Building Effective Community College Engineering and Information Technology Internships

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Abstract
Despite their potential to support and enhance technology education and career goals, little is known about what makes community college technology internships effective for student participation, learning, degree completion, and the transition to technology employment. This study fills these gaps with case study research on technology internships at two Florida community colleges. In this research we explore, engineering and information technology internship structure; participation; and outcomes on program persistence, program completion, and self-efficacy in future technology and career engagement. Our case study research draws from both qualitative and quantitative data from a range of perspectives including students, faculty/administrators and employers who provided the internships. Findings show that credit-bearing technology internships prepared students to be successful in technology careers, strengthened student self-efficacy and confidence towards their technology education and career goals, and provided a bridge from education to employment. Because these findings cut across gender, race, and ethnicity, the research suggests that credit bearing internships have the potential to broaden participation in technology careers. Despite their effectiveness, however, very few students who enrolled in a technology program participated. This is mainly because most students leave college before earning enough credit to participate in an internship for credit. For those who completed a degree, they were not likely to participate in an internship unless it was required for graduation.

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I. Background
Research suggests that internships which provide authentic work experiences, structured learning activities, and assessment and recognition of skills, increases students’ persistence, graduation, and employment rates generally (Rodriguez, Fox, and McCambly 2016). When learning takes place within a context of employment, as they do in internships, the hands-on experiences, access to role models and mentors, and sometimes pay, have the potential to bolster student’s self-efficacy and confidence to meet their education and career goals. (Bragg et. al, 1995, Bragg and Hamm 1996; Swail, 2002). Because of these benefits, internships could be very beneficial for supporting all women, men of color, and youth and adults in low-income occupations to entry careers for which they have traditionally been underrepresented. (Raelin et al, 2014; Cahill 2016, Author 2018).

Research has also identified challenges with internships which could limit their benefits including a lack of pay which can make them inaccessible to lower income students, minimal and ineffective on-the-job supervision, lack of fit with skill level, and educational and career goals, and inability to find and secure internships (Carnevale et. al. 2015; Carnevale and Smith, 2018; Hora 2019; Hora, Zi, Parrott, and Her, 2019). Researchers have also noted gender and racial/ethnic differences in internship experiences. Arthur and Guy (2020), for example, found
that women in four-year engineering programs could feel overwhelmed by their internship experiences if it did not address issues of sexual harassment, chilly climate, and microaggressions. Knouse, Tanner, and Harris (1999) found more internship participation among White and among high achieving students (Hora, Zi, Parrott, and Her, 2019).

The literature is notably lacking in its assessment of community college (CC) internships. In a recent review of the literature on community college internship programs, McHugh (2017) found that there was little agreement about which outcomes were most important to measure and a lack of information about internship structure and its impact on participation and outcomes. Because students at CC’s compared with their counterparts at four-year institutions are more diverse, lower-income, older and with competing family-care and work responsibilities, it is not clear how the lessons learned from the four-year context will apply to the two-year context. Hoar, Wolfgram, and Chen (2019) noted, for example, that without sufficient support, it will be challenging for community college students to secure relevant and paid internship experiences.

Also lacking in the research are studies that look at internships by program level. Yet, given the different frameworks of community college transfer, terminal degrees, and certificates as well as program of study, it is likely that key elements of internships including participation, structure, and outcomes vary considerably by these factors. For example, in allied health programs, where practicums are often required for certification, the structure and experiences in these work-based-learning (WBL) experiences are likely different than internships in other program areas where they are not as well integrated into the curriculum or required for certification. To fill these gaps, this research focuses on credit-bearing community college technology internships. Credit-bearing internships are highly structured WBL experiences offered by community colleges as a component of degree completion. Internships are designed to meet educational requirements established by the community college and are supervised by a faculty member in a credit-bearing course. They may be required for graduation or be an elective, be paid or unpaid, and typically mandate that students have earned enough credits towards the degree and a high enough GPA to participate. We focus on credit-bearing internships since non-credit internships may be structured very differently than those overseen and sanctioned by the college. In addition, because colleges rarely collect data on student participation in non-credit internships, it is difficult to identify students who have participated in these WBL activities.

Participation in community college technology programs has grown rapidly over the last ten years although not evenly across all groups. Between 2003 and 2015, while both men and women’s completion of associate degree STEM programs grew, women accounted for 33% of theses degrees in 2003 and 38% in 2015. Racial/ethnic differences in associate degree completion remained mostly steady during this time with Asian students earning 23% of these degrees, Hispanic students 16%, American Indian 15%, and Black and White students 12% (Baird et al., 2017). Given the rapid change of technology, internships can potentially play a key role in this area of study providing students with exposure to cutting edge technologies which may not yet have translated into the classroom. In addition, the hands-on learning that internships provide gives students the chance to test their skills in a real-world environment where the parameters of problem-solving are not as clear cut and static as they are in the
classroom. Finally, internships offer students the chance to develop professional skills which along with technical skills are valued by employers when hiring (Stateler et al. 2020). For these reasons, technology internships in particular have the potential to serve as an effective bridge to employment for community college technology students.

