

Paid STEM Core Internships: Impacting Skillsets and Career Trajectories for Community College STEM Students

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Internships are a crucial milestone for college students in which their technical skills, career pathways, and STEM aspirations are molded. Employers have come to expect that students will enter the workforce with relevant experiences and an understanding of the field. However, community college students are more likely to face unique barriers that hinder their participation in an internship throughout their academic career. Whether the challenges are socioeconomic, social or a general lack of opportunities, community college students are 22% less likely than their 4-year university counterparts to participate in a virtual or in-person internship; 42% Community College interns vs. 64% 4-year University interns. (Ezarik, n.d.). This deficit in experiential learning opportunities for community college STEM students hinders the persistence of students in tech and engineering.

In considering undergraduate internship candidate trends, community college students are much less likely to earn college credit or be paid for internship experiences compared to students currently attending 4-year Universities- 42% vs 71%. (Ezarik, n.d.) Many major employers don't accept applicants from community colleges for engineering roles - prefer to expend resources on individuals closer to BS degree achievement. Growth Sector and college partners implementing the STEM Core Program work actively to expand impactful internships to often overlooked community college engineering students.

Early access to internships and hands-on experiences can have a significant impact on students' technical skills, persistence to BS degrees (Graham, 2023), post-graduation income (Bolli, 2021) and confidence in STEM. Early interventions and the creation of internship opportunities in which students can gain technical experience and generate income is pivotal to impacting longer-term outcomes including BS degree achievement and full-time STEM employment. To further address the barriers faced by students, Growth Sector, backbone organization for the National Science Foundation INCLUDES Alliance for STEM Core Expansion (#1834628), developed *paid* internships to provide skills, mentorship and career exposure for community college STEM students nationally. NSF, recognizing the impact of work experience, continues to emphasize paid internships as a tool for broadening participation in engineering through multiple programs including the new Experiential Learning for Emerging and Novel Technologies (EXLENT) program which invested \$18.8 million in the program's inaugural cohort, (*NSF Invests \$18.8M in Inaugural Cohort of ExLENT Projects*, n.d.) To this end, during summer 2023, Growth Sector worked with industry partners and educational institutions in four states to subsidize 160 internships for community college students.

These structured and supported internships consisted of the following best practices:

Financial Support

- **Stipends** of at least \$7,000 were provided to participants. Partners recognize that finances are a major barrier to persistence in STEM undergraduate pathways, and many low-income/first-generation students work simultaneously while attending school. Students need a competitive financial incentive to mirror top internships in the field.
- **Leveraging funds to pay for internship positions** prioritized for STEM Core students. Growth Sector utilized funds from NSF INCLUDES, Department of Defense, Department of Energy, Philanthropic dollars, State Community College funds to pay students for internships.

Early Interventions and Support

- **Internship and Employer Development Series** developed and delivered throughout the academic year to students in order to break down myths and misconceptions about the internship process. This early exposure to employers allows students to gain understanding of high-level careers in STEM, as well as visualizing themselves in those roles and seeing a realistic pathway
- **Summer Bridge programs** as an opportunity to further participation and preparedness for internships. Many of STEM Core (SC) Summer 2023 interns were educated on the importance of internships and exposed to the SC internship process, since their Summer Bridge in 2022. This intervention led to a large number of applicants and subsequent intern placements through participant retention and overall confidence/resilience
- **Employers and high-level partners understand the needs of CC students.** Partners are sought out for their understanding of barriers to success and their work towards providing opportunities for students. Employer partners are invested in the success of participants engaging in early mentorship, exposure to industry, then leading to internship hosts.
- **Wraparound Support for Summer Interns.** Throughout the summer interns checked in regularly with GS staff as an added support and proactive practice.

Employer Relations

- **Providing local University research experiences** as a tool to not only provide students with a structured technical/research experience but also explore transfer pathways.
- **Exploring research placement at national labs.** Exploring an informal apprenticeship in which students return for multiple paid internships (even sometimes PT work during academic year) while they complete their degree.

