



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

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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 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 HPE 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, 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 HPE's top customers, and helped many business units develop their value proposition and future direction.

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

You had me at undergraduate research: starting a successful research program

Abstract

This evidence-based practice paper will explore how a freshman and sophomore focused research program has produced positive results in terms of student engagement and student desire to pursue an engineering degree – while also addressing the hot topic of paying for college. Institutions work hard to recruit and attract students to their engineering programs, and want to do everything they can to engage and retain those students. First-year experiences and undergraduate research are both high impact practices (HIPs) [1] that can be extremely beneficial and rewarding to students from almost all backgrounds. The implementation of such HIPs for students in the form of co-curricular programming can be quite daunting and time-intensive. This paper will provide clear, concise information on how one institution not only created a very successful first-year/freshman (and sophomore) engagement experience that involved undergraduate research, but also paid students for their time in research labs, thus addressing two of the hottest topics today for students – the rising cost of obtaining a college degree and the astronomical level of student loan debt many students incur to earn an undergraduate degree.[2] Student and faculty impact of this program was exceptional, as measured by an anonymous online survey, and will be discussed in the final section.

Introduction

As institutions, we work hard to recruit and attract students to our engineering programs, and want to do everything we can to engage and retain those students. We want to help our students find a path, become self-motivated, and discover a pursuit that engages and excites them. We want our students to become leaders, and not just VPs and C-suite executives, but people who lead by creating positive work environments, who are not afraid to take risks, who are willing to try new things and who take the lead in solving difficult problems. Our goal at the most basic level is to help our students be successful, both in and out of the classroom. So, let's reel this in a bit before we promise you this paper will resolve world hunger - when we think about engaging our students and helping them find success, our thoughts often turn to high-impact educational practices or HIPs.

A little over ten years ago, the Association of American Colleges & Universities first published information on HIPs [1]; these practices are generally accepted as “best practices” in the academic world, and as we create new programs for our students we often look to HIPs to guide our efforts. Some HIPs such as collaborative assignments and common intellectual experiences are in place at most major colleges and universities, and implementable without a lot of cost or overhead. Undergraduate research is also a HIP, however, this practice is a bit more daunting to implement. How will faculty and undergraduate students be matched? How will we ensure first generation students and students from other under-represented groups (e.g. racial/ethnic minorities) will get an equal chance to participate in a research program? Will the undergraduate student's salary be paid by the faculty researchers, or by some other means? Do first-year undergraduates have enough knowledge to work in a research lab? In September 2019 an article

was published [3] describing how three institutions tackle the topic of undergraduate research by offering a series of three courses; does it really require this level of resources to create a successful undergraduate research program?

All of these questions are valid, and this paper will answer these questions and more as we take a look at how the Walter Scott, Jr. College of Engineering at Colorado State University (CSU) implemented a very successful undergraduate research program – the Scott Undergraduate Research Experience or SURE - in the spring of 2019. Spoiler alert: yes, you can put a successful and valuable undergraduate research program in place without offering a series of three course (not to diminish this approach, rather to confirm an undergraduate research program can take many different forms and still be very valuable to everyone involved.) CSU is an R1 land-grant institution, whereby faculty members have access to graduate as well as undergraduate students to work in research labs. This paper will describe the process used and resources required to initiate and run an undergraduate research program, and these artifacts should be scalable to an undergraduate-only institution as well. Details specific to adapting this process to an undergraduate-only institution will be noted in the Results and Discussion Section.

Project Approach

This section will cover five major areas to be considered when starting an undergraduate research program:

- Sponsorship
- Setting the goals & scope of the program (includes how goal attainment will be assessed)
- Budgeting: program expenses & funding
- Matching undergraduate research students with faculty
- Logistics & implementation

For each topic above (with the exception of the last topic) there will be two sections: one with a description of how to address the topic from a theoretical perspective, and one with the details of how the topic was implemented for the SURE program.

Sponsorship

Prior to starting any major project, sponsorship should be secured – this is true whether you are starting a project in industry or academia. “Sponsorship” is used in many contexts, and the exact type and level of sponsorship required depend on the project in question. Therefore, it is useful to define the key sponsorship roles required for an undergraduate research program.

Sponsorship – theoretical description

The theoretical description of the project sponsorship roles is shown in Table 1.