As noted above, however, we know very little about how pervasive these internships are, how they are structured, and how structure impacts both participation and outcomes. Importantly, we know very little about the impacts of technology internships on women and students of color who remain underrepresented in technology programs and employment. It is not known if technology internships broaden participation or reproduce existing inequalities. Because women and students of color face barriers in technology employment including negative stereotypes, marginalization, and a lack of role models, mentors, and champions (England 2010, Marco-Bujosa, Joy, & Sorrentino, 2019) it is not clear whether technology internships will open opportunities for women and students of color or reproduce barriers (Chopra 2020).

This study seeks to fill these gaps with case study research on credit bearing technology internships at two Florida community college. According to Crow et. al. (2011), “A case study is a research approach that is used to generate an in-depth, multi-faceted understanding of a complex issue in its real-life context.” Community college internships occur at the complex intersection of students, colleges, and employers. Internship structure and implementation are shaped by the specific ways that the college brings together students and employers in the on-the-job learning experience. Partial information from only some of the stakeholders would leave gaps in our understanding. For example, student-level college, state, or national datasets that include a variable for student participation in internships often lacks information about whether the internship was an option for students and, if so, whether it was required for graduation or an elective. Also lacking in these datasets are the availability, uptake, and quality of support services colleges provide to help students with job search. Student level data does not capture information from employers about why they offered internships, how they folded learning objectives into on-the-job experiences, and the intensity and quality of supervision. When this kind of information is lacking, it is hard to discern student differences in internship participation and variability in the impact of internships on outcomes likes student persistence, graduation, and transition to technology careers. The case study analysis which takes place in a “natural real-life context” allowed us to see the internship process from multiple points of view to better understand what is working, for whom, and under what conditions (Stake, 1998; Miles 2015).

We address the following questions in our research: How are technology internships designed and structured? Who participates in technology internships and why? What are the opportunities and challenges for student participation and how do these vary by gender and race/ethnicity? What are the opportunities and challenges for employer participation in internships? What are the impacts of participation on persistence, degree completion and self-efficacy in technology education and transition to careers? What are best practice structures for effective technology internship participation and outcomes?
II. Summary of Key Findings

Community colleges serve as necessary hubs that bring students and employers together for effective technology internships

a) Findings on Student Experiences

Technology internships have the potential to serve as an effective bridge to employment.

• By participating in quality technology internships, students:
  ▪ Learn how to find and apply for technology jobs.
  ▪ Gain hands-on, real-world technology experiences.
  ▪ Develop professional skills.
  ▪ Earn money while they learn.

Despite these benefits, few technology students have the opportunity to participate in internships.

• Most technology students leave college before they are eligible for an internship.
• For those who stay, barriers to finding and applying for internships, along with lack of pay and challenges with scheduling and transportation, keep most students from participating unless they are required to do so for graduation.
• Students often lack adequate supervision and mentorship in internships.
• Students from populations that are underrepresented in technology—including Black and Latinx individuals and women of all backgrounds—face added challenges when participating in the internship process.

b) Findings on Employer Perspectives

• Employers offer technology internships to create a talent pipeline into middle-skill technology jobs.

  • Local community colleges are a primary source of technology interns.
  • Effective technology internships support regional economic development.

Employers may face challenges related to internships. It can be difficult to set up an internship program for the first time, creating job postings that enable them to find
students with the necessary skills they need, and structuring internships that meet college coursework requirements.

c) **Findings on Community College Roles**

- Community colleges act as necessary “hubs” that bring students and employers together for effective internships with equitable access.
- Community colleges provide the essential scaffolding of supports, resources, and staffing that students and employer need.
- Without effective supports, it is likely that only students who face the fewest barriers to degree completion and employment will have access to high-value internships.
- Because of this, elective internships (those not required for graduation) may inadvertently contribute to inequality.
- When offering internships as electives, colleges may not provide enough support and resources to make them feasible for most students.

III. **Case Study Colleges**

To answer our research questions, we conducted case study research of the engineering technology (ET) and information technology (IT) associate of science programs at two Florida community colleges we call Mid-Coast West and Mid-Coast East (MWCC & MECC). MWCC is a large and diverse urban college serving 65,000 students from 100 different countries. As of 2011, MWCC required all engineering and information technology associate of science students to participate in a credit-bearing internship to complete their degrees. Between 2010 and 2019, 6,277 students participated in technology education including 1,126 engineering technology (ET) students and 5,151 information technology (IT) students.¹ 77% of the students were male and 64% were white, 13% were Black, 12% were Hispanic, and 4% were Asian.

MECC is a large and diverse urban college with a total enrollment of 62,508 students, 66 percent of which are underrepresented minorities. Internships are mandatory for the Marine Engineering Technology and Biomedical Technology program but not an option for students enrolled in the Engineering Electronic and CNC Engineering technology programs. Internships were not required for the Information Technology students but available as an elective. Between 2010 and 2019, 6,465 students enrolled in technology with 1,697 enrolled in engineering technology and 4,768 in information technology.² Men accounted for 83% of the technology students. 22% of the technology students were white, 34% were Black, 34% were Hispanic, and 4% were Asian.

We chose these schools for their large and diverse enrollment in engineering and information technology and because they offered internships either required or as an elective for both ET and IT students. Including two schools in our analysis, allowed us to explore internships in two different institutional settings with designs that varied between the schools. Choosing both schools in one state allowed us to reduce the mediating impacts of both state post-secondary education contexts.

