Assessing the Impact of Internships on Undergraduate Students' Academic Success: A Case Study of Engineering Technology and Related Programs

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Dr. Mulay has been working with minority students in the STEM fields since her graduate school days. She has been assistant director for the REAP summer camps funded by NSF, which aimed towards increasing the participation of minority students in STEM research. She has also been part of the FAMU STEM Day team, assisting with the demonstration and experiment portion of this annual event. She has assisted many undergraduate students in getting internships and scholarships through various programs.

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Abstract: (Evidence-based Practice Papers)

This study examines the influence of internships on undergraduate success in engineering technology and related disciplines. While many students opt for summer classes to accelerate graduation, internships are critical for developing practical skills, understanding career paths, and bridging the gap between academic learning and industry practice. Using Kolb's Experiential Learning Theory as its framework, the research explores how internships enhance active experimentation and reflective observation, helping students apply theoretical knowledge to real-world contexts. The study focuses on Architecture, Construction Engineering Technology, Electronic Engineering Technology, and Facilities Management programs, using surveys to assess students' perceptions of internships. It collects quantitative and qualitative data to analyze the impact of internships on academic interest, performance, and career readiness. Results are expected to show a positive correlation between internships and academic success, including increased course engagement, improved performance, and enhanced professional preparation. The findings emphasize the importance of incorporating experiential learning into curricula to prepare students for their careers better. The study highlights internships as essential complements to traditional education, encouraging academic institutions to prioritize these opportunities. Future research will examine the long-term effects of internships on career trajectories and strategies to increase student participation in such programs.

Keywords: Experiential Learning, Internship, Undergraduate Success, Engineering Education, Student Engagement.

Overview

Internships are a cornerstone of higher education, particularly in engineering and engineering technology and other similar disciplines, providing students with hands-on experience and practical exposure to real-world challenges. While many undergraduate programs require students to complete internships before graduation, a notable number of students prioritize taking summer classes to accelerate their academic journey. Despite this trend, co-curricular activities like internships are vital as they provide essential skills, practical experience, and a clearer understanding of future career paths. Landis [1] discussed the importance of pre-summer employment for engineering students to broaden their education. Some of the benefits he discussed in his book were the opportunity for students to develop employment searching skills, exposure to engineering practices, and applying the knowledge, skills, and abilities to the tasks provided at the job. Another benefit is that students can earn an income that will assist in the cost of education.

This study investigates whether internship opportunities foster increased interest in coursework and improved academic performance among undergraduate students in Architecture, Construction Engineering Technology, Electronic Engineering Technology, and Facilities Management programs. The motivation for this study stems from the belief that experiential learning, through internships, plays a crucial role in bridging the gap between academic learning and industry practice. The theoretical framework guiding this research is Kolb's Experiential Learning Theory,

which emphasizes learning as a process of transforming experience into knowledge. According to this framework, internships offer students the chance to engage in active experimentation and reflective observation, reinforcing theoretical concepts learned in class and applying them in practical, real-world contexts.

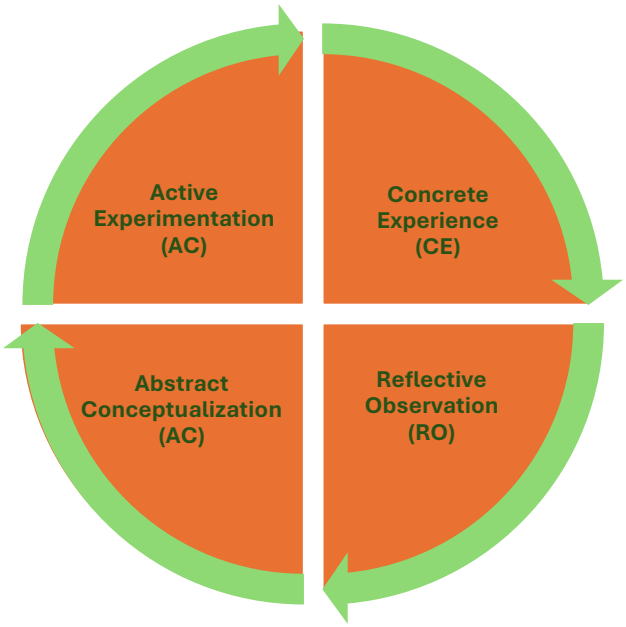

Figure 1: Kolb's Experiential Learning Theory

The research adopts a case study approach, employing survey methods to gather data on the experiences and perceptions of undergraduate students regarding internships. Students across four different programs were surveyed to determine how their internship experiences influenced their interest in their courses, overall academic success, and readiness for professional careers. The survey results collected allowed for a comprehensive analysis of the correlation between internships and educational outcomes. The hypothesis was that the student responses would demonstrate a positive correlation between internship participation and student success metrics, such as increased academic interest, better course performance, and enhanced readiness for professional careers. These insights highlight the importance of integrating experiential learning opportunities into the curriculum, encouraging educational institutions to emphasize internship programs as an essential element of undergraduate education.

