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Broadening participation in engineering and STEM workforce development through unconventional community partnerships

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Jared Halsey

Ever since I was a child, I've been intrigued by every aspect of technology. This curiosity would propel me toward learning about technology and want to learn how items are made. Fast forward a few years, I am an electrical engineer who wishes to focus on RF & optics. It's been a hard journey getting through school but I enjoy every moment and lesson learned.

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Abstract
While enrolled in a university, many students desire a way to secure employment in the industry of their major. How does the student actively secure their potential job? The typical answer would be by procuring an internship. Traditionally, internships can be secured by students applying for formal internship programs, or even by arranging an internship through the career center at their respective universities. However, there are internships that are obtained by non-traditional means. There are times when opportunities arise in the most unlikely circumstances. This paper will discuss a student perspective of obtaining and participating in an informal industry-sponsored internship in engineering through unconventional community partnerships. Unconventional community partnerships include community centers, places of worship, and social venues (i.e. cafes, cafeteria). A transcript-like version of student-to-workforce interactions that are available to the student is proposed. These transcripts should be reviewed like academic transcripts to flag students that have "leaked out" (i.e. no matriculation, no graduation, no work placement) of the pipeline. Lessons highlighted in this paper may assist in broadening participation in engineering and STEM workforce development.

Introduction

As engineering students progress through their undergraduate education, often they would want work experience in industry. To do so, some schools offer a co-op program so that students could work and gain the necessary experiences. Internships give insight to students, enabling them to learn how the industry works by shadowing a mentor whom of which will help them navigate through situations that are different from what their student was taught. For a student to become the best version of themselves in industry, the theoretical concepts learned from class and hands-on work experience are needed.

Often, schools will have some type of connection with companies outside of the school as well as an internship program available. What does a student do when neither of these situations is present?

If a school does not have any formal programs or immediate industry connections, most students will find themselves on an external commercial job search site looking for the ideal position. These sites tend to require many prerequisites, some fair and others unfair for a person that is trying to get their foot into the door. If one does not meet all the requirements and is denied during the application process, what is next?

The benefit of networking with those immediately within reach will be explored in this paper.

This network could be friends, family, coworkers, and teachers [1]. Unconventional community partnerships include community centers, places of worship, social venues (i.e. cafes, cafeteria).We will examine the case of a student that leveraged an established relationship and a small community that allowed entry into unexpected opportunities.

The Benefits of Networking

Excerpts of a student's essay on the internship experience follow in this section[2]. This section highlights the discouragement the student experience while undergoing the application process. "While in school I would often think of the benefits of having an internship. This would include being able to apply the knowledge I learned in classes to the real world as well.

By the time my senior year came around, I felt the time for an internship lined up before I graduated was ending quickly. I would apply for multiple positions in various states, all applications ended up being denied as I "did not have enough work experience" which is what I was attempting to gain. I felt discouraged and wondered if I would ever be able to get a position of any sort at this point. This would lead to me contacting my teachers to see if they knew of any places but all they could recommend were simple commercial job-searching websites.

After feeling discouraged, by the constant back and forth with my applications, I gave up actively searching online. I thought I would have to start again somewhere why not start by asking family members, friends, and acquaintances? I ended up doing just that. As a disclaimer, I want to mention that each of the people I mention for this portion of networking is those I have spoken with on multiple occasions over at least two years. At first, asking family members did not go in my favor as there was no person they could immediately contact. Next, I went on to ask friends that had family members in any engineering field, asking if there was an open position as well as any advice prior to entering the industry. This interaction only left me with advice, they would hold on to a copy of my resume, but sadly no internship position developed. At this point, all I could do is wait.

Networking between my immediate community proved to be immensely helpful later. Although it was not immediate, some friends and family would forward my resume to their friends and family. That pattern continued until there were a few job offers available to me."

Preparation for the Interview

The following excerpt discusses the steps the student took to prepare for the internship hiring process. "Preparation for an internship is crucial to secure a spot. The first thing that would need to be organized is your resume. Making sure all the relevant work experiences (if you have any), accomplishments and skills are properly listed can help you stand out. Assuming one has the right skills for the job gained from academic experience, that should be listed on the resume. One can even display projects they did either for class or in a club.

Prior to an interview, it is best to express interest in the company and do research prior to working for any company. Nobody should go to an interview without knowing what the mission of the company is. In this case, before I was interviewed and hired at J-Factor Embedded Technologies, Inc., I did just that. At the time of the interview, I would be briefly tested on the basics of what I learned in college such as how a circuit works, how to use a DMM, etc. Even though I did prepare and was able to get this internship, I still felt unsure of myself. It is okay to not know everything

prior to going into a workspace. Remember, an internship's purpose is to obtain hands-on work experience and more applied knowledge."

Internship Experience

Internships are more necessary in today's workforce with the benefit of potentially greater opportunities later down the line. Internships are more than likely to be a student's first experience in the industry[3]. By shadowing and working with professional engineers, interns can gain skills and polish them prior to becoming full-time engineers.

At the end of the student's narrative he recounts his internship experience. "Initially, my experience as an intern felt like a rollercoaster. There would be a sizable number of days I would feel discouraged. Prior to my first day as an intern, I thought I knew a decent amount prior to work based on the knowledge learned in both class and labs. That could not have been more wrong. On my first day, I was told to use programs that are entirely different than what I was used to. This would include the likes of Altium as well as Nextion. These programs were new to me and were nothing similar compared to what I learned in school. It is a good thing that I had a mentor during my internship who would help guide me through how to operate these programs.

Eventually, everything clicked. A few years later and I can say that the experience is extremely helpful. I learned how to do many things such as build a PCB, utilize the Command Line Interface, and read datasheets to see how various parts need to be wired for the board to perform our desired tasks."

Conclusion

After I read this student narrative about the internship process, it appears to me that there are significant hurdles that domestic underrepresented students experience as they prepare to enter the workforce[4]. It is disturbing to learn of the discouragement and apathy the student experienced from the faculty. The faculty member should provide guidance to the student to identify the career center and discipline-specific professional organizations. It is not clear how to develop good will in faculty in order for faculty to empathize and support students that fall out of formal STEM pipelines. The takeaway from this paper is that many of the critical decisions that are important to the professional development of students are left to informal systems that rely on good will and existing social constructs. Typically, students use job fair schedules and graduation as prompts to prepare to enter the workforce. First-generation and underrepresented students typically have external responsibilities (i.e. low-wage employment outside of the discipline, lack of childcare) that limit their access to these informal prompts. If a student happens not to benefit from the good will of a faculty or career counselor, then their career trajectories are significantly disrupted.

It is proposed to formally document the student-to-workforce pipeline. A formal system like a transcript that tracks student-to-workforce development activities is recommended. Formal STEM pipelines are traditionally academic programs, formal industry internship programs, and on-campus research experiences. For example, participation can be tracked and used to identify if a student has "leaked out" (i.e. no graduation, no work placement) of the pipeline. This one student is 100% of an entire demographic at the institution. Historically, the data sets have been limited to 1 or 2 students of this demographic. In some cases, a single essay is all the evidence an institution can access to plan DEI interventions and improve academic programming. Our recommendation for addressing the STEM pipeline leak is to create a system to track students that fall out of formal

STEM pipelines. The system can assist the student to return to the pipeline if the student desires. The system will support the student to secure employment in the engineering discipline.

References

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