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¹ Source: Author analysis of MWCC administrative student data.
² Source: Author analysis of MECC administrative student data.
work-based-learning policies and regional economic factors on internship structure, participation, and outcomes.

IV. Data

MECC:

• 50 one-hour interviews between October 2019 and March 2020 with: 31 students (12 who participated in the internship and 19 who did not)\(^3\);
• 13 technology faculty, administrators, and internship coordinators
• 6 employers who hired interns
• Ten years of technology student administrative data (2010 – 2019)

MWCC:

• 60 one-hour interviews between October 2018 and August of 2019 with: 30 technology students (20 who participated in the internship and 10 who had not yet participated)\(^4\)
• 16 technology faculty, administrators, and staff
• 16 employers who provide internship opportunities to students.
• Ten years of technology student administrative data (2010 – 2019)
• Internship Survey fielded to all students who participated in an internship between March 2019 – March 2020).\(^5\) The response rate was 60% (see Table 1 for summary statistics).

V. Methodology

Each interview was coded by two researchers with a range of codes pertaining to the ET and IT program, student background, and internship challenges and opportunities. We assured reliability and validity by comparing the analysis of two different coders with differences in the use and understanding of the codes resolved through iterative discussions over several months. Also, having two case study schools for analysis and two different programs within each college, gave us the chance to explore how findings could be generalized. (Yin, 2013).

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\(^3\) Among the students that were interviewed, 7 were female, 21 were male, and 1 was neither. 77% of the interviewed students were Black or Hispanic. See Table 2 for more details.

\(^4\) Among the students we interviewed, 8 were female and 21 were male. 23% of the interviewed students were Black or Hispanic. See Table 2 for more details.

\(^5\) At MECC because we were able to interview half of the 60 students who completed an internship during the 2019 – 2020 school year, capturing a wide breadth of the student internship experience, we did not need to field a survey.
After the coding, researchers extracted quotes associated with each code, for each college separately, to explore themes emerging from the student, faculty and administrator, and employer interviews separately. In this thematic analysis, we explored differences in responses by school, students’ demographics, program, and internship participation. Then we compared responses across students, faculty and administrators, and employers to find where there was overlap and where there were differences in perspectives about the internship.

We explored the student administrative and student internship data using descriptive statistics and visualizations to assess mean differences in variables by college, student gender, race/ethnicity, program, and for the student administrative data college. Findings were triangulated across the qualitative and quantitative data sources (Miles et al., 2014).

VI. Findings

Internship Opportunities:

Internship as a “bridge” to employment: Faculty, administrators, and students at both schools overwhelming viewed the internship as a bridge to employment which is why at both colleges students were required to complete at least two semesters of coursework prior to participating. Faculty reported that students needed at least two or three semesters of technology coursework prior to the internship so that they would be qualified for the technology position. Employers agreed that students near the end of their program were better prepared for the internship than students earlier in their studies. More than a retention or recruitment strategy, college personnel saw the internship as a means for students to develop real world experience that would help students find a job after graduation, something that students confirmed as well. In service of this goal and with support from career services, students were expected to find internships just as they would a technology job through job search, application, and interview. In addition to providing a pathway into employment, then, the internship provided students with the experience and skills to navigate a technology job search.

"I believe they should be gaining skills that are beneficial to show that they've learned something, to have new qualifications for their intended career. It's very important to me as a counselor and advisor to these students ...that they come out with something that they didn't have before. So, something that's meaningful, and that is maybe, hopefully, going to give them the edge versus another person at their level, because they had these great learning opportunities in the internship." MECC, Internship Coordinator

Hands-on Learning: Students from both colleges who participated in internships reported many benefits including opportunities for real-world practical experiences; the development of professional skills; and support for future education and career goals. A major theme cutting across many student interviews was the benefits of internships for hands-on learning experiences in an actual work setting. Through internships students experienced the practical applications of

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6 Author analysis of student administrative data confirms that the majority of students at both schools enrolled in the internship during their last two semesters before graduating.

7 According to our MWCC internship survey, 36% (N=28) of the men and 24% of the women (N = 5) received a job offer from their internship employers. Sample too small to report by race/ethnicity.
the theories that they had learned in class. They also had the opportunity to develop skill with new equipment and work systems and in some cases earn industry certifications. Many students shared some version of the idea that there is no substitute for real-world experience. One student illustrated this concept with the example of students from large universities coming into the workplace with extensive classroom knowledge but “no idea how to turn a wrench.” Another recounted learning how to write instructions for processes and shared that they had not realized how much technical writing is part of the engineering field.

“There are multiple things that the classroom experience alone cannot teach you.” MECC Student

“You know, it's pretty cool stuff. Some of it is way over my head, but I'm trying to pick up what I can and learn what I can. I know that when I leave I'm gonna have a better skill set then when I went in.” MWCC, Student

**Development of Professional Skills:** Students reported the development of professional skills in addition to the technical skills. They became aware of “workplace citizenship” where their reliability, teamwork, and consideration of others was important to be an effective and productive team member. Some had to learn customer service skills for the first time along with time management and effective communication with co-workers and supervisors. Students reported benefitting from the opportunity to learn from co-workers to expand their skills in all areas of work and the creative gains of collaborating. One student specifically noted the importance of learning not to say “no” but instead “I will figure that out.” Others discussed learning to interpret what clients want even when they lack the terminology or know-how to clearly express those needs.