Through this paper, best practices from the STEM Core Expansion Alliance can be shared to enhance opportunities to engage and prepare students for competitive STEM pathways via paid summer internships.

Financial Support

Recognizing that community college program participants are overwhelmingly low-income, Growth Sector's commitment to STEM student success and access begins with ensuring

compensation for work-based learning opportunities. STEM Core students receiving stipends for their program commitments is a priority. To begin, Summer Bridge participants are awarded \$1500-\$1800 for 4-6 week programming, where as interns are stipended \$7-10k for ten week placements. Students are paid a stipend for participation and to aid in alleviating financial circumstances, which can create a barrier to student participation (Busser & Others, 1992). Furthermore, to be truly reflective of the community, participants are recruited from feeder high schools, local community-based organizations and current community college patrons.

Stipends are the most expensive component of the STEM Core program and are developed in various manners. The simplest form is securing grants that support the STEM Core including funding for internship stipends. Unsubsidized, employer-funded internships are also common- especially for STEM Core students with more experience and closer to transfer to 4-year university. Some STEM Core students have been able to access federal or state workforce funding to subsidize their internship including the federal Workforce Investment Opportunity Act (WIOA) and California's Learning-Aligned Employment Program. Additionally, Growth Sector also raises unrestricted philanthropic funds that go towards STEM Core student internship stipends.

Summer Bridge Programs providing Technical Skills/ Hands- On Experiences

The majority of STEM Core participants enter the program with the STEM Core Summer Bridge as their introduction. 64% of STEM Core Bridge participants identify as first generation and begin college with little to no experience. Growth Sector believes a holistic approach is necessary to fill the gaps many have experienced in terms of skill and knowledge (Ezarik, M. 2022). The STEM Core Summer Bridge Programs, before students have even begun fall credited courses, are the first opportunity for community colleges to promote and prepare students for early internship opportunities. The 4–6 week programs not only provide a math refresher, but also relevant hands-on projects infusing technical skills development into the experience. Growth Sector partners with faculty (Community College and 4-year), national labs and industry leaders to create and implement the hands-on projects that are documented on students' resumes. Students also learn how to work in groups, produce deliverables and hone their presentation skills. Growth Sector identifies three potential partners to linking students to real world applications and essential hands-on skills during Summer Bridge:

- 1. *ORISE Summer Projects***
- 2. *Industry Projects***
- 3. *Research/4-Year Projects***

ORISE Summer Projects

Oak Ridge Institute for Science Education (ORISE), based at Oak Ridge National Laboratory, was contracted to develop 5 two-week modules for Summer Bridge sites to incorporate the hands-on STEM project experience. Hands-on projects are based on research

and work happening at partner national laboratories and include engineering graphics, 3D printing, introductory-level computer programming, and cybersecurity simulations. The projects are also contextualized for students to help real world issues and are approachable for students who have no experience in the topic. Lastly, each module encourages facilitators to share resources and career pathways available at the national labs in these areas. This approach helps ensure that students connect a career with the projects and skills they are gaining. ORISE, in addition to developing the modules, also works with Growth Sector to facilitate training community college faculty on the modules and how to adapt to their students.

2023 Summer Bridge Site ORISE Example

Summer Bridge Site	Hands-On Projects	Technical Skills Listed on Students Resumes
Forsyth Technical Community College, NC	Additive Manufacturing ORISE Module	• 3D Design/Printing • Machine Repair • Functionality Testing

Industry Projects

Project-based learning and collaborating with strong industry leaders is a proven way to connect students with relevant projects and skills they can leverage (Kirschenman & Brenner 2011). In summer 2023, for instance, two Cisco employees delivered Network Essentials and Cybersecurity Certificate Courses to Summer Bridge students at San Jose City College and Evergreen Valley College. This interaction directly resulted in increased interest and successful preparation for Cisco internships and jobs in Summer 2024. In the months leading up to both programs ‘Cisconians’ worked with Growth Sector and the partnering institutions to create relevant and exciting lessons for participants. Furthermore, Growth Sector and Cisco took the opportunity to expose students to their internship processes and demystify the application process.