Objectives

The main purpose of this paper was to survey students from the Architecture, Engineering Technology programs (Construction and Electronic), and Facilities Management at the School of Architecture and Engineering at Florida Agricultural and Mechanical University. The survey was collected from students of all levels: freshmen, sophomores, juniors, and seniors. The reason for including all levels was to.

1. Collect the perception of students on the importance of internship

2. Get feedback from students who have already completed at least one internship.

The results from the two groups provided a clear analysis of why internships are important for students in their performance and post-graduation plans, whether joining a graduate program or going to work in the industry. The articles reviewed collectively emphasize the multifaceted benefits of internships, from academic performance enhancement to improved career readiness.

Key Benefits of Internships

Bridging Theory and Practice

Bringing theory and practice from the classroom to the industry is one of the important aspects of providing valuable internship experiences for students. Making sure the curriculum aligns with what the industry needs knowledge. Boettcher and Kempler [2] highlight that internships in electrochemical engineering help students integrate theoretical knowledge with practical skills. This alignment prepares them for clean energy challenges, illustrating how experiential learning bridges academia and industry. Similarly, Ghaleb et al. [3] underline that internships enable engineering students to apply classroom concepts to real-world problems, reinforcing the transformative power of experiential learning.

Enhancing Academic Performance

One of the benefits of internships is that they provide growth and maturity for students who have not been involved in a professional working environment. With the structured work schedule and deadlines, students begin to understand the need to have good time management and be self-driven to gain the knowledge they need to benefit from the experience. Kuduz and Kaçar [4] focus on how internships foster improved understanding and application of technical skills, such as machine learning and biomechanical analysis. Their findings show a direct correlation between hands-on internship experiences and academic success in coursework. Nguyen and Ricke [5] explore public health internships, demonstrating how such opportunities increase students' engagement with their academic curriculum and inspire higher performance levels.

Career Readiness and Skill Development

The process of obtaining an internship in the United States is very similar to seeking a full-time job, where students have to provide a presentable resume, apply to a company, and get interviewed. Encouraging students to undertake this process at an earlier stage of their education helps them to be prepared for the time when they are seeking full-time employment by not only having experience but also being able to present themselves to potential employers. Fuentes-Tristan and Sifuentes [6] discuss the role of internships in empowering STEM students to make informed career decisions. They argue that structured internship programs help students visualize potential career paths, reducing uncertainty about post-graduation opportunities. Botchway and Mohamed et. At. [7] emphasize the innovative potential of technology-focused internships. They describe how integrating Building Information Modeling (BIM) and Extended Reality (XR) into internships equips students with cutting-edge tools, enhancing their employability.

Addressing Socioeconomic Barriers

In addition to the knowledge gained from internships, these opportunities provide much-needed financial support for students who may not have worked in any non-professional environments. At FAMU, about 75% of the students are on Pell Grant and work during the semester to make ends meet. The internship opportunities have afforded most of them the ability to get financial assistance for their needs in addition to gaining knowledge in their respective areas of concentration. Ghaleb et al. [3] discuss the socioeconomic dimensions, noting that internships can mitigate the impact of financial and cultural barriers on engineering students' academic achievements. In addition, Edwards and Gerberry [8] delve into internships within high-needs communities, showing that such programs enhance teaching efficacy among STEM students and address educational disparities.

Fostering Interest in STEM Careers

According to a report by the American Society for Engineering Education, only 37% of students begin an engineering career after completing an engineering degree. Furthermore, although the higher percentage of college scholars are women, only 2% of women graduate with an engineering degree compared to 10% of men. Coleman [9] highlights that internships in STEM fields are crucial for reducing dropout rates and promoting sustained interest in these disciplines. Early exposure to practical applications, as described by Doly [10] , further ensures that students remain motivated to pursue STEM careers. Memari and Zucker [11] extend this idea by examining entrepreneurial internships, showing how such experiences spark innovation and long-term career interest among students. With early exposure to engineering and engineering technology practices and jobs, this trend may shift, increasing the number of students who not only pursue engineering degrees but move to practice. At the School of Architecture and Engineering Technology, over 85% of the students enrolled receive an internship before graduation, and over 95% of those who graduate stay in engineering technology careers.

Data Collection

As mentioned in the previous section, surveys were conducted on students from freshman to senior from the Engineering Technology program, Architecture and Facilities Management. The survey was grouped into two groups: those students who had an internship and those who did not have one yet. Both groups were asked similar questions, with the exception of rephrasing the question on the experience of the internship and how it helped with the student's success. Students who did not have a chance to do an internship were asked about their perception of the outcomes of an internship and how it helps with their success in college.