“[The internship] helped me more with my soft skills. Working with people, being able to delegate tasks, making sure that I was able to complete tasks on time and efficiently. It helped me become more of a team player.” MECC Student

“I've learned really a lot about balancing and how to set priorities. [There is] bigtime value in looking a little bit further ahead so that you know what's coming up. It is not uncommon with this many employees and stuff to have three or four people sending you messages and calling you at the same time to have something fixed. So you [learn] to step back, look at it, figure it out.” MWCC, Student

**Professional Networking and Career Exploration:** The internship also opened-up avenues for networking to pursue future education and career goals with management and other decision-makers. Students also gained valuable knowledge about career pathways in technology from entry-level positions to advancement and gave them the opportunity to see if a technology career was a good fit.

“Sometimes we’re not sure if what we are studying is what we really want to do. The opportunity to go and work in something related then definitely say ‘Yes, I want to do this’ or maybe ‘I need something else.’” MECC, Student
Students valued exposure to multiple roles and experiences within the company, especially being able to see what others do and how the system works as a whole. This enhanced understanding of the field and their potential role within it and can inform their future job search and potentially benefit them in obtaining the right job for them. One student recounted working with both a mechanical engineer and a machinist, explaining that one was “desk-focused” and the other “hands-on”. The student learned from observing the symbiosis between them, as well as the difference in their mindsets and roles. Students expected the skills and experience they gained during their internships to benefit them in procuring future employment.  

The positive experiences students had in internships was also reflected in the MWCC internship survey. All the women respondents and 90% of the men reported that “I am a good fit with this company.” Similar results were found in response to the question, “My internship confirmed my technology education and career interests.” Students also overwhelmingly agreed that the day-to-day work in the internship “was related to my technology education” and that “the internship gave me the opportunity to learn new skills to further my education and career goals.”

Internship fills middle skill STEM “niche”: Employers sought out technology interns to fill current middle skill technology needs and to build a pipeline of potential candidates for future needs. Employers from both colleges noted that the colleges did a good job preparing students with the technology skills to be successful in their internships. Several employers favorably contrasted the knowledge and skills of students with those of students from 4-year universities. In particular, employers reported that, in their experience, community college students had more practical knowledge and better problem-solving skills than their counterparts in bachelor’s degree programs which tended to emphasize more theoretical foundations. As one MWCC employer described it, “I appreciate a 4-year degree, but I honestly prefer someone who knows how to think rather than just what to think….People from 2-year schools are taught that it is okay to not know something because they know how to figure it out.”

Internship-Related Challenges for Students:

Low Student Participation in Internships: Our research showed that most technology students did not participate in internships. Most students left the technology program before they were eligible to participate. At both colleges, fewer than 2% of the students who left the college before earning a degree participated in an internship. For most of these leavers, non-
participation occurred because students left college before earning enough technology credits to participate in the internship course or did not meet the technology GPA requirements to participate in the internship. For those who persisted, most of the students who participated in an internship were required to do so for graduation. At MWCC where the internship is required for the IT and ET degree, 88% of the IT graduates and 83% of the ET graduates completed an internship. At MECC, where the internship is required for the Marine Engineering and Biomedical Engineering Technology degree, 96% of Marine and Biomedical ET graduates completed an internship compared with 15% of the IT graduates. Where internships were required, at both MECC and MWCC, women and students of color participated in shares that were proportionate to their representation as graduates. Where not required in the MECC IT program, students of color participation in internships in proportionate to their representation as graduates while women were 13 percentage points more likely to participate compared to their representation as graduates.

Students Lacked Understanding of Internship Process and Options: At both colleges, the first challenge that students faced during the internship process was understanding and identifying internship options. Students at both schools reported not knowing if the internship was required for graduation, eligibility pre-requisites, and alternative options for meeting requirements. They described a lack of guidance about internship requirements and the overall process, including when the internship should take place, the sequential pathway toward completion of the requirement, and the paperwork and preparation necessary prior to beginning. Many students indicated they lacked a clear path to and through the internship process, including timelines and benchmarks to guide their journey. Students lacked awareness of where to find assistance with searching and preparing for internships. In one case a student was opted-out of the internship because they had already completed an alternative class.

“There’s an internship part of the degree, but it can also be opted out of [with] a certain class, and somehow I did that without knowing so I didn’t get the opportunity to do the internship. I was opted out before I knew it existed.” MECC, Student

Applying for Internships: At both colleges, applying for the internship was also a challenge that students faced in the internship process. Students - both those who had completed internships and those who had not yet completed them - conveyed a need for additional support from the college in preparing for and procuring internships. Interviewees expressed a strong need for help in identifying employers to work with. Students without established contacts in the industry described being “left to flounder” in the search for an internship. As one MWCC student lamented, “You’re almost having to beg people to take you as an intern.”