2023 Summer Bridge Site Industry Example

Summer Bridge Site	Hands-On Projects	Technical Skills Listed on Resumes
San Jose City College, CA	Cisco led projects Cyber Security, Data Science & IoT and Digital Transformation	• Programming • Python • Cryptography • Cyber Defense • Analysis

Research/4-Year Projects

Partnerships between community colleges and 4-year institutions can provide students with a seamless pathway to achieving their academic and career goals. Research internships are a great option for students especially as they build their resumes and interests. Additionally, “the transfer pathways between 2 and 4-year institutions play a critical role in growing a bigger and more diverse domestic STEM workforce (National Science Board, 2015). Growth Sector recognizes a great opportunity to demonstrate these partnerships and transfer pathways by encouraging 4-years institutions to partner with community colleges on Bridge projects. The projects not only demonstrate the caliber of research at their institutions, but also connect students to faculty. During Summer 2023 this potential was demonstrated by the partnership between University of Colorado Boulder and the Colorado Space Grant Consortium, as they aided in Bridge projects at Community College of Aurora and Community College of Denver. At both sites students completed a 6 week NASA Rover Project created by the UC Boulder and the Colorado Space Grant Consortium in order for students to learn the engineering challenges of operating a robot on Mars from Earth.

2023 Summer Bridge Site Research Example

Summer Bridge Site	Hands-On Projects	Technical Skills Listed on Resumes
Community College of Aurora, CO	NASA Rover Project created by the University of Colorado Boulder and the Colorado Space Grant Consortium	● Basic Motion/Obstacle Avoidance ● Navigation ● Arduino board and software ● Basics of soldering ● Sensors

Bridge Projects Impacting Sense of Belonging

The holistic approach to these interventions are designed specifically to impact students' ability to see themselves persisting in tech and engineering. The hands-on projects and direct exposure to researchers and practitioners helps “buffer against feelings of low sense of belonging, isolation, and alienation in competitive STEM majors” (Sax et al., 2018). STEM Core students matriculate from Summer Bridge to Fall credited courses as a cohort, helping provide a community of resources and caring for students nationally. Additionally, Bridge sites set up industry and research speakers that help “enhance mentoring and persistence” (K.A., 2022) in students. Most STEM Core students enter college with no professional connections or networks within STEM. Providing students with a chance to learn and ask questions helps students see a route to their career goals. Guest speakers are also a pillar of STEM Core programming during

the academic year as well as the summer, teaching students the importance of fostering professional relationships and networking.

In an effort to aid students' development of STEM belonging and better prepare students for the STEM Core Internship process, Growth Sector staff also work with sites to present to students on the importance of internships and demystifying the internship process. Whether virtual or in-person, summer participants are encouraged to seek an internship and made aware of what experiences will contribute to successful placement (course completion, hands-on projects, work experience). Staff also spend significant time, during Bridge and academic year, helping students articulate their Bridge experiences and academic coursework to their resume. This early exposure of students to future internships aided in retention rates- 87% of students who participated in Summer Bridge 2023 remained with the STEM Core program on their campus during Spring 2024.

Qualitative Data Results

Growth Sector collaborated with a research and evaluation consultant, to create pre and post surveys for participants. Leading up to the summer, the Growth Sector team worked with the consultant to create surveys that would help capture the Bridge student experience and growth. Students provided helpful insights into areas such as STEM confidence, overall impact of their program and campus support. Below are testimonials from student surveys on how their experiences in Bridge have impacted their career knowledge and pathway.

“The Bridge program has helped me grow by giving me a support system that I had never had before. The counselors are welcoming and encourage you as an individual not just as a group. I feel that I now have access to resources that will help me get to the places I want to go.”

“Engaging in the summer program has facilitated my unexpected personal and educational growth, leading me to attain success and a heightened sense of self-assurance. Earning a certificate in the STEM program furthers my achievements.”

