a percentage point each year, the SURE Program has a track record of raising these rates by 4.7 percentage points at CSU, and 7.4 percentage points in the WSCOE. Notably, first generation (FG) SURE students are 6.1 percentage points more likely to persist to CSU and 8.5 percentage points more likely to persist within WSCOE compared to other FG Engineering students who did not participate in SURE. Tables 4 and 5 below provide additional detail behind these numbers.

Overall SURE Persistence & Demographics with Reference Group[a]			
	SURE SP19-SP23 Participants	**WSCOE Reference Group[b]**	**Difference**
N	*184*	*3762*	
Subsequent 2nd/3rd Fall Persistence[c]			
At CSU	98.4%	93.7%	4.7 PP
In WSCOE	94.6%	87.2%	7.4 PP
Demographics			
Transfer	8.2%	8.5%	-0.3 PP
Female	51.1%	27.8%	23.3 PP
First Generation	48.4%	17.0%	31.3 PP
Limited Income[d]	34.2%	20.1%	14.1 PP
CO Resident	78.8%	65.3%	13.5 PP
Racially Minoritized	40.8%	24.8%	15.9 PP

Table 4: Overall SURE Persistence & Demographics with Reference Group

Table 4 Notes:

[a]Data and interpretation for table A and B provided by Nicole Ross of CSU's Office of Institutional Research, Planning, & Effectiveness.

[b]The WSCOE reference group includes all full-time new (summer and fall start)s and transfer (fall starts) undergraduates in entering cohorts FA17-FA22 whose entering cohort college is WSCOE.

[c]For the reference group, 2nd (3rd) fall persistence at CSU is calculated among an adjusted cohort who were enrolled at end-of-term in 1st (2nd) spring. 2nd (3rd) fall persistence in WSCOE is calculated for students who were enrolled at end-of-term in 1st (2nd) spring within the WSCOE. These sample restrictions ensure SURE participants are benchmarked against an appropriate subset of students (i.e., all students had an equal opportunity to complete SURE) within the overall reference group. The demographic measures apply to the broader (unadjusted) reference group.

[d]Limited income status here only refers to a student's status in their entering cohort year and not subsequent years.

First Generation (FG) Persistence & Demographics with Reference Group[a]			
	SURE SP19-SP23 FG Students	**WSCOE FG Reference Group[a]**	**Difference**
N[b]	*92*	*641*	
Subsequent 2nd/3rd Fall Persistence[c]			
At CSU	97.9%	91.8%	6.1 PP
In WSCOE	93.6%	85.1%	8.5 PP
Demographics			
Transfer	14.1%	15.8%	-1.6 PP
Female	44.6%	31.0%	13.5 PP
Limited income[d]	57.6%	53.8%	3.8 PP
CO Resident	84.8%	82.7%	2.1 PP
Racially Minoritized	56.5%	47.9%	8.6 PP

Table 5: First Generation Persistence & Demographics with Reference Group

Table 5 Notes:

[a]Data and interpretation for table A and B provided by Nicole Ross of CSU's Office of Institutional Research, Planning, & Effectiveness.

[b]The FG WSCOE reference group includes all full-time new (summer and fall starts) and transfer (fall starts) undergraduates in entering cohorts FA17 – FA22 whose entering cohort college is WSCOE and who are first generation students.

[c]For the reference group, 2nd (3rd) fall persistence at CSU is calculated among an adjusted cohort who were enrolled at end-of-term in 1st (2nd) spring. 2nd (3rd) fall persistence in WSCOE is calculated for students who were enrolled at end-of-term in 1st (2nd) spring within the WSCOE. These sample restrictions ensure FG SURE participants are benchmarked against an appropriate subset of students (all students had an equal opportunity to complete SURE) within the FG reference group. The demographic measures apply to the broader (unadjusted) reference group.

[d]Limited income status here only refers to a student's status in their entering cohort year and not subsequent years.