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11 Participation was less than 100% because some students were allowed to use prior work experience to earn their internship credit or substitute the internship with a capstone project. Internship participation has risen from 84% of graduates in 2015 to 96% in 2019.
12 At MECC, the internship was not offered for credit (either as an elective or required) in the Electrical and CNC Engineering Technology programs.
The challenges surrounding finding an internship were reflected in the MWCC Internship Survey. Finding an internship was by far the most difficult aspect of the internship. 78% of the women and 64% of the men reported that finding an internship was somewhat difficult, difficult, or very difficult. In comparison, 66% of white students, 59% of Hispanic students, and 87% of Black students reported that finding an internship was somewhat difficult, difficult, or very difficult.

Lack of Employer Support: In many cases students described a marked lack of employer interest in developing intern knowledge and skill beyond the narrow parameters of the employer’s desired work product. Some students discussed both a general lack of on-the-job training and support as well as a workplace environment that discouraged questions and de-emphasized on-the-job learning. As a result, many interns were left on their own to figure out how to get things done. These challenges may be related to the time students spent with their employer supervisors which varied significantly from student to student. According to the MWCC Internship Survey, 34% of respondents met with their supervisors several times per week, 29% once per week, 10% once every two weeks, and 19% less than 2 times per month.

“[The internship] felt a little weird […] I never actually met anybody from [the company] or was trained in any way, or did anything, or met anyone that went to the facility.” MECC Student

“I think that if a company is going to offer an internship that they need to have a better understanding of what that really means. You have a student coming out of school [who] has never been in this position before and he needs guidance and advice. And if he has a question or doesn’t understand, don’t make him feel bad because that’s how I'm made to feel. If I am told to do something and I’m given very vague instructions on how to do it, if I then go back and ask another question, [the employer] makes me feel bad. And so then now I will sit at my desk for hours trying to figure it out on my own before I go ask him because he's not approachable and I don't feel comfortable.” MWCC Student

Understanding the Technical and Professional Demands in the Work Environment: Some employers reported that interns didn’t understand the different expectations between classroom or work situations or had trouble applying what they had learned. According to employers, some interns were unprepared to keep up with the activity level and pace of change in a real work environment, something that employers also noted that was a challenge for four-year college graduates. Employers believe that students need better career guidance on realistic job expectations and career pathways, and better preparation in terms of resume writing and interview skills. One employer shared his belief that students should have to do an internship earlier in their college program so that they can learn what the day-to-day work is really like before they have invested too much time and money in the training.

“But getting back to the biggest challenge, so I would say it's them [students] thinking they understand the actual business side of this. And the only way to help them understand that there's a lot more than what they assume that they know is to actually speak to them and ask them questions and just bring light to what they think they
understand but really don't. And sometimes they get it, and sometimes they don't.”

MECC, Employer

Lack of Pay, Scheduling Conflicts and Transportation Challenges: Students also sent a strong message that unpaid internships are untenable for them. According to the MWCC Internship Survey, only about half the interns were paid with no difference by gender or race/ethnicity. Other challenges identified in the internship survey were related to transportation to the place of employment and fitting in the responsibilities of the internship along with other family, work, and academic obligations. According to the MWCC Internship Survey, 41% of men and 48% of women found it difficult to find reliable transportation to their internship. By race, Black students found this most challenging (30%) compared with less than 10% for other groups. 60% of the men and 63% of the women found fitting in the internship along with other obligations to be difficult. By race and ethnicity, 66% Asian interns found this a challenge along with, 40% Black interns, 60% Hispanic and 65% white interns.

“I've met a couple of people where it's holding them back from graduating—being able to find a [paid] internship—because college students can't work for free. An unpaid internship just doesn't work for people who are coming out of college. They [have] many student loans and are in debt, and now they're expected to work for a company for free?” MWCC, Student

“A lot of our students in these AS programs work during the day and they’re coming to school at night. So, they don’t have the opportunity to do an internship – they can’t give up their jobs.” MECC IT Dean

“The biggest challenge by far is that the majority of the internships are unpaid.” MECC IT Faculty

Lack of Inclusion: A subset of challenges particularly affected female and non-white students. In some cases, these students reported being treated as if they didn’t belong in the workplace—an attitude or message of “what are you doing here?” One non-white student expressed that this can result in self-doubt, explaining “You can feel intimidated when you’re walking into a room full of people that don’t look like you... should I even be here?...you get that type of vibe.” One female student reported feeling dismissed and discounted by both customers and co-workers, who expressed a preference—sometimes overtly—for dealing with her male counterparts. This student also recounted experiencing over-friendliness and “touchy-feely behavior” in the course of their internship experience.

Internship-Related Challenges for Employers:

Establishing Internship Scope of Work & Learning Objectives: For employers, internships can create a different set of challenges. Some administrators shared that the issues they most often heard from employers include challenges related to setting up an internship program for the first time and preparing detailed job postings to find the right student to hire. Some employers also need support to appropriately structure an internship to meet college requirements. This challenge was also shared by faculty who work with employers and students to develop learning
objectives. From the perspective of faculty, employers also struggled to provide mentors for interns something particularly difficult for small companies.

