Industry Mentoring and Internship Experiences at a Community College Baccalaureate Program in Software Development

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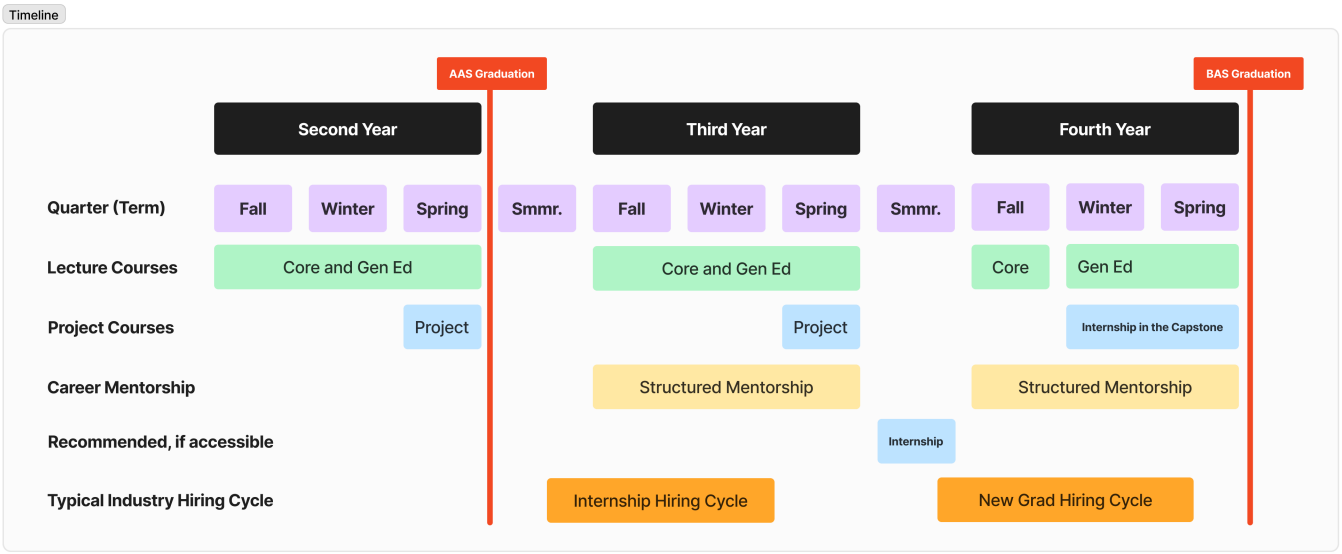

Figure 1: Program Timeline and Typical Industry Hiring Cycles

ABSTRACT

Community college students cite career advancement as their top reason for enrolling, with over 70% of first-year students expecting to participate in an internship as part of their college experience. However, surveys indicate only between 10% and 25% of bachelor's degree holders participated in an internship, with Black and Latino students, women, low-income, and first-generation students having less access. With strong associations between paid internships and positive outcomes in the labor market after graduation, the impact is substantial: new grads who start out underemployed are five times more likely to remain underemployed after five years.

This experience report documents a multifaceted intervention at Green River College. Partnering with Mentors in Tech provides community college baccalaureate students studying software development with structured mentorship from industry mentors who help students navigate the hiring process and landscape and bring impactful aspects of internships into capstone projects. Partnering with CodeDay provides students with accessible internships, working on open-source software. In 2022-23, this intervention reached over 90% of students in the program, consisting of 47% students of color, 28% women, 59% receiving financial aid, and 20% first-generation college students.

Initial results include a review of hiring process metrics, placement outcomes, and student reflections. Seventy-five percent of students who graduated in 2022 landed a tech role within six months of graduation. Over 90% of participating students expressed confidence in their ability to transition from student to tech professional. Ongoing work focuses on long-term sustainability and expanding opportunities for students enrolled in similar programs at comparable institutions.