“The IoT was my most favorite hands-on activity because I learned a new skill which motivated me to want to learn more. The cybersecurity project was also my favorite because it made me realize that I am going in the right direction in my career path and that I will also have fun with my career. I really do feel more connected with my major.”

By providing students with a paid opportunity to gain hands-on skills, surveys showed students had increased their confidence in themselves and how they view the STEM field.

Internship Preparation: Virtual Employer, internship development series

As students transition from summer programming into the academic year, Growth Sector has identified one of the key best practices to supported and successful community college internships to include mentorship and engagement with internship host early in the pathway. The importance of STEM Core employers to engage with students (and vice versa) is necessary to showcase student skillset, desire to learn and professionalism. Similarly, a recent survey of employers showed that employers have favorable views of CTE (career and technical education) students and they value job-specific skills over degrees. 77% of STEM employers reported hiring employees due to their CTE experience (To, n.d.) which further displays Growth Sector's internship processes as an imperative component to meeting the employment needs of students, simultaneously meeting hiring needs of STEM employers.

The implementation of the STEM Core Virtual Employer Speaker Series is an opportunity for students to engage with employers, meanwhile encouraging students to see themselves in high level STEM industry/research placements. "Research has shown that a student's development of scientific identity (i.e., considering oneself a scientist) improves academic performance, retention and persistence in STEM, and STEM degree completion" (Maton et al., 2016). With this concept in mind, Growth Sector offers weekly discussions where students get an overview of potential employers. Companies (STEM Core Employer partners) share their mission and vision, speakers outline their educational and career path, give an overview of necessary skills for incoming interns, and feature recent STEM Core interns. GS has identified the speaker series in order to assist students in developing their STEM identity/confidence, and begin preparing them for high-level, internship and research placements.

The typical format is a 60-minute scheduled block including:

- Company Overview
- Staff Career Path
- Highlight Projects
- Internship Overview (skills, intern projects/involvement)
- Intern Alum Advice
- Ways to get involved
- 15min Student led Q &A

Exposure to the different companies and sectors allows students to learn about an array of previously unknown employers and career pathways. The STEM Core Virtual Employer Speaker Series further displays that connecting students to relatable STEM role models help students further engage, meanwhile showing them what they can achieve in the near future. (*The Power of STEM Role Models* | *National Inventors Hall of Fame®*, n.d.). Many of the talks feature previous STEM Core students who participated in the previous summer's internship allowing

them to share their experience with the new cohorts of students. Hearing from STEM Core participants who were in the same position less than a year ago (in most cases) give students an opportunity to learn about the day-to-day schedules of student interns, opportunities for growth and skill development, and making the entire process feel more approachable.

The lineup of speakers includes upcoming internship hosts and partners from National Labs (Berkeley National Lab, Livermore National Lab), Engineering Companies (Caltrans, Stryker) and Partner University Research i.e. CSULA SMART program. The employer speaker series remains a popular and well attended virtual opportunity for both new and returning students to engage with employer partners and future internship hosts. Additionally, all sessions are recorded and added to the resource library on the STEM Core YouTube Channel, giving students the opportunity to rewatch or catch up on missed sessions.

In order to prepare students for internship placement, Growth Sector and STEM Core colleges provide intentional support from beginning to end of students' duration in the STEM Core. In addition to employer engagement, the offering of the STEM Core Internship Development series is a very targeted way to continue to develop STEM Core participants for high-level research and internship placements. In order for students to have the capital (not only academically), to feel confident interviewing and entering into professional STEM settings, the development series is implemented to ensure students can enter these spaces confident and competitively. The series features multiple résumé workshops, LinkedIn overview and profile assistance, alumni student intern focused panel discussions, training on effective communication, resilience/confidence and STEM identity. Additionally, in response to the need of our first-year students, Growth Sector offers STEM Core resume support in the form of 1-on-1 consults to help students build strong STEM resumes.