“We could have used more help from the college setting up the internship.” MWCC, Employer

Scheduling Challenges: Employers of all sizes, whether offering paid or unpaid internships, agreed that scheduling was a pervasive challenge. For some, the short time frame of an internship (60 to 180 hours over a 15 to 16-week semester) meant that interns were constantly churning through a position. As one described it: “You just get the intern up to speed and it’s time for them to go.” Other employers identified a challenge with the intern’s available hours – interns who only worked one day per week took longer to onboard and were slower to pick up on the work. Many employers noted that internships required more active supervision and thoughtful work assignments than regular employment positions. One small employer shared his frustration that “you can’t just give them an assignment and walk away” and that there were many days where he struggled to keep the intern busy with relevant work. Others noted issues with the workplace behaviors of interns, including poor phone etiquette, failing to show up or communicate about absences.

Lack of Ongoing CC Support: Several employers reported that there were not enough opportunities to connect with the college during the internship, whether for guidance or feedback. Large and small employers both shared a desire for more active guidance from the colleges to help in structuring the internship experience, including support in developing effective job descriptions, and more check-ins from the college throughout the internship period. Employers also wanted more opportunities to provide feedback to the college on interns as well as on their experiences with the internship program and student preparation overall for IT and ET occupations. One MWCC supervisor echoed the need for this kind of feedback loop to help the college understand why students get hired, what is working, and what needs to be adjusted to help students better meet the needs of employers.

Diversity, Equity, and Inclusion: We found that employers largely deflected questions on diversity with statements about “hiring the best applicant” without regard to personal characteristics. Some reported that their workplaces were diverse, with “a mix of people from all walks of life.” Only two employers from MWCC shared that their companies have specific initiatives around diversity, equity, and inclusion with one identifying outreach efforts to recruit a more diverse applicant pool and the other noting diversity training for supervisors and other employees. Others reported that while they would love to hire more diverse workers, there just isn’t enough diversity in the pipeline for them to do it.

“Everyone who has come through in some way was from an underrepresented group.” MECC, Employer

“They’ve been coming in all shapes, sizes, backgrounds, gender, everything...I like the fact that it happens organically.” MECC, Employer
Beyond this lack of attention to diversity, we also found during the interviews that some employers revealed negative or limiting attitudes about women in technology. These spanned ideas that older women are unlikely to understand technology and require special handling by IT staff, that a woman should make sure the men around her are comfortable with her being in the workplace, and that women should be spoken to in a softer tone of voice and treated more gently than men. One biomedical engineering technology employer shared that while he would ask a male applicant to demonstrate his skills on a piece of medical equipment, he would give a female applicant a task “more specific to typical female culture.”

One ET employer (and several faculty from both colleges) noted that in manufacturing the shop floor can be a hostile environment for women and minorities, so more needs to be done to address workplace culture if the company wants to attract and retain a diverse workforce. One employer from MWCC offered this summary perspective: “Could we use additional help on improving diversity and inclusion? Yeah, I think everybody could. I don’t think anybody is telling the truth if they say ‘no, we got this.’”

VII. Discussion of Findings

This research demonstrated the potential of credit-bearing technology internships to build student self-efficacy towards their education and career goals; enhance technical skill acquisition through the hands-on learning experiences; and develop professional skills and understanding of career pathways in technology. Across both case study schools, students, faculty, administrators, and employers agreed on these positive aspects of technology internships. Students, faculty, administrators, and employers also agreed that internships provide students with a bridge to employment by teaching them how to find and apply for technology jobs and providing work and networking experiences in the field – something that is highly valued by employers.

Students who participated in technology internships overwhelming agreed that the experience gave them both skills, experience, and confidence to pursue further technology education and career goals. With few exceptions, these outcomes did not vary significantly by gender or race/ethnicity. The exceptions were for women and learners of color who sometimes felt unwelcomed and hostility in the work environment.

From the student perspective, the biggest challenge to the internship was the difficulty students had understanding the internship process, finding relevant opportunities, and applying for them. Our research suggests that students require ongoing assistance from CC faculty and career counselors applying for internships which was the most difficult part of the process. Of particular importance is curating viable technology jobs out of the overwhelming number of online postings and offering ongoing guidance during the application process and the internship itself.

We also found that unless the internship is required for graduation, it is unlikely that students will participate. This is likely because of the difficulty for students of finding, applying for, and negotiating internships – especially those that pay - with employers. When the internship is required, the college is obligated to provide the support services and scaffolding necessary to ensure that their students are matched to relevant internships.
Requiring internships, however, is only a first step in creating successful opportunities for students. In addition to requiring internships for graduation, our research suggests that internships could be strengthened through more ongoing and targeted support for students throughout the internship to help students create meaningful and appropriately challenging learning objectives, communicate with employers, and resources to address technical and professional challenges.

Community college support for employers is also crucial to the process. Engaging more employers in the internship process and increasing employer retention in the program would allow more students to benefit from them. Employers require assistance creating an internship scope of work that matches the technical and professional skills students bring with them into the workplace while building opportunities for technical and professional growth. Faculty have much more in-depth and intimate knowledge of the skills that students will bring to the job and are in the best position to assist employers to develop feasible, engaging and appropriately challenging learning agendas. Employers also need guidance from CC’s about how to onboard interns into their organizations and provide students with appropriate supervision, coaching, and mentorship. Once on-the-job, students need not only employer mentors and supervisors but also ongoing faculty support to help monitor learning objectives, navigate workplace cultures, develop productive workplace relationships, communicate with supervisors and mentors, and problem-solving in a fast-paced environment.