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CCS CONCEPTS

• **Social and professional topics** → **Software engineering education**; **Employment issues**; *Adult education.*

KEYWORDS

community college, applied baccalaureate, community college baccalaureate, experiential learning, mentoring, internships, capstone, inclusion

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1 BACKGROUND AND MOTIVATION

This experience report documents a series of interventions that originated at a community college baccalaureate program in software development [13] as a response to the impacts of the COVID-19 pandemic as it emerged in 2020. While teaching faculty were focused on pivoting to remote instruction to support students, two community partners reached out and offered to help mitigate the impacts on soon-to-be graduates entering one of the worst job markets in history, with internship opportunities cut in half [37] and new grad job openings for the class of 2020 dropping by 68% from the previous year [38]. Mentors in Tech and CodeDay partnered with Green River College and to implement a program starting in Spring 2020 to support third- and fourth-year students in the classes of 2020 and 2021 to be in the best possible position, given unprecedented circumstances and uncertainty in the job market.

Beyond navigating the impacts of COVID-19 stay-at-home orders and remote instruction, the George Floyd protests in Spring 2020 catalyzed a call for societal change and resulted in institutions of higher education and faculty members re-examining systems and their work through an equity lens. Influences on our work during that time included McGee [18], McNair, Bensimon, and Malcom-Piqueux [19], and Goldrick-Rab [11]. While pursuing a shared vision to be responsive to impacted students in deploying a co-curricular program with partners to support students during the pandemic, there were inequities and gaps, summarized below, that our team recognized and did not wish to exacerbate or inadvertently perpetuate, but rather hoped to make inroads to reversing.

1.1 The Internship Gap

While over 70 percent of first-year college students expect to participate in an internship, only one in three bachelor's degree holders report landing a paid internship [26]. At another public university system with community colleges, fewer than 10% of college CS majors were able to access an internship [16]. Our experience at a community college has shown that traditional summer internships are not accessible by all students. For example, students who are parents—22% of undergraduates across the U.S. or 3.8 million students [34]—are often not in a position where they can step away from their caretaker responsibilities or their existing (non-tech) job for temporary employment for 10–12 weeks, especially if the internship requires a significant amount of commuting time, relocation and/or is unpaid.

Student Demographic Data for 5BD
2020-21 Academic Year

Student Demographics	Number	Percent
Unduplicated Headcount	111	
Female	30	27%
Male	81	73%
Students of Color*	49	50%
African American	2	2%
Asian	28	25%
Hispanic	5	5%
Other	2	2%
Pacific Islander	2	2%
Two or More Races	10	9%
White	49	44%
Not Reported	13	12%
Age Group		
Under 20	4	4%
20 to 29	73	66%
30 to 39	28	25%
40 and above	6	5%
First Generation**	63	57%
Receiving Financial Aid	58	52%
Pell Grant recipients	39	35%
Have dependents***	18	16%
Veteran	9	8%

**Excludes students not reporting race/ethnicity.*
***Excludes students not reporting first generation status.*
****Excludes students not reporting family status.*

Figure 2: Demographic data for software development baccalaureate students (third and fourth-year students) at Green River College, 2020-2021. Green River College is a federally designated Asian American and Native American Pacific Islander-Serving Institution (AANAPISI).

Policy analysts [8] and education researchers [14] have identified financial, time, professional development hurdles, and competing priorities as constraints that prevent students, particularly students who are pursing higher education with a goal of alleviating those constraints, from accessing internships. Kapoor and Gardner-McCune [15] identifies the barriers to securing industry internships in computing, specifically. The intern selection process at big tech companies (who have the most openings and offer the top salaries; 18,000 intern positions, paying $30,000 for summer at one big tech company [36]) makes assumptions that result in students from lower-income backgrounds and from lesser-known colleges being disadvantaged in the process [35]. The students who can access and participate in an internship find value in the technical learning experience, expanding their professional networks, enhancing their social capital, and providing confidence and greater understanding of their career choices [25, 29].

In our work, we sought to help increase the number of students who participate in traditional summer internships as well as provide students with access to experiential learning opportunities that provide similar value to students as a traditional industry internship.