Internship Placement Process:

As the program works to support and prepare students for industry research/internships, Growth Sector also hosts a formal internship application process for all interested participants. While GS works with partner employers to setup opportunities (remote and in person) the STEM Core Network wide internship application is a required first step for all STEM Core sponsored internships. GS has also created a comprehensive student facing video overview of the entire Internship Application Process. Following student submissions, GS conducts brief interviews with applicants prior to submitting candidates to employer partners for consideration. 1st round interviews are 1on1 (GS Staff: student) to get a better idea of student interest/qualifications for best internship placements in addition to giving immediate student feedback on resumes and interview techniques. Students are informed throughout their time in the program that internships are not guaranteed and are still competitive. Selected candidates are then moved on to "Round 2 interviews" directly with the internship host site. Additionally, Growth Sector focuses on best practices by equipping campus partners/students with resources to help prepare application

materials, in addition to 1on1s with campus staff to ensure students are being advised appropriately.

Resources for STEM Core Internships include:

- STEM Core Internship Overview Video & Internship Flier
- FAQ
- STEM Resume Workshop Recording & Resume Resources
- Application Timeline
- Employer Speaker Series & Internship Development Workshop Fliers

At the close of the summer 2023 placement process, Growth Sector successfully placed 160 STEM Core internships at 22 partner sites including:

- Sandia National Lab
- Lockheed Martin
- SLAC National Accelerator Laboratory
- Lawrence Berkeley National Lab
- Lawrence Livermore National Lab
- NASA Goddard
- National Renewable Energy Lab
- Stryker
- Glidewell
- California Department of Transportation (CalTrans)
- California State University Los Angeles
- San Jose State University
- University of New Mexico
- University of Colorado Boulder
- University of Colorado Denver
- Santa Clara University's Frugal Innovation Hub
- Bloom Energy
- Tesla
- Veev
- Arccus
- Growthsphere.Ai
- Kwanzoo

With the success and feedback on STEM Core participant internship placements from employers, Growth Sector continues to work on increased partnerships to create increased opportunities for community college students in STEM.

Employers (and high-level partners) understanding the needs of CC students

Many employers in the technology sector are unfamiliar with hosting engineering and computer science majors from community colleges for internships. Many tech companies, after

all, rely on “University Relations” staff to develop awareness for, and recruit to, their open undergraduate internship positions. As JFF concluded, many employers hosting community college students for internships were unable to assess interns’ level of proficiency with technology in general, (Joy, 2022). In their study, JFF cited employers’ struggle to structure challenge and rigor into the internship’s relatively short time frame. Additionally, they noted, community college students are generally diverse and employers don’t have adequate DEI framework to support students from “populations that are underrepresented in technology”, (Joy, 2022). Growth Sector and the STEM Core Network have developed impactful relationships with various engineering and technology employers who lacked experience working directly with community college students. While many of these employers had the best of intentions on supporting community college students in their educational and career goals, many are unaware at some of the differences between the traditional undergraduate engineering or computer science intern (much closer to B.S. degree achievement, more technical coursework completed, more knowledge of transit/housing options). Thus, Growth Sector and the STEM Core Network have developed the following program components in order to increase awareness on behalf of employers of the needs of community college students.

Internship Eligibility Standard

One key development was the establishment of a standard level of skills needed or courses completed for eligibility into internships across all STEM Core internship hosts and regions. While many STEM Core internship hosts prefer students with more skills, all partners agreed to the following requirements for internship eligibility:

- Studying Engineering or Computer Science
- Completed Math to- or through Calculus 1
- Complete STEM Core Internship Application and Round 1 Interview
- In good standing with STEM Core Program (Attendance, Communication, etc.)

By maintaining this eligibility standard, the notion can be reinforced with students in the STEM Core as early as during Summer Bridge (prior to credited courses, even) that in order to participate in a paid internship they must be successful in courses and with the program during the academic year. Since the eligibility requirements for internships align with transfer requirements, this model builds the mindset that internships are a crucial, income-generating component of a path to transfer for community college STEM students.

Establishing Transportation and Housing

In contrast to many students from 4-year universities, community college students often attend college very close to home. This often results in community college students not even applying for internships outside of their home region. In order to increase participation in national internship opportunities with private-sector employers, national labs and NASA Centers, and Universities, potential interns must know that housing and transportation will be secured.