Discussion & Final Thoughts

While the data collected via the SURE survey portrays excellent results, the retention data shown above conclusively proves that the SURE Program is effective and has a stellar impact on retention. Undergraduate research programs are considered to be a high impact practice, so this outcome is not surprising from some viewpoints. However, the fact that the SURE Program requires far fewer resources than some other undergraduate research programs, hopefully provides the spark for many other research universities to start or expand undergraduate research programs at their institution. In addition, the fact that the SURE program shows excellent retention results for all student populations, including those from underrepresented backgrounds, is significant as we work to create equity across all demographics and as we work to create compelling college experiences for underrepresented students, which have often been lacking. One group of underrepresented students that needs more work/attention from the SURE program is transfer students. The population of transfer students participating in SURE has been very small and we hope to change this in the future. Note that because of the low engagement with transfer students, our retention results in this area are not statistically significant.

Collecting the retention data and performing the required computations on that data is no small task, however it is critical to the success of an undergraduate research program. Not only will this information allow a program to move forward, it will also provide the background needed to continue to secure funding so the program can grow and expand. Academia is not standing still nor is the world, and the programs we invest in also must continue to evolve in order to continue to benefit students and all the communities they touch. If your institution opts to start an undergraduate research program, it is well worth the effort to collect survey and retention data, as it will most likely be required to sustain the program. As noted above, this is no small task, and it is imperative to have a highly skilled research analyst collect, investigate, and compile the data to effectively analyze program outcomes.

Acknowledgments

- Thank you to the Suzanne and Walter Scott Foundation for making the SURE program possible.
- Thank you to the CSU Provost Office for their generous funding as part of the Student Success Initiative, highlighting CSU's commitment to student success.
- Thank you to Dr. Daivd McLean, WSCOE Dean Emeritus, and Dr. Anthony Marchese, University of Rhode Island Dean of Engineering, for your enduring support of the SURE program, which would not have started without your vision.
- Thank you to Laurel Donahue, Mary Jarchow, Melissa Burt, Benette Wallace, Rebecca Leonard, Renee Hirschenhofer, Jim Jensen, Carol Bernard, Dixie Poteet, Emily Valerioti, and Cody Dozier for the time and energy you invested in supporting the SURE program, survey, poster fair, and celebration.

- Thank you to Nicole Ross, an incredible Research Analyst in CSU's Office of Institutional Research, Planning, & Effectiveness. Without your diligent work, the SURE program would not have grown and thrived.
- Thank you to all the SURE faculty and SURE students who have participated in the SURE program; you are the life blood of the SURE program.
- Thank you to the many people, both at CSU as well as the ASEE members, who reviewed and improved this paper.

References

[1] K. Allen, "Belonging: a review of conceptual issues, an integrative framework, and directions for future research," *Taylor & Francis Online*, March 10, 2021. [Online]. Available: Taylor & Francis Online, https://www.tandfonline.com/doi/full/10.1080/00049530.2021.1883409. [Accessed February 3, 2024].

[2] "Students' Sense of Belonging Matters: Evidence from Three Studies," *MIT Teaching + Learning Lab*, February 2023. [Online]. Available: MIT Teaching + Learning Lab, https://tll.mit.edu/sense-of-belonging-matters/. [Accessed February 3, 2024].

[3] A. Schuette, "Navigating the Enrollment Cliff in Higher Education," *Trellis Company*, 2023. [Online]. Available: Trellis Company, https://files.eric.ed.gov/fulltext/ED628984.pdf. [Accessed February 3, 2024].

[4] N. Morrison, "Give Students a Sense of Belonging and They Are Less Likely to Drop out, Study Finds." *Forbes*, May 5, 2023. [Online]. Available: Forbes Magazine, https://www.forbes.com/sites/nickmorrison/2023/05/04/give-students-a-sense-of-belonging-and-they-are-less-likely-to-drop-out-study-finds/. [Accessed March 15, 2024]

[5] J. Blake, "Weighing Perceptions Against Realities of Going to College," *Inside Higher Ed*, November 8, 2023. [Online]. Available: Inside Higher Ed, https://www.insidehighered.com/news/students/financial-aid/2023/11/08/cost-attendance-one-many-college-decision-influences. [Accessed March 15, 2024]

[6] J. Petrella, A.Jung, "Undergraduate Research: Importance, Benefits, and Challenges," *International Journal of Exercise Science,* vol. 1, no. 3, pp 91-95, 2008. [Online]. Available: National Library of Medicine, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4739295/. [Accessed February 3, 2024].