1.2 The Underemployment Gap

For employers, relevant work experience, including internships, are often one of the most important factors in evaluating candidates for hiring early career college graduates, including when hiring CS graduates [39], with internship experience often being the deciding factor when employers evaluate two otherwise equivalent candidates [28]. With the connection between internship experience and being competitive for early career / new grad job opportunities, students who are not able to access internship or other related work experiences are more likely to struggle in the new CS grad hiring process in both the resume screening step (under the Work Experience section) and during the interviewing step, particularly in behavioral interviews when candidates are asked to reflect on their past project experiences ("Tell me about a time…" behavioral interview questions). As a result, students in this scenario are more likely place into a position of underemployment. Recent studies indicate that nearly 43% of recent graduates, including 30% of graduates of engineering and CS programs, are underemployed [41].

First jobs matter, as the effects of underemployment are long-lasting. New grads who start out underemployed are five times more likely to still be underemployed after five years. And the cycle is difficult to escape: three-quarters of workers who were underemployed as new grads remained underemployed after 10 years. New grads who landed in positions that matched their levels of education (avoided the underemployment trap) rarely slid into underemployment five and ten years later [41].

With community college students (including our own students as indicated in our department's Data Buddies Survey [1]) citing career advancement as their top reason for enrolling [10], it was imperative that our work focused on helping students reach their desired outcomes, particularly since community college baccalaureate students are more likely to be first-generation college-goers, and come from historically marginalized communities and low-income households [44].

1.3 The Perception Gap

Although 24 states in the U.S. have authorized community colleges to offer baccalaureate degrees [17] and studies of graduate outcomes show promising results [22–24], community colleges and their students are subject to many myths and misconceptions, including by potential employers.

Van Noy and Jacobs [43] conducted a 2012 study of employer attitudes in two major metropolitan areas, including the area where Green River College is located, found that hiring managers expected negative characteristics of associate degree graduates from community colleges, such as a lack of academic ability, initiative, or skill. While our students already possess an associate degree and are currently baccalaureate degree program students, there is a stigma attached to community colleges [4], even though nearly 40% of undergraduates in the U.S. are enrolled at a community college [30].

Part of our work is to follow the recommendation from [43]: while it may be difficult for colleges to reverse widespread perceptions, our work can cultivate relationships with people who are likely in a decision-making position in the hiring process in employer organizations. Our work in helping students at our institution involves cultivating relationships with senior engineering staff members and hiring managers working in our industry community to win hearts and minds, one at a time, to help shift employer perceptions.

2 LEVERAGING PRIOR WORK AND EMPLOYING EVIDENCE-BASED PRACTICES

2.1 Open-Source Internships with Industry Mentors

In Spring 2020, as companies announced cancellation of their summer internship programs, CodeDay responded by offering CodeDay Labs, an open-source internship program that ran for 8 weeks over Summer 2020. While the program has existed since 2017, CodeDay reached out to community college faculty during the initial pandemic response to make the opportunity more visible to students. The CodeDay Labs open-source internship model with industry mentors is described in [21] and involved:

- A project mentor with current work experience as a full-time software engineer who selects a project to work on, serving in a role comparable to a mentor in an industry internship.
- Students, working as interns in teams of three, contributing features or bug-fixes to an existing software project or a new software project as guided by the project mentor.
- The project work being licensed under an Open Source Initiative approved license, which allows for students' open source contribution and project experience to be visible and shareable on their resumes, in interviews, and their portfolios/public profiles (e.g. GitHub, LinkedIn).

CodeDay Labs was offered in a virtual format, allowing for a broader range of students with constraints the opportunity to participate. Students and mentors used both asynchronous and synchronous communication tools to work together on their projects: the same tools that employees use day-to-day in remote work environments, removing the need for intern relocation and commuting. In addition to the project work experience, CodeDay provided opportunities to student interns similar to what many leading companies offer, which are considered best practices for internship programs [27] including:

- Paying student interns a stipend: recognizing interns' labor and supporting inclusion.
- Allowing for flexible work arrangements: student interns who have time/schedule constraints (e.g., caretaking responsibilities, survival job) co-created their work schedule with their intern peers and project mentors.
- Holding orientations for all involved: both project mentors and interns attended sessions to set expectations and define roles.
- Holding career panels and hosting guest speakers: interns were invited to meet both near-peers and leaders from industry in weekly events focused on career development activities as well as connect one-on-one with their project mentor for career advice.