Growth Sector has developed the following best practices for students interning outside of their home region.

First is the provision of \$1,500-\$3,000 extra in internship stipend for housing. This stipend is provided upfront (not as part of the internship stipend throughout the summer) so that interns can secure accommodations local to their internship location

Additionally, Growth Sector is sometimes able to leverage funds from various sources to cover housing and transit. This is especially helpful in allowing a STEM Core student to access an internship that may already have the actual stipend, but not extra for housing. This includes internships at NASA Centers, Federal Energy Labs, and 4-year University REU's.

GS also works directly with internship hosts to secure housing. Many of the federal energy labs bring in hundreds of interns per summer and so have dedicated Facebook Pages focused on matching interns with roommates and hosts. University-based REU's sometimes include on-campus housing options that our interns are able to access with minor assistance.

Scaffolding Employer and STEM Core Student Interactions

Because STEM and technology employers traditionally recruit engineering interns exclusively from four-year colleges, they are used to meeting interns in-person for the first time on their first day. As UW's National Survey of College Internships reports (Joy, 2022), the average distance from a student's home to an in-person site for internship was 331 miles.

As stated, many employers are new to working with Community College students and do not see community colleges as producing the skills their company needs. With this in mind, Growth Sector and the STEM Core Network have worked deliberately with employers to develop opportunities for employers to meet STEM Core students prior to an internship interview. This helps students gain awareness of an employer's work and the potential paths that may lead to this employer or their sector. Additionally, it informs the employer about the population of students that will be applying for internships at their organization in the near future. The following methods have proven particularly effective in helping employers connect directly with STEM Core students prior to the internship.

The most common way employers interact directly with STEM Core students is to present directly to them as a participant in the STEM Core Employer Speaker Series. Many employers have noted to Growth Sector directly after one of these sessions that even just the questions asked by students to the panelists changed their perception of community college STEM students.

Additionally, employers hosting site visits and tours have proven impactful in creating connections with students. This setting provides a forum for both formal and informal conversations between employer and student that can help employers understand the technical skills students will bring to an internship, or allow an employer to target a specific group of students they met.

Some employers have developed projects for the Pre-STEM Core Summer Bridge. For students in the STEM Core in Gallup, New Mexico, the hands-on Summer Bridge activities are

led by engineers and technologists from Los Alamos, Sandia, and Livermore National Labs. Each lab owns two weeks of the afternoon. Lab staff have taught in both virtual and in-person modalities. Lab-led projects include Sandia's TracerFire Cybersecurity Program, Design and Fabrication of Explosives Testing Devices, and Non-Destructive Evaluation Testing. These experiences helped participants understand some of the research conducted every day at partner labs and encouraged them to pursue STEM Core internships at partner labs in future summers.

Employers have also interacted directly with STEM Core students by serving as judges on engineering design competitions, hosting hackathons, or collaborating directly with a on-campus, student-led group such as Society for Women Engineers (SWE).

Internship Wraparound Support for Summer Interns

The STEM Core program takes a holistic approach to student intern experience by being involved in preparation, interview process as well as engagement throughout the duration of the internship placement process. During placements, GS staff completes intern check-ins with student interns. Staff virtually meets with students to discuss their overall internship experience, their workload, communication with internship mentors, and safespace for any additional comments. Overwhelmingly, students note having a great experience in their internship, noting that they were working on programs, projects, and skills they had no former experience with. Most interns pointed towards great communication and support from their internship mentors and sites. Many interns also noted an eagerness to apply the following year for another great internship experience. Any negative experiences disclosed to staff were immediately addressed and resolved with the partner site in a discretionary manner. Similarly, quarterly check ins are scheduled with site mentors to touch base on student progress and any areas of needed improvement.