Table 1: Theoretical description of sponsorship roles

Role	Description
Strategic Champion	This person is high enough in the organization to ensure an undergraduate research program fits with and supports the college's strategic plan, and in a position to decide an undergraduate research program is a higher priority than other programs that could utilize the same funding. I doubt many people will disagree with the idea of starting an undergraduate research program; the big question – is such a program a higher priority than other initiatives the college/university could undertake to engage and retain students? And even if the answer to this question is yes, then the next question packs an equally big punch – do we have the funding and resources to implement such a program? This paper will talk more about how to estimate the funding and resources needed near the bottom of this section; for now, we simply want to focus on the need for a sponsor who is responsible for setting and influencing strategy, has a rough idea of the cost in terms of dollars and people resources, believes an undergraduate research program is high priority and should be pursued, and is willing to be an unwavering supporter for the program.
Program Champion	This person owns the actual creation and execution of the program. To be successful, the program champion should have an in-depth understanding of the steps required to create a new program – from defining the program vision and goals, to securing buy-in from the key players, to identifying the steps required to take the vision/goal and create an implementable plan. The program champion is responsible for communicating program details to both faculty and students, matching faculty and students, setting deadlines, developing requirements for expected outcomes, troubleshooting and resolving any issues, and conducting a survey at the end of the program to assess effectiveness.
Administrative Champion	This person needs to be familiar with the HR and payroll systems of the institution, and will be responsible for guiding the students through all applicable hiring steps (background check, I9 process/paperwork, time clock system initiation for each student, etc.) This person will provide support to students and faculty throughout the program.
Faculty Stakeholders	A group of faculty who will be willing to participate in and support an undergraduate research program in the initial year, especially if any funding will come directly from the faculty.

Sponsorship – SURE details

Descriptions of the actual sponsorship roles filled for the SURE program are shown in Table 2.

Table 2: Sponsorship roles filled to support the SURE program.

Role	Description
Strategic Champion	The Dean of Engineering served as the main strategic champion, with the Associate Dean of Academic and Student Affairs also serving in a supporting role. The Dean and Associate Dean provided sponsorship, as well as on-going guidance to the program and administrative champions.
Program Champion	This role was filled by a very new employee, so the Dean and the Associate Dean of Academic and Student Affairs offered continued guidance for the spring 2019 SURE program. The spring 2020 SURE program has started, and for this cycle, the program champion has been able to move forward with minimal guidance from the strategic champions.
Administrative Champion	The Assistant to the Dean filled the role of administrative champion; during the fall of 2018 and spring of 2019, this person also offered continual guidance to the program champion. Once again, with the second cohort of the program targeted for spring of 2020, the hope is for the program champion to require less guidance (sounds kind of like raising kids, doesn't it 😊)
Faculty Stakeholders	All undergraduate participants in SURE were funded by the Office of the Dean; due to this dynamic as well as the large population of faculty researchers at CSU, the faculty stakeholders did not need to be identified prior to starting the SURE program. In colleges with a smaller number of faculty researchers, and in instances where the faculty researchers will need to fund any undergraduate researchers assigned to them, identifying faculty stakeholders prior to starting the research program will be critical.

Setting the Goals & Scope of the Program

You have strong sponsorship for an undergraduate research program and believe you have the appropriate funding - now it is time to start diving into the goals and details. For those of you thinking, “shouldn't we have a *really* good handle on the budget before we dive into more details?” – I agree with your line of thinking. The goals/scope and the funding are like the chicken and the egg – which should come first? In my experience, you will oscillate between the two as you hone in on the final answer for each. You can start with the budget, then as you set the goals and scope, you will likely make budget adjustments; or, you can set the goals and scope first, then as you look at the budget (and it is never as big as you hope) you will need to adjust your goals and scope. The bottom line: this is an iterative process and for this paper I am simply going with personal preference and what I have found to work, starting with goals and scope.

Goals & Scope – theoretical description

While it would be wonderful to involve all faculty and undergraduate students in research, the realities of time and budgeting will most likely make this impractical. The following list of items should be considered and discussed as you start an undergraduate research program.

- 1) What goals do we hope to achieve, and how will the program effectiveness be assessed?
- 2) How many students do we want to support?
- 3) Which student populations will be supported/allowed to participate?
- 4) How will students be selected?
- 5) Will a formal application be required?
- 6) Will students need to have completed specific coursework in order to participate?
- 7) Will the students be paid to work in a lab? If so:
 - a) How will the students be funded?
 - b) How much will they be paid?
- 8) How many hours will the student be expected to work each week?
- 9) How long will the program last?
- 10) What are the expectations of:
 - a) The undergraduate student
 - b) The faculty researchers

Goals & scope – SURE details

The details from the SURE program conducted in the spring of 2019 will be used to describe how CSU ran their undergraduate research program in the first year, with a few notes added to describe how things are changing for the spring of 2020. The questions from the section above will be copied to this section for ease of reading and interpreting.