- Offering training: interns were invited to a series of technical talks to broaden interns' exposure to technologies and skills outside of their projects.
- Showcasing intern work: at the end of the program, students created and presented "tech talks", a 10-15 minute presentation demonstrating their project and sharing technologies learned and used with an audience of peer interns, mentors, and invited guests from industry.

2.2 Structured Yearlong Mentorship with Industry Mentors

During Spring 2020, Mentors in Tech reached out to faculty at community and technical colleges to offer students the opportunity to connect with industry mentors in a structured mentorship program designed to help fourth-year students graduating into the pandemic-disrupted job market navigate the tech hiring process and landscape. Mentors in Tech designed and launched an evidence-based mentorship program with teaching faculty input that tailored the program specifically for students at community and technical colleges who do not have access to individuals in their personal networks (such as friends, family, or acquaintances) who work in tech or tech-adjacent roles.

Characteristics of the structured mentorship program, which took place over the academic year as a co-curricular program, included:

- Orientation and onboarding activities for both industry mentors and student mentees to help understand each other's backgrounds and motivations, establish expectations, and clarify roles, including both Mentors in Tech and college faculty roles in the program.
- Matching each student with two industry mentors, allowing for students to specify preferences for affinity groups (sharing a common identity characteristic or common background experience) and for career role (software developer, project manager, program manager, technical sales, etc.). This afforded the opportunity for students to hear two different perspectives from industry.
- Students meeting with each of their two mentors for one hour a month, with a suggested agenda and activity provided by Mentors in Tech. Mentors and mentees had agency to redirect the agenda to best fit the needs of the mentee. For example, if the month's suggested topic was a resume review, but the mentee just secured an interview, the mentor and mentee could spend the hour practicing with a mock interview instead.
- Both students and mentors completing a reflection after each meeting. Students reinforce lessons learned during the meeting through their reflection, while mentors provide feedback and specific advice on what they recommend the mentee work on next.
- Students attending a one-hour career panel or workshop once per month. Workshops were led by individuals with first-hand experience with each stage of the CS grad hiring process: recruiters responsible for resume screening and/or phone screening, engineers and technical team managers responsible for technical and behavioral interviews, and professionals involved with the salary negotiation process and explaining benefits packages.
- Sync/review meetings where Mentors in Tech would meet every two weeks with program faculty to relay observations, feedback, and opportunities to support efforts in both the academic program and the mentoring program and foster a whole-team approach to supporting students.

While participating in an internship or having related work experience is a differentiator in the hiring process for early career new grads, there are many other factors in the hiring process that students need to be aware of and be prepared for. In our experience in working with students who have prior work experience outside of tech (such as retail customer service, food service, construction, manufacturing, transportation/logistics, and military service), the CS grad hiring process described in [39] is not apparent to students and there are gaps between what students think employers are searching for in a candidate, versus what faculty think employers want in a candidate, and what employers actually seek in candidates [20].

Figure 3: Career mentor support during the tech hiring process.

2.3 Integrating Industry-Mentored Internships into the Capstone Course Experience

Prior to the COVID-19 pandemic, our program's two-quarter (20 week) capstone incorporated the Industry Partners model [32], where the capstone is co-taught by one academic faculty member (responsible for course logistics and assessment) and one industry partner (providing current industry perspective and subject matter expertise), with elements in common with the TEALS model [12] pairing classroom teachers with industry professionals. Students assemble into teams of four and select a project, to be developed using a client-centered CO-FOSS approach [42], often on an open-ended project with undefined scope, which comes with challenges