To be effective for all students, CC’s need to provide underrepresented students with targeted support to navigate technology careers in which they are a minority and provide employers with strategies for building diversity, equity, and inclusion in the internship experience. Additionally, for internships to be viable for all students they need to be paid, allow for flexible scheduling, and be geographically accessible (or have online opportunities). By working closely with employers throughout the internship process, community colleges can insure successful outcomes for both students and employers.

VIII. Study limitations and future research

The case study approach to studying technology internships is appropriate because they take place within institutional settings (the college) coordinating multiple stakeholders (students, faculty and administrators, employers). The case study approach gave us the opportunity to “observe” internship design, participation, and outcomes in a real-life setting from the perspective of students, CC faculty and administrators, and employers. This kind of multifaceted data on technology internships is not available in college, state, or federal datasets. Triangulating information from these stakeholder groups and across two colleges, allowed us to observe how internship experiences were impacted by CCs and employer support, resources, engagement. A key limitation of the case study approach however is generalizability. What applies in other settings (states, colleges, programs) would require additional case study analysis.

IX. Conclusion

Internships have the potential to serve as an effective bridge to employment for community college technology students. With the right structures and resourcing, they provide students with
important hands-on real-work technology experiences, help them build professional skills, and cultivate self-efficacy and tools towards reaching their education and career goals. Since these are qualities that employers look for in job candidates, internships can help students demonstrate that they are prepared for the workforce. To be effective, however, structures need to be in place to support, guide, and engage both students and employers in the process. Requiring technology internships for graduation is a key to full student participation. The requirement obligates colleges to establish necessary structures and resources to adequately connect and support students and employers in this important work-based-learning opportunity. Without the effective structures and resources to support them, internships will likely remain beyond the reach of most CC technology students and may serve to reproduce inequality if only those students who face the fewest barriers to participating in technology internships are able to participate.

**Acknowledgements:**

Much gratitude goes to our research partners from the Florida College System and the engineering technology (ET) and IT students, faculty, administrators, and employers for taking the time to talk to us and share their insights, experiences, and understanding about how internships work, for whom, and under what conditions. Our research would not have been possible without their generosity. A committed group of researchers conducted the data collection and analysis that made this article possible. Tara Smith, Associate Research Director, JFF, developed interview protocols, conducted interviews, developed codes for analysis, and analyzed and summarized the qualitative interview data; Nia Yisrael, Project Manager, JFF, coordinated and scheduled the interviews; arranged for gift cards for students and faculty; conducted, coded, and analyzed interviews; and managed the budget for the project; Valentine Pedroza, Senior Research Associate, WestEd, analyzed the student administrative and survey data that supported the qualitative analysis; and Adrienne Washington, Research Associate, WestEd, developed codes for the analysis of interviews and analyzed and summarized the qualitative interview data. This material is based upon work supported by the National Science Foundation under Grant No. NSF 1760993. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation. The author reports there are no competing interests to declare. IRB approval to conduct this research which included interviewing and surveying community college students was obtained by the IRB boards of the two case study colleges participating in this study.

**X. References**


Table 1: MWCC Student Internship Survey Summary Results

<table>
<thead>
<tr>
<th>Survey Question</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>CC Resource was Very Helpful or Helpful in Finding</td>
<td></td>
</tr>
<tr>
<td>Internship:</td>
<td></td>
</tr>
<tr>
<td>CC Faculty</td>
<td>77%</td>
</tr>
<tr>
<td>CC Internship Coordinator</td>
<td>71%</td>
</tr>
<tr>
<td>Resume Building Workshop</td>
<td>71%</td>
</tr>
<tr>
<td>Internship Interview Workshop</td>
<td>75%</td>
</tr>
<tr>
<td>Career Fair</td>
<td>55%</td>
</tr>
<tr>
<td>Question</td>
<td>Response</td>
</tr>
<tr>
<td>----------</td>
<td>----------</td>
</tr>
<tr>
<td>Did you create an internship from an existing job?</td>
<td>Yes</td>
</tr>
<tr>
<td>Found these internship and search activities Very Difficult or Difficult:</td>
<td></td>
</tr>
<tr>
<td>Finding internships to apply for</td>
<td>36%</td>
</tr>
<tr>
<td>Interviewing</td>
<td>13%</td>
</tr>
<tr>
<td>Testing for technical skills</td>
<td>7%</td>
</tr>
<tr>
<td>Developing learning objectives</td>
<td>11%</td>
</tr>
<tr>
<td>Negotiating flexible schedule</td>
<td>11%</td>
</tr>
<tr>
<td>Preparing resume</td>
<td>5%</td>
</tr>
<tr>
<td>Was this a paid internship?</td>
<td>Yes</td>
</tr>
<tr>
<td>Strongly Agree or Agree with Following about Internship:</td>
<td></td>
</tr>
<tr>
<td>Able to communicate with employees at company</td>
<td>96%</td>
</tr>
<tr>
<td>I feel like I am a good fit with this company</td>
<td>91%</td>
</tr>
<tr>
<td>I have been encouraged to speak up at meetings</td>
<td>91%</td>
</tr>
<tr>
<td>I have been encouraged to take on more responsibility</td>
<td>92%</td>
</tr>
<tr>
<td>I have the opportunity to meet people in other departments</td>
<td>91%</td>
</tr>
<tr>
<td>I had a good introduction to the company when I began</td>
<td>95%</td>
</tr>
<tr>
<td>I was readily able to get help with communication challenges</td>
<td>85%</td>
</tr>
<tr>
<td>I was readily able to get help with technical challenges</td>
<td>90%</td>
</tr>
<tr>
<td>I know where to get help when I need it</td>
<td>96%</td>
</tr>
<tr>
<td>I have learned skills needed to be successful in my internship</td>
<td>90%</td>
</tr>
<tr>
<td>Learning to work as a team has been difficult</td>
<td>17%</td>
</tr>
<tr>
<td>My supervisor has given me support</td>
<td>94%</td>
</tr>
<tr>
<td>My supervisor gave me clear expectations when I began</td>
<td>90%</td>
</tr>
<tr>
<td>The work I am doing makes a valuable contribution to the company</td>
<td>92%</td>
</tr>
<tr>
<td>I have had the flexibility to set my own hours</td>
<td>94%</td>
</tr>
<tr>
<td>I have had the opportunity to learn skills to further my education and career goals</td>
<td>94%</td>
</tr>
<tr>
<td>The day to day work in my internship was related to my technology education</td>
<td>91%</td>
</tr>
<tr>
<td>It has been a challenge to fit my internship into with other responsibilities</td>
<td>41%</td>
</tr>
<tr>
<td>I have found it difficult to find transportation to my internship</td>
<td>13%</td>
</tr>
</tbody>
</table>
Already employed at this company prior to internship: 11%