[7] United States Department of Education. (2022, November). *Degree-granting postsecondary institutions, by control and level or institution: Selected academic years, 1949-50 through 2021-22.* National Center for Education Statistics. [Online]. Available: https://nces.ed.gov/programs/digest/d22/tables/dt22_317.10.asp. [Accessed February 3, 2024]

[8] United States Department of Education. (2022, December). *Total fall enrollment in degree-granting postsecondary institutions, by attendance status, sex of student, and control of institution: Selected years, 1947 – 2031.* National Center for Education Statistics. [Online]. Available: https://nces.ed.gov/programs/digest/d22/tables/dt22_303.10.asp. [Accessed February 3, 2024].

[9] S. Krakoff, "Is College Worth the Cost?" Champlain College Online. [Online]. Available: Champlain College Online, https://online.champlain.edu/blog/is-college-worth-the-cost [Accessed March 15, 2024]

[10] G. Andrews, "Is College Worth it? Consider These Factors Before Enrolling," *Forbes*, January 24, 2024. [Online]. Available: Forbes Magazine, https://www.forbes.com/advisor/education/student-resources/is-a-college-degree-worth-it/. [Accessed March 15, 2024]
[11] L. Welding, "Is College Worth the cost? Less Than Half of Students Think So," *Best Colleges*, November 1, 2022. [Online]. Available: BestColleges.com, https://www.bestcolleges.com/research/is-college-worth-the-cost/. [Accessed March 15, 2024]
[12] D. Chamely-Wiik, "The Impact of Undergraduate Research Experience Intensity on Measures of Student Succes," *Journal of the Scholarship of Teaching and Learning,* vol. 23, no. 1, pp. 14-20, April 2023. Available: https://files.eric.ed.gov/fulltext/EJ1390753.pdf. [Accessed March 15, 2024]
[13] F. Diep, "Carnegie Is Changing How It Classifies R1 Institutions. Will Your University Make the Cut?," *The Chronicle of Higher Education*, November 1, 2023. [Online]. Available: The Chronicle of Higher Education, https://www.chronicle.com/article/carnegie-is-changing-how-it-classifies-r1-institutions-will-your-university-make-the-cut. [Accessed February 3, 2024].
[14] The Carnegie Classification of Institutions of Higher Education. About Carnegie Classification. [Online]. Available: American Council on Education, https://carnegieclassifications.acenet.edu/about/. [Accessed January 20, 2024].
[15] The Carnegie Classification of Institutions of Higher Education. Research Activity Index Resources, January 8, 2023. [Online]. Available: American Council on Education https://carnegieclassifications.acenet.edu/resource/research-activity-index-resources/. [Accessed February 3, 2024].
[16] G. Kuh, C. Schneider, *High-Impact Educational Practices: What They Are, Who Has Access to Them, and Why They Matter*, Washington, DC: Association of American Colleges and Universities, 2008.
[17] "High Impact Practices: Enhancing the Student Experience," Teaching & Learning Resource Center, The Ohio State University, circa 2023. [Online]. Available: The Ohio State University: https://teaching.resources.osu.edu/teaching-topics/high-impact-practices-enhancing. [Accessed February 3, 2024].
[18] "Trending Topic: High Impact Practices," American Association of Colleges and Universities, circa 2023. [Online]. Available: American Assocation of Colleges and Universities: https://www.aacu.org/trending-topics/high-impact. [Accessed February 3, 2024].
[19] N. Stump, "At these colleges, students begin serious research their first year," *The Conversation*, September 16, 2019. [Online]. Available: The Conversation, https://theconversation.com/at-these-colleges-students-begin-serious-research-their-first-year-117959. [Accessed February 3, 2024].
[20] S.E. Benzel, *You Had Me at "Undergraduate Research": How One Institution Achieved Incredible Results in the First Year of a Formal Program to Place Freshmen (and Sophomores) in Research Labs, While Helping Students Chip Away at the Cost of College.* Paper presented at 2020 ASEE Virtual Annual Conference. June, 2020. Content Access, Virtual On line . 10.18260/1-2—35716 ©2020, American Society for Engineering Education
[21] J. Beauchamp, "Seven Practices for Building Community and Student Belonging Virtually," *Ithaka S+R*, October 21, 2022. [Online]. Available: Ithaka S+R, https://sr.ithaka.org/publications/seven-practices-for-building-community-and-student-belonging-virtually/. [Accessed February 3, 2024].