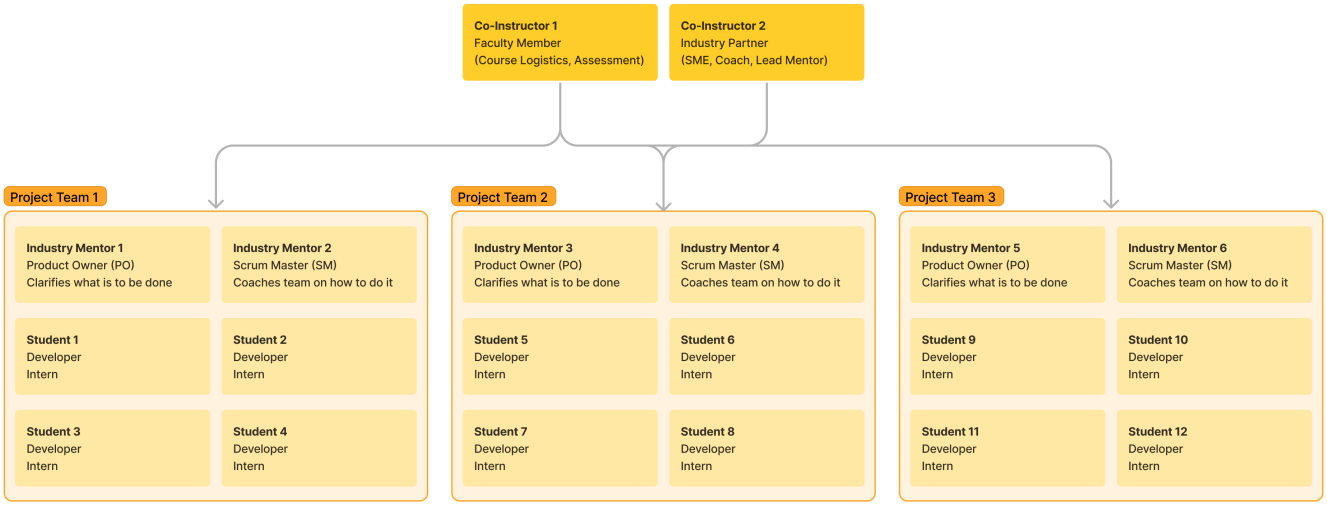

Figure 4: Organization of the "Internship-in-the-Capstone" experience.

as the co-instructors may have limited experience in the domain and thus cannot evaluate if the project is appropriately scoped or can be adequately supported [31].

In Spring 2022, we piloted an evolution of the Industry Partners model with several selected capstone projects that included the following features:

- Projects were industry-sponsored, which funded stipends for students' time working on the project outside of regular class hours.
- Working with Mentors in Tech, industry sponsors provided an appropriately scoped project (defined scope with some flexibility) and a technical mentor (in a Product Owner role) for the project, who served in a role comparable to a mentor in an industry internship, focused on helping students with the engineering aspects of the project. Some industry sponsors selected an open-source software project that had value to the sponsor as it removed constraints and barriers associated with students working with proprietary software (non-disclosure agreements, intellectual property issues).
- Project mentors and students completed on-boarding activities, with additional attention to support students working in an open-source project, leveraging practices described in [5].
- Teams of four students worked on a project with their technical mentor, in an experience designed to model what one would learn in an industry internship. Teams would meet with their mentor at least once per week to present and obtain feedback on progress and plan out the work for the following week (Sprint Review and Sprint Planning).
- A professional mentor (in a Scrum Master role) was provided by Mentors in Tech for each project, who coached students on how to navigate project impediments such as setting expectations, understanding professional norms, team communication, and how to professionally ask for help. The professional mentor also coached students on how to recognize and communicate their project experience on their resume and in interviews.
- Students wrote weekly reflections on what they accomplished and impediments they faced, comparable to writing a status report for a manager at work. In addition, the weekly reflection exercise prompted students to share what they personally learned (technical and non-technical) each week as a learning log that was revisited at the end of the project.
- Project mentors and professional mentors met weekly with the co-instructors to identify issues from the various projects to take into whole-class meetings to share and improve on through lecture and/or structured activities. For example, if several teams were not meeting project mentor expectations because items discussed in a meeting were not acted upon by the team, the co-instructors prepared a lesson for the whole class that on professional meeting norms and provided tangible strategies on how to record, assign, address, and close action items after the meeting to better meet expectations.

Intentionally designed to be comparable to what interns would experience in a tech internship, students who are unable to access a traditional summer internship can complete an internship in their capstone course, with the support of industry mentors. With industry sponsoring an authentic project of their choice, based on their needs, the project can be shared on students' resumes and during interviews.

3 INITIAL RESULTS

3.1 Reach

Student enrollment in the baccalaureate program has held steady since the beginning of the pandemic in 2020. At the inception of this series of interventions in 2020-2021, 20% of students in the baccalaureate program participated in the industry-mentored open source project and/or the yearlong structured mentoring.