- 1) What goals do we hope to achieve, and how will the program effectiveness be assessed?
 - a) Goals for the SURE program:
 - i) Increased student engagement
 - ii) Increased student enthusiasm for studying engineering
 - iii) Strengthened connections between students and faculty
 - iv) Support for under-represented students, with a focus on first generation students
 - b) How program effectiveness was measured: At the end of the spring 2019 semester, a survey was administered to both SURE students and the faculty researchers/GRAs. How this survey was administered and a detailed analysis of the results are covered below in the “Results and Discussion” section.
- 2) How many students do we want to support?

For the SURE program, this parameter was determined by funding. In the spring of 2019 we funded 24 students, believing the funding available would only cover 24 students. After reviewing data from the spring of 2019, and receiving some additional funding, the program is moving forward in the spring of 2020, this time funding 44 students.
- 3) Which student populations will be supported/allowed to participate?

At CSU, first and second year students have the most trouble obtaining positions in a research lab, and we wanted to start having a positive impact on engineering students early in their college career. Therefore, freshman and sophomores who were either first generation students or part of the CSU Scott Scholars program (those receiving the Walter Scott, Jr. scholarship) were eligible to apply to the SURE program. This allowed us to keep the program focused and manageable, while also serving one of our key underrepresented populations.

4) How will students be selected?

Prior to creating an application for students interested in the SURE program, we had to decide how the students would be matched with research opportunities, so we could collect the appropriate information from students, including their major, research interests and any schedule constraints

5) Will a formal application be required?

Students are required to submit a brief application for the SURE program including: name, student ID, major, any previous work or research experience, resume (optional), which research opportunities they are most interested in pursuing (students are provided with a brief description of each open research position), a short description indicating why they are interested in participating in SURE, any scheduling constraints, and lastly, are they a part of the Scott Scholars, a first generation student, or both.

6) Will students need to have completed specific coursework in order to participate?

Students are not required to have completed specific coursework to participate in SURE. With that being said, some faculty members who participate in the program do request students who have already finished a specific chemistry or physics class, for example. For this reason, it has been very important for the program champion to have access to appropriate systems to check student transcripts.

7) Will the students be paid to work in a lab?

SURE students are paid for their time working in the research lab, including meetings and training related to their lab work.

- a) How will the students be funded? SURE funding comes from the Office of the Dean, and specifically from various alumni donors.
- b) How much will they be paid? SURE students are paid minimum wage, which is currently \$12 per hour.

8) How many hours will the student be expected to work each week?

SURE students can work from five to ten hours a week, and a maximum of 150 hours a semester, with the understanding that classwork is higher priority than research lab work.

9) How long will the program last?

Students who participate in SURE are paid via the SURE program for one semester. After this time, it is up to the student and their faculty mentor to determine if the student will

continue to work in the lab, and if so, whether or not they will be paid. If the student will be paid, it is the responsibility of the faculty mentor to find the funding source.

10) What are the expectations of:

- a) The undergraduate student: The student is required to work with HR to set up auto-deposit for the money earned through SURE, to reach out proactively to their faculty mentor to set goals and working hours, and to create a poster highlighting their work and what they learned at the end of the semester. All students who are available are also expected to participate in a poster fair.
- b) The faculty researchers: Faculty researchers are required to either work directly with the SURE student or assign a graduate research assistant (GRA) to mentor the SURE student. The faculty/GRA mentor needs to train the student, help set goals for the student, and provide guidance for the student. Faculty are also encouraged to attend the poster fair.

Budgeting: program expenses & funding

Budgeting – theoretical description

Item five of the previous section posed the key question, “will the students be paid to work in a lab?” Even if the answer to this question is no, there are still program costs to be considered. In looking at funding for an undergraduate research program, the primary budgeting notions of what needs to be paid for, and who will pay for each item need to be considered. Here is a basic list to consider when starting a research program:

- Expenses/required resources
 - Student wages – this is usually the main expense, assuming students are paid to participate in the research program. Most students realize the incredible benefit of research experience, and will often volunteer to work in a research lab, however volunteer students will often lose interest and/or prioritize other tasks ahead of volunteer lab work, so we do recommend paying research students.
 - Lab equipment – this could be as basic as protective eyewear and lab coats, and as expensive as outfitting a dedicated work station for the student researcher.
 - Training – students will need to be trained on everything from how to clock in and out, to safety procedures, to keeping a log book, to using specialized equipment in the lab, to research ethics. Most, if not all, of the required training may be viewed as not having a cost associated (see the next bullet on faculty and/or GRA time – nothing is free 😊), however it should be carefully considered to be sure a faculty and/or GRA mentor will have adequate time to train an undergraduate research student.
 - Faculty and/or GRA time – while you might not assign a dollar amount to this resource, the time needed to train and mentor the student needs to be considered.
- Income sources/program funding
 - If you do not intend to pay the undergraduate researchers an hourly wage, you may not need to give this topic much thought, at least not from a strictly financial perspective. As noted above, faculty and/or GRA time invested in the program should still be analyzed, as it is valuable resource.

- If you do plan to pay the undergraduate researchers, income sources could include: alumni donations, discretionary funds, industry donations, grants, bake sales (just checking to see if you are paying attention...), and any other sources you might typically use to fund department-wide programs

Budgeting – SURE details

The main financial expense for SURE is student salaries; lab equipment, training and mentoring time is covered by the faculty member sponsoring the undergraduate research student. Program funding for SURE is covered via alumni donations that are specifically directed to undergraduate research, and the Dean's Innovation Fund, which is supported by many alumni and partners who wish to support the development of CSU engineering students. Now that SURE is in its second year, the development team for the college of engineering at CSU actively markets this donation opportunity to alumni: a \$2,000 donation from an alumnus could provide a direct scholarship for a student, or could be used to fund a student in a research lab, where the student will still get the financial benefit of the donation through the wages they earn, and they will also greatly benefit from the faculty mentoring and hands-on experience. Since 2014, the Strada-Gallup Alumni Survey (previously the Gallup-Purdue Index) has shown the strong link between students and faculty mentoring, including greater academic achievement, career development and positive long-term outcomes after college. The 2018 version of this report [4] takes an in-depth look at the importance of these mentoring relationships.

Matching Undergraduate Research Students with Faculty

At CSU, there have always been undergraduate students who want to work in research labs, and there has been no lack of faculty researchers willing to hire undergraduate students. The problem is not one of lack of interest, but rather one simply of matching; simple in theory, yet both students and faculty struggle to find their match. Enter the SURE program – the eHarmony of the research world.

Matching – theoretical description

There is no rocket science involved here; for an undergraduate research program the goal is simply to match faculty researchers with undergraduate students interested in their research. From a high level, the main question to consider is, “what criteria do we want to use when matching students and faculty?” Possible areas to consider include student major, coursework completed, number of years the student has completed in the engineering program, student stated interest and if it aligns closely enough with research goals, whether the student has financial need, and whether the student is part of a predefined group - for example: a student organization like SWE or IEEE, recipient of specific scholarship, part of an underrepresented group, etc.

Once you determine how you are going to match students and faculty researchers, be sure to include appropriate questions in the applications for both students and faculty to ensure adequate information is collected.

Matching – SURE details

As described in the “Goals and scope” section above, the following information is collected from each SURE student: name, student ID, major, any previous work or research experience, resume (optional), which research opportunities they are most interested in pursuing (students are provided with a brief description of each open research position), a short description indicating why they are interested in participating in SURE, any scheduling constraints, and lastly, are they a part of the Scott Scholars, a first generation student, or both.

The information gathered from each faculty member requesting to participate in the SURE program is as follows: the type of activities or projects proposed for the student work on, required major, completed coursework and skills, work location and any scheduling constraints on work hours, and preferences for working with a student who is part of the Scott Scholars program, a first generation student or no preference.

The program champion requests applications from all interested and qualified students, as well as all faculty researchers, placing all data in a spreadsheet. Students are then matched with faculty researchers, based roughly on the following items, shown in priority order: interest match, major match, coursework and skills match, scheduling constraints. Matching is an iterative process, with the goal being the best possible match between student and faculty. Once the initial matching phase is complete, student matches are reviewed with faculty, any required adjustments made, and matches are then communicated via personalized email to each student/faculty pair

Logistics & implementation

There are countless ways an undergraduate research program could be run, with many different people in various positions taking on tasks. As such, a “theoretical” description of running an undergraduate research program could fill many pages, and be of little value, to be completely honest. Therefore, this section will only cover the main elements of the SURE program, who covers each element, and the approximate time involved; this information is summarized in Table 3 below. This table assumes sponsorship, goals and scope, and funding for the research program have been established. Note that all work elements in the table below were used (or will be used) for both the spring 2019 and spring 2020 SURE programs with the exception of the matching fair, which was introduced for the first time with the spring 2020 SURE program.