Intern Feedback Survey

As the STEM Core Network focuses on being student focused, Growth Sector administers feedback surveys with participating interns. In the survey, interns are asked to review the full internship process inclusive of interview process, placement support, onboarding, payroll, mentorship and their overall placement. While the experience is fresh in interns minds it is important to get honest feedback that can be used to make changes for future internships. This information will be used to meet with employer/university partner to discuss how to improve next year's internship program and expectations. Results from the STEM Core Intern Feedback Survey were promising indicating:

- 99.5% of students found their internship to be extremely/very valuable
- 82% of students felt extremely/very prepared for an internship through the program
- 99.8% of students found the services provided by Growth Sector to be extremely/very valuable i.e resume support, workshops etc.

Additionally, interns displayed overall enjoyment with their internship experience, students noting:

“I learned so many things, that would be helpful not only in my career in the future, but also any future classes that might require the things that I learned. for example, in this internship i learned simulink and matlab, which i'm sure will be helpful later on the future.”

“I enjoyed being able to finally put my skills to use in a practical environment and also the new challenges that school doesn't prepare you for because i felt as if i was missing that needed work experience in school. school alone cannot prepare students fully for work so having an internship really helps with that. My internship at LLNL was great because I got to run experiments and be responsible for projects.”

Overall, student interns indicated overall satisfaction with the internship experience saying:

“I would recommend stem core to anyone because internships can be difficult to get naturally especially coming from a community college so it's nice to have a helping hand as well as having recommendations of where we would fit in best.”

Providing local University research experiences

Reflecting on internship learning outcomes, Growth Sector has identified structured and paid University research as an excellent way to accomplish a few pivotal outcomes in a CC student's pathway including:

- Students gain valuable hands-on experience in a supportive learning environment
- Opportunity to network and be mentored by faculty/ 4-year university students and grad mentors
- Development of identity as STEM learners
- Comfort/familiarity with the 4-year university, further instilling transfer goals and attainment of B.S

With these learning outcomes in place, Growth Sector works with the following universities to develop and continue to implement research internship placements for STEM Core students:

- San Jose State University Engineering & Computer Science
- California State University Los Angeles Engineering
- Santa Clara University Frugal Innovation Hub
- Florida International University
- University of New Mexico Engineering / Micro and Nano-Technology
- University of Colorado Boulder
- University of Colorado Denver

- CSULA SMART Internship program

Growth Sector has worked with network campuses and four-year partner universities to develop on-campus research experiences to build students' resumes and their confidence to apply for industry positions. This approach is supported by studies, showing that completing these kinds of research experiences prior to internships is linked to higher percentages of participants graduating with a bachelor's degree and higher engagement in various extracurricular STEM programs (Howell et al., 2019)

STEM Core's flagship research program at Cal State University Los Angeles: Summer Making, Academic prep, and Research for Transfer students (SMART) Internship Program, has been the pioneer in providing high quality opportunities for STEM Core students. In partnership with Growth Sector, The SMART Internship Program has been instrumental in structuring progress and growth of participants. Multidisciplinary research projects paired with faculty/grad student mentorship has proven to be a great combination in keeping participants engaged. Similarly, an intern shares,

"I aspire to attain traits like the grad-students that shared plenty of enthusiasm in their respected field while learning how to teach my generation of learners. I am grateful to have an opportunity to embrace these endeavors. I leave here with inspiration and intent to share my enthusiasm for knowledge with others."

The SMART Internship provides an internship program at the College of Engineering Computer Science and Technology, California State University, Los Angeles (Cal State LA) to Growth Sector's STEM Core students. The interns participate in the workshops and educational/research activities hosted on campus at the University. The internship format includes:

- Duration: 40 hours a week for 8 weeks
- Place: Hybrid though interns are encouraged to participate in the in-person lab educational/research activities

Requirement workshops

- Workload - 30 hours per week
- Learning format
 - Self-paced workshops – 20 hours
 - Graduate-assistant hosted weekly meeting (remote and in-person)
 - Graduate assistant office hours
- Subjects
 - Required: Intel DevCloud – machine learning applications
 - Elective: Oracle, Linux, Cadence Simulation tools, and MATLAB applications

Educational/Research activities

- Workload – 10 hours per week
- Learning format
 - Each intern will choose to join a participating research lab.
 - Each faculty research advisor will meet 2 hours per week with the interns.
 - The faculty advisor of the research lab will assign tasks to the interns based on the research activities and the interest of the interns.
 - The interns will generate course materials with the guidance of the faculty advisor.