During the second year of the program in 2021-2022, the internship-in-the-capstone option was launched and we observed growing participation overall. Roughly 80% of students participated in at least one of the three opportunities.

In academic year 2022-2023, over 90% of students engaged in the yearlong structured mentoring program. In an end-of-year survey, 92% of participants indicated that their mentor interactions met or exceeded expectations and 94% expressed confidence in their ability to transition from student to tech professional. In addition to the career mentoring program, 20% of students opted into the internship-in-the-capstone experience. There were a limited number of sponsored projects for students to work on and students filled all of the available positions on all the projects.

3.2 The Internship Gap

Tracking placement into internships depends on students self-reporting of their internship, either by notifying a faculty member, program academic advisor, through a program exit survey, or through an update on LinkedIn. With only a third of students participating in a paid internship before graduating with their bachelor's degree [26], our graduates reported the following:

- 14% of the class of 2020 had a paid internship
- 20% of the class of 2021 had a paid internship
- 28% of the class of 2022 had a paid internship
- 47% of the class of 2023 had a paid internship

Students who participated in CodeDay Labs open-source internship or Mentors in Tech's internship in the capstone were counted among those who completed a paid internship as both programs satisfy researchers' [3] definition of an internship and follow practices from [27].

3.3 The Underemployment Gap

Tracking placement into employment also depends on student self-reporting, which becomes more challenging after graduation. Students from the following classes reported placing into a tech role within six months of graduation.

- 64% of the class of 2020
- 56% of the class of 2021
- 75% of the class of 2022

As of this writing, it has been only two months since the class of 2023 graduated and 50% have already placed into a tech role. The average salary for an offer (as self-reported by graduates) is $95,000 per year, with students placing into a variety of tech roles such as Software Development Engineer, Integration Developer, Platform Engineer, Application Support Engineer, Quality Engineer, Project Manager, and Product Owner.

It is challenging to discern what a "good" placement rate is at this time for our students as the impacts of the COVID-19 pandemic is what initiated the series of interventions described in this experience report and more recently, macroeconomic factors including the tech layoffs that started in November 2022 and continued into 2023 [33, 36] have affected the job market and are disproportionately impacting our Black and Brown colleagues in tech the hardest [6]. Our only other frame of reference is from another public university system with community colleges in a different state, where 50 percent of all CS graduates from 2017 to 2021 were employed within their field of study one year after graduation [7].

3.4 The Perception Gap

To gain insights on employer perceptions in our regional labor market about community college baccalaureate graduates, we would need to conduct (or commission) a study similar to [43], which is our work in the near future.

We currently have a network of nearly 200 industry mentors who work with our students and we are hopeful that as they get to know our students one-on-one, our mentors will be ambassadors to advocate for community college baccalaureate students. And they already are, with some mentors referring their mentees for positions within their organization and one mentor hiring their mentee into their own small business.

Our team also seeks to change perceptions through storytelling efforts. We use LinkedIn as an avenue to share students' successes (with their permission), have experimented with sponsorship on a local public radio station, and are responsive when opportunities arise to be featured in the local trade press [40] and to share our work with researchers who study relationships, networks, and social capital [9] and researchers who study community colleges who have recognized our partnership efforts to support students in their last mile from college to career a "promising practice" for community college baccalaureate degree programs [2].

4 NEXT STEPS

In this experience report, we shared an overview of an intervention strategy, which emerged as response to the COVID-19 pandemic and has evolved over three years, aimed at mitigating the internship and related underemployment gaps encountered by community college baccalaureate students in software development. As a "promising practice" (and not a proven practice), there is further research to be done on evaluating each of the three major components, separately and holistically: open-source internships with industry mentors, a yearlong structured career mentorship program, and the integration of industry-mentored internships into the capstone course to facilitate broader access to an experience that employers value.

We have engaged an education researcher to help our team with program evaluation efforts over the next year as there is more detailed data on each of the components to review, analyze, and share in forthcoming publications. In addition, we are seeking collaborators to try this strategy at another community and technical college and/or another institution to gain a better sense of the variability, to identify limiting factors to scaling, and to develop a strategy to work towards long-term sustainability.

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