Table 3. Major work elements of the SURE program

Work Element	Description	Owner (O:) & Participants (P:)	Approximate Time Commitment
Recruit faculty participants	Develop, administer and collect responses to faculty application	O: Program champion O: Strategic champion P: Interested faculty	O: 8-10 hours for program champion to develop application, collect responses, answer questions, and place all data in a spreadsheet O: 1-2 hours for strategic champion to create and send application email, then answer questions P: up to 2 hours, depending on time spent discussing the application with their research team prior to submittal
Matching fair	Each faculty member wishing to host a SURE student is available to speak with students interested in participating in the SURE program	O: Program Champion P: Prospective SURE faculty researchers and students	O: 2-3 hours to coordinate, send out email notices, attend fair P: 1.5-3 hours for faculty to prepare and attend fair; 1.5 hours for students to attend fair
Recruit student participants	Develop, administer and collect responses to student application	O: Program Champion P: Prospective SURE students	O: 10-12 hours to create survey, mail to prospective students (including collecting email addresses), answer questions, and place all data in a spreadsheet P: 1 hour, assuming student does not take extra time to create a resume (which is an optional part of the SURE application)
Match students and faculty	Utilizing spreadsheets summarizing faculty and student applications, match faculty and students (this step definitely requires some patience and caffeine)	O: Program Champion P: Strategic champion, and potentially the prospective SURE faculty and students	O: 10 – 15 hours, depending on the number of students who apply and how well the student applicants match the requirements of the prospective faculty P: 1-2 hours for the strategic champion to consult with the program champion and review matches; a variable amount of time is required from the prospective faculty and students as the program champion asks them clarifying questions throughout the matching process
SURE program kickoff	After the matching is complete, all matched students and faculty attend a 1-hour kickoff	O: Program champion O: Administrative champion P: Strategic champion, SURE faculty and students, administrative champion	O: 3-4 hours for the program champion to schedule, prepare for and facilitate the kickoff meeting O: 1 hour for the administrative champion to prepare for the kickoff meeting P: 1 hour to attend the kickoff meeting

Student HR paperwork	There is always paperwork!	O: Administrative champion P: SURE students	O: 10-12 hours to initiate all paperwork, meet with students, answer questions, troubleshoot any issues P: up to an hour to fill out paperwork and get setup on appropriate systems so they can log hours and be paid
Onboarding of student in lab	SURE faculty and/or a GRA train the student to be productive and safe in the lab	O: SURE Faculty and/or a GRA(s) P: SURE student	O and P: highly variable depending on the lab and SURE student assignment
Ongoing student and faculty correspondence	This correspondence could be related to many things including schedule, research goals, research meetings, lab protocol, etc.	O: SURE faculty and student	O: variable
Poster fair preparation	SURE students are required to participate in a poster fair at the end of the semester	O: Program Champion O: SURE students P: SURE faculty and/or GRA	O: 4-6 hours to set fair date/time/location, create poster template, hold a poster making workshop, communicate poster fair details and expectations, and answer any questions O: variable number of hours for SURE students to create poster, review poster with SURE faculty and/or GRA, and print poster P: variable – depends on advising and review time required by student
Poster fair event	This event is held at the end of the semester, and provides an opportunity for students to showcase their work, and for program donors to view the return on their investment	O: Program Champion P: Strategic Champion, SURE students/faculty/GRAs, CSU faculty and students, SURE program donors	O: 6-8 hours to coordinate details with an event coordinator (display boards, food, name tags, etc.), communicate with attendees, and attend event P: 1-2 hour for all attendees, plus extra time for SURE students to prepare
Program survey preparation	Develop the survey questions	O: Program champion	O: 2-3 hours to develop a draft, review, edit and iterate as needed
Program survey execution	Post the survey	O: IT representative	O: 2-3 hours to post, test, edit and iterate as needed
Program survey results compilation and presentation	This includes the initial summary of the raw data from the survey, as well as the compilation to create charts and explain results	O: IT representative O: Program champion	O: 1-2 hours for IT representative to summarize results and spot check for any anomalies O: 4-6 hours to summarize data, and a variable number of hours to communicate results depending on forums for communication (faculty meetings, advisory boards, etc.)

Results and Discussion

The SURE program was run in the spring of 2019, with 24 students matched with faculty researchers. Of the 24 students, 23 created posters and 22 participated in the poster fair. The exact number of SURE faculty/GRAs who attended the poster fair was not tracked.