Strongly Agree or Agree with these internship outcomes:
- A career in technology is a good fit for me: 98%
- I developed stronger communication skills: 95%
- I developed stronger teamwork skills: 93%
- I learned new technical skills: 93%
- Interested in pursuing further technology education: 91%
- Developed negotiation skills: 80%
- Would like a permanent job at this company: 80%

Demographics:
- Female: 20%
- Male: 70%
- Black: 10%
- Hispanic: 18%
- White: 53%
- Asian: 8%

N=106: Fielded at MWCC March 2019 - March 2020 (Pre-Pandemic)

### Table 2: Interview Sample

<table>
<thead>
<tr>
<th></th>
<th>MWCC</th>
<th>MECC</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
</tr>
<tr>
<td><strong>Students</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>8</td>
<td>27%</td>
</tr>
<tr>
<td>Male</td>
<td>21</td>
<td>70%</td>
</tr>
<tr>
<td><strong>Nonresponse (gender)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>16</td>
<td>53%</td>
</tr>
<tr>
<td>Black</td>
<td>4</td>
<td>13%</td>
</tr>
<tr>
<td>Nonresponse (race/ethnicity)</td>
<td>Hispanic</td>
<td>0</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>----------</td>
<td>---</td>
</tr>
<tr>
<td>Asian</td>
<td>3</td>
<td>10%</td>
</tr>
<tr>
<td>Nonresponse (race/ethnicity)</td>
<td>7</td>
<td>23%</td>
</tr>
<tr>
<td>Internship (Yes)</td>
<td>ET</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>IT</td>
<td>20</td>
</tr>
<tr>
<td>Total</td>
<td>18</td>
<td>60%</td>
</tr>
<tr>
<td>Total</td>
<td>30</td>
<td>50%</td>
</tr>
</tbody>
</table>

### Faculty & Administrators

<table>
<thead>
<tr>
<th>Faculty &amp; Administrators</th>
<th>IT Faculty</th>
<th>5</th>
<th>31%</th>
<th>4</th>
<th>31%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ET Faculty</td>
<td>5</td>
<td>31%</td>
<td>2</td>
<td>15%</td>
</tr>
<tr>
<td>Math Faculty</td>
<td>2</td>
<td>13%</td>
<td>0</td>
<td>0%</td>
<td></td>
</tr>
<tr>
<td>IT Dean</td>
<td>1</td>
<td>6%</td>
<td>2</td>
<td>15%</td>
<td></td>
</tr>
<tr>
<td>ET Dean</td>
<td>1</td>
<td>6%</td>
<td>4</td>
<td>31%</td>
<td></td>
</tr>
<tr>
<td>Internship Coord.</td>
<td>2</td>
<td>13%</td>
<td>1</td>
<td>8%</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>16</td>
<td>13%</td>
<td>13</td>
<td>8%</td>
<td></td>
</tr>
</tbody>
</table>

### Employers

<table>
<thead>
<tr>
<th>Employers</th>
<th>IT</th>
<th>10</th>
<th>62%</th>
<th>5</th>
<th>83%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ET</td>
<td>6</td>
<td>38%</td>
<td>1</td>
<td>17%</td>
</tr>
<tr>
<td>Total</td>
<td>16</td>
<td>6</td>
<td>16</td>
<td>6</td>
<td></td>
</tr>
</tbody>
</table>

Total All | 62 | 50 | 50 | 50 |