Having the added component of required workshops prove to be a pivotal aspect of the research Internship Program. Skill building workshops in Intel DevCloud and various elective workshops allow student to gain confidence meanwhile gaining resume building hands-on experiences. Furthermore, interns prepare for final presentations showcasing the faculty-led Educational/Research activities. Adding in the component of final presentation give students the opportunity to delve into developing critical communication/language skills (Seitenova et al., 2023), real-world applications and research, meanwhile practicing high level presentation skills.

Overall, creating research-based internship opportunities provides participants the experience of working in a cross-disciplinary environment in resolving engineering and computer science problems, mimicking real-world industry experience. STEM Core research Interns reflect on the overall experience sharing,

“What I found most enjoyable about the internship was the opportunity to engage in research discussions with the instructors. I delved into fascinating subjects like the Internet of Things (IoT), realizing its pervasive presence in our lives, often unnoticed. The application process for the internship went smoothly, and though I was initially anxious, I felt incredibly fortunate to be selected. As my first internship, it was a fun and rewarding experience.”

Exploring research placement at National Labs .

Growth Sector has identified multiple national lab partners including Lawrence Livermore National Lab (LLNL), Stanford Linear Accelerator Lab (SLAC), National Renewable Energy Lab (NREL), and Lawrence Berkeley National Lab (LBNL) that have led the charge in the STEM Core informal apprenticeship pathway. National lab partners have acknowledged the importance of supporting STEM Core’s diverse talent pool acknowledging that “providing them with accessible entry points into highly skilled tech roles, apprenticeships help break down barriers to hiring and recruiting and create a more inclusive talent pool.” (Apprenti, 2023). National labs have worked with GS to identify and host interns for initial internship placement, using the 10 week internships as an evaluation process for longer term employment. Following the GS subsidized placement, national lab partners have made efforts to hire interns for ongoing part-time employment (during

academic year) and full-time employment (during academic breaks). This informal apprenticeship pathway creates opportunities for longer term technical experiences for students, exposure to deepen professional relationships with mentors, meanwhile alleviating the financial stressor that many STEM Core students are faced with year-round.

As advocates of STEM learners, GS pushes itself and partners to “continuously ask how internship experiences are accessed, the types of experiences students have in their participation, and who benefits from them.” (Schalewski, 2021). Providing opportunities for ongoing employment/apprenticeship pathways allow for STEM Core participants to see value (immediate and long term) in striving for and securing employment through the STEM Core program.

Conclusion

Broadening participation in engineering to include more women, first-generation college students, individuals from low-income families, and those from ethnicities underrepresented in engineering, is a crucial issue in terms of equity as well as economic & national security. Efforts to expand diversity in engineering have been undertaken across the country by thousands of well-intentioned practitioners. And, research clearly demonstrates the significant impact that internships have on community college STEM students’ ability to enter the field of engineering specifically, and STEM more broadly. Yet, due to a variety of factors including lack of awareness of community colleges, negative preconceived notions of community colleges, and the time between a community college internship and B.S. degree completion, community college students are much less likely to have the opportunity for a technical internship.

Following a decade of success in developing employers, raising and leveraging grant funding to subsidize internships, and working with CC’s to train students appropriately, Growth Sector and the STEM Core Network have incorporated a series of effective approaches to building early internships for CC STEM students that can benefit other colleges, employers, and stakeholders. The STEM Core program and associated interventions represent a scalable model to expand internships across multiple sectors, employers, and locations for community college engineering students across the country. And, by expanding internships for these early community college engineering students, impact will be evident in increased student retention rates, graduation rates, and lifetime earnings for a student population with the potential to represent a seismic shift in the diversity of the engineering profession.

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