To measure the success of the SURE program two surveys were created: one for SURE students and one for SURE faculty/GRAs. The student survey was completed by 21 of 24 SURE student participants. The faculty/GRA survey was completed by 11 people; we did not track if each respondent was a member of faculty or a GRA. The surveys were created and administered via Survey Monkey by an IT representative at CSU, and all results were anonymous. Given the high response rate (87.5%) of the student survey, the results can be considered to be statistically significant. With the rather low response rate (45.8%) for the faculty/GRA survey, these results cannot be considered statistically significant, and thus less time will be devoted to these results.

The first section below, “Summary of student and faculty survey results” contains eight figures with direct survey results: figures one through six depict student survey results, with figures seven and eight depicting faculty/GRA survey results. The second section below, “Discussion and future work,” contains observations about the eight figures, and explores how the SURE program can and will be improved in the future.

Summary of student & faculty survey results

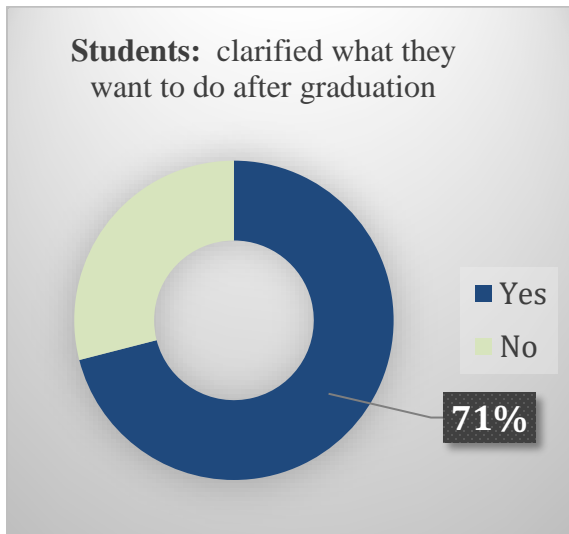


Figure 1: % of students who feel the SURE program helped them clarify what they want to do after graduation

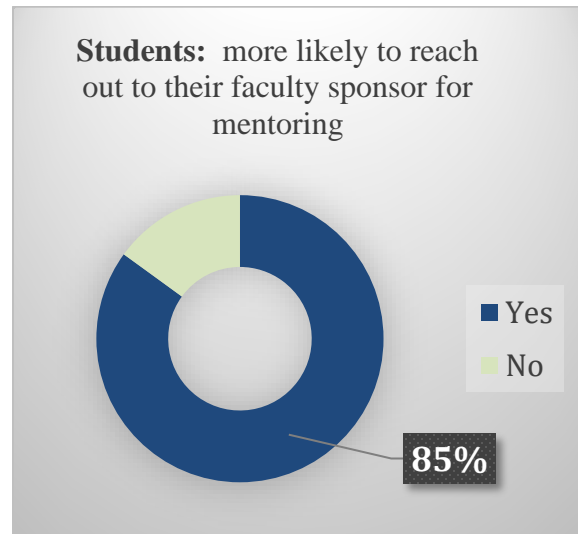


Figure 2: % of students who will be more likely to request mentoring from their faculty sponsor in the future

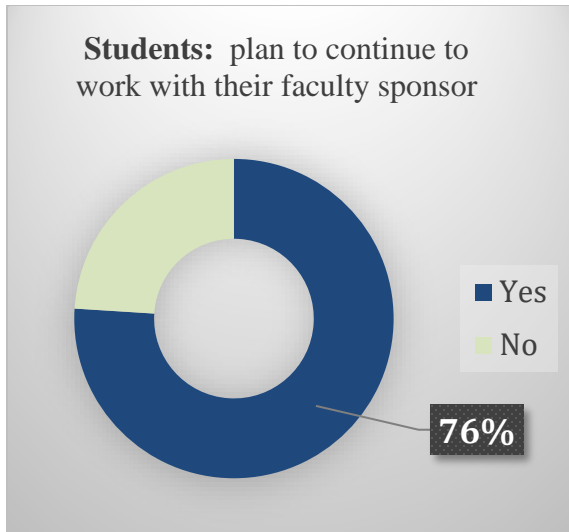


Figure 3: % of students who plan to continue to work with their SURE faculty sponsor after the SURE program ends

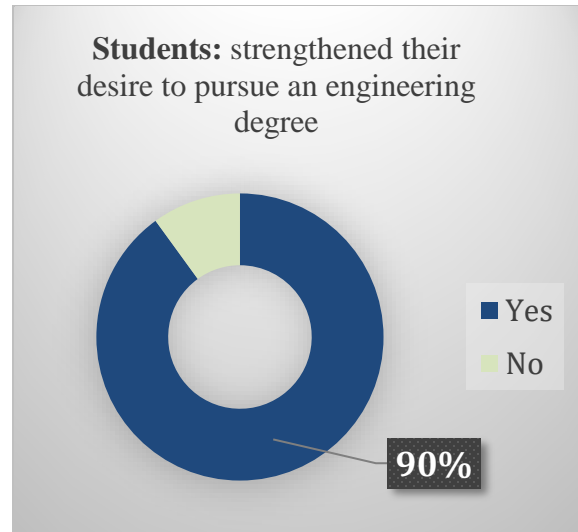


Figure 4: % of students who have strengthened their desire to pursue an engineering degree as a result of participating in the SURE program

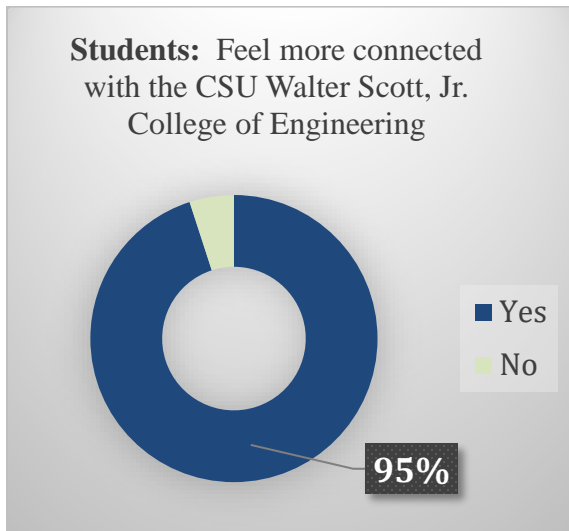


Figure 5: % of students who feel more connected with the CSU Walter Scott, Jr. College of Engineering after participating in SURE

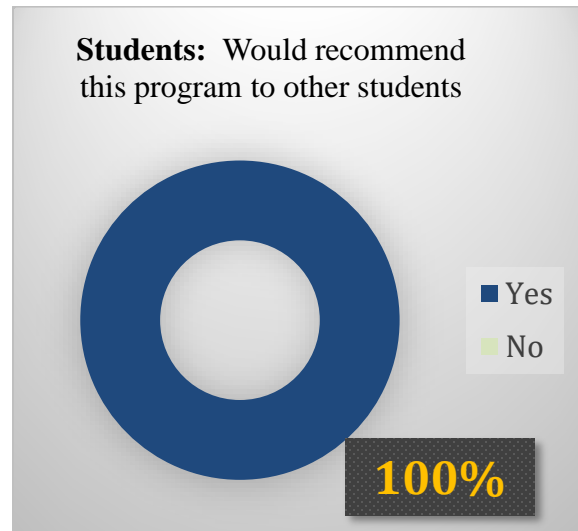


Figure 6: % of students who would recommend SURE to their fellow students

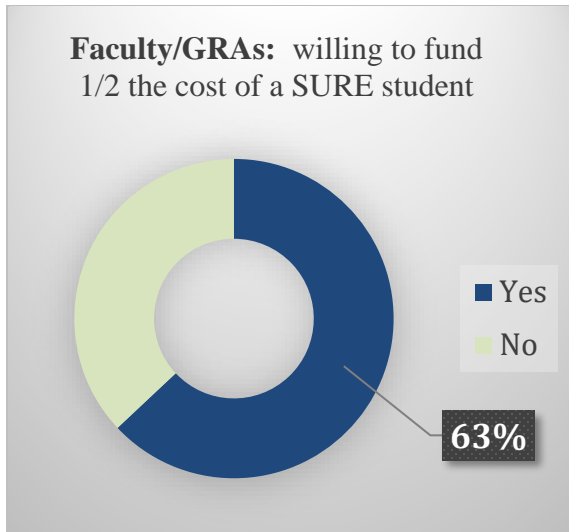


Figure 7: % of faculty/GRAs who would be willing to fund half the cost of a SURE student in the future

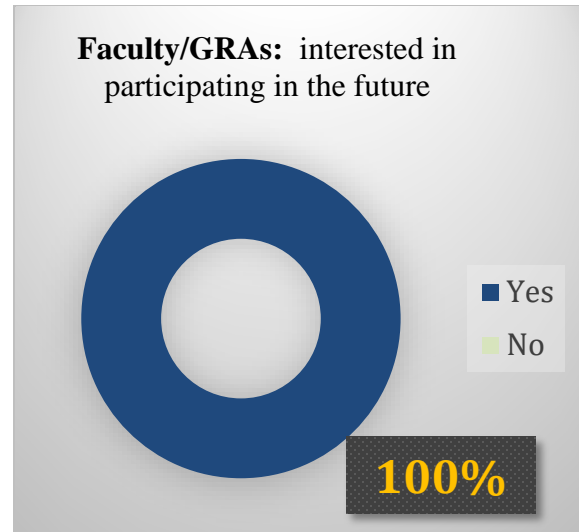


Figure 8: % of faculty/GRAs who are interested in participating in the SURE program in the future

Discussion and future work

Considering the eight figures above:

The SURE program bore out the improved student engagement one would expect from implementing a HIP (high impact practice.) With 90% or more of student respondents indicating they have strengthened their desire to pursue an engineering degree, feel more connected to CSU Walter Scott, Jr. College of Engineering, and would recommend the SURE program to their fellow students, CSU has designated SURE as a high priority program to continue to fund in future years. While faculty input was not statistically significant, results did show a strong interest in continued participation in the SURE program, with some faculty even willing to foot part of the bill for their SURE student in the future.

Additional observations:

While many students are willing to volunteer in research labs in order to get experience, by paying the students for their research hours, SURE is helping students chip away at the high cost of college and reducing their student loan burden. SURE students were allowed to work five to ten hours per week, for a total of 75 to 150 hours for the spring 2019 semester. At a wage of \$12 per hour, this works out to be \$900 to \$1,800. Donors may be more inclined to provide \$1,800 to pay for a student to work in a research lab, versus simply donating \$1,800 for a scholarship. Financially, the result is the same – the donor pays \$1,800 and the student receives \$1,800; however if a donor funds a student working in a lab, the student not only receives the \$1,800, they also will be more likely to become more deeply engaged with their college and more likely to be successful in completing their degree.

The end-of-semester poster fair allows students to practice their communication skills and reflect on the many benefits of participating in a research program, while also providing the donors a detailed view of the benefits to the students, faculty and CSU of sponsoring undergraduate

research. An article in the August 30, 2019 edition of the Wall Street Journal [5] noted employers hiring college grads are looking for communication and teamwork skills even more than technical and computer skills, according to a study released in late 2018 by the National Association of Colleges and Employers. While students do need to take this with a grain of salt – a company looking to hire a mechanical engineer will not hire a psychology major with good communication skills – they also need to be mindful that good communication skills could make the difference for them in landing a desirable position.

A few thoughts for undergraduate-only institutions:

Schools who don't have the luxury of utilizing graduate students to help support an undergraduate research program will find the complete burden of training and mentoring research students falling on the faculty researchers, which would take time away from teaching and research activities. Thus, the time commitment of these faculty members needs to be seriously considered before embarking on the journey to create an undergraduate research program. At such institutions, faculty may be involved in projects that are not technically considered to be research, however it is still very valuable scholarship work, and a student could still be hired to assist with the work. Both the faculty and the student would reap many of the benefits discussed in this paper.

As can be seen in Table 3 above, much of the coordination, communication, strategy, goal setting, and execution of an undergraduate research program can be done by a program champion, thus relieving faculty of these tasks. And, a program champion can help faculty overcome the time-consuming task of actually finding a student interested in their research work. This would hold true for both an R1 university where students are placed in research labs, as well as an undergraduate-only institutions where students may be placed in research labs or in other positions to assist with faculty scholarship.

Future work

In some ways, the future is already here for the SURE program at CSU University. The spring 2020 SURE program has begun, and many changes have been implemented when compared with the 2019 SURE program. To start, prospective SURE students were allowed to give input on their first, second and third research lab position choices; this required the addition of a matching fair, which was not part of the spring 2019 SURE process. Once SURE students and faculty were matched, faculty were allowed to give input prior to communicating the matches to the students; this did not take place for timing reasons with the spring 2019 SURE program. Lastly, matches were made prior to winter break so students could complete paperwork prior to the break, and start working with their assigned faculty member immediately after the break.

As the spring 2020 SURE program progresses, we still have additional improvements we hope to make. Finding incentives for faculty/GRAs to complete the SURE survey so we have a better picture of whether we are meeting our end goals with faculty/GRAs is a priority. We also plan to collect faculty and GRA survey inputs separately in order to spot any trends and/or issues. In the coming years we would like to expand the SURE program to other populations of engineering students.

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