Survey Results

The survey questions were classified into five categories for both groups of students. The results reported below were separated between the group of those who had an internship and those who did not have an internship. This provided an opportunity to see the major differences between the two groups in order to provide proper guidance for the students who did not have an internship on aspects that need to be reinforced to encourage their involvement in pursuing an internship and for

those who did have an opportunity for an internship to see how the curriculum needs to be improved to provide basic skills for a better experience.

Overall surveyed students

A total of 40 students completed the survey, which included about 30% of the population of undergraduate students in the school. Of those who completed the study, 44% had an internship, while 56% did not have an internship. Figures 2 and 3 show the distribution of students who completed the survey from each of the programs and the distribution per program of those who had an internship and those who did not have an internship.

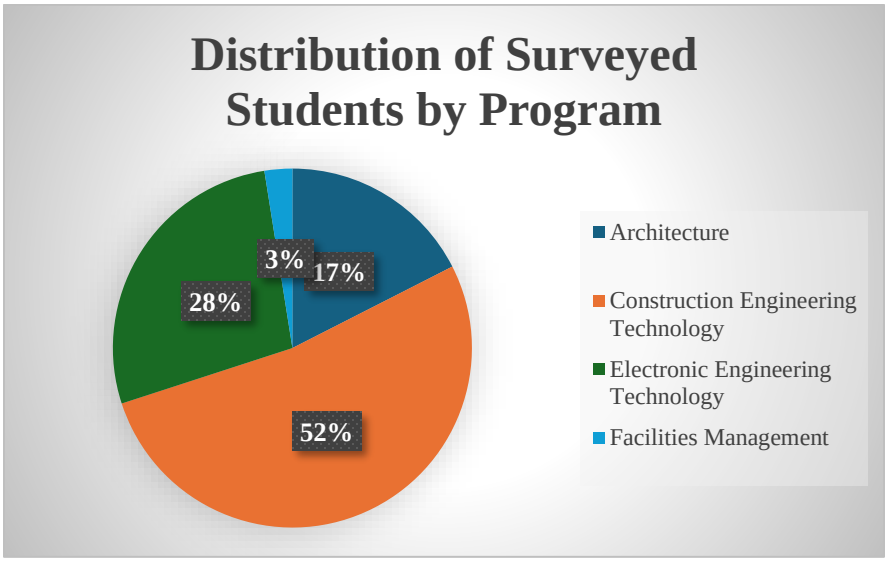

Figure 2: Distribution of Surveyed Students by program.

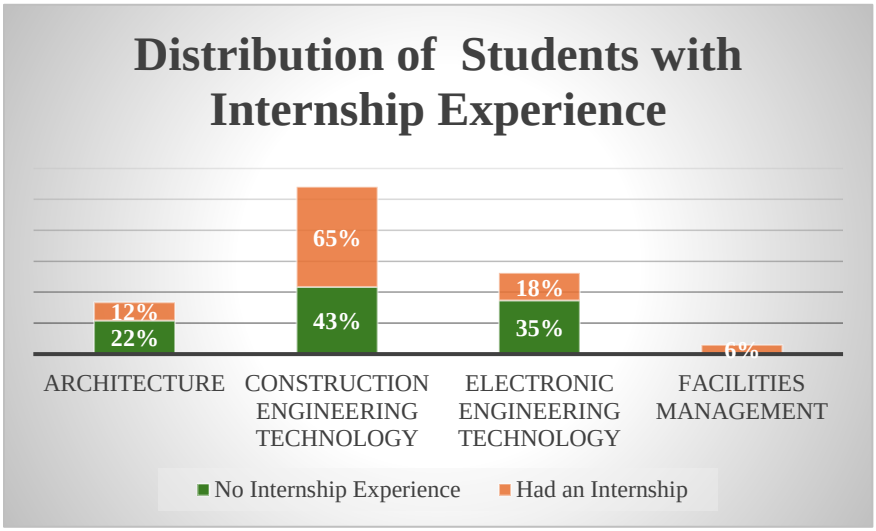

Figure 3: Distribution of Students with Internship Experience

Students who attended an internship.

Perceptions on the Importance of Internships

For this category, the students were asked about the importance of internships in engineering education, with 1 being not important and 5 being very important. The other question asked their opinion on how essential internships were for securing employment in the field. 56% indicated that internships are very important for their engineering education.11 % indicated that the internship is important. Also, for the following question, 44% of the students indicated that internships were very important, and 22% of the students indicated that internships are important in securing employment.

Expectations and Experiences:

For this category, students were asked to what extent the internship met their initial expectations, and they were to rate the expectation from 1 as the expectation was not met at all to 5 as they exceeded expectations. The next questions in the category asked about the primary skills or knowledge areas they anticipated gaining from the internship. The skills listed were critical thinking, communication skills, professionalism, engineering testing, engineering management, data collection, and programming skills. The results showed that 44% of those who had internship experience reported that the internship exceeded their expectations, and 17% indicated that the internship met their expectations. As for the skills gained, the majority of the students indicated that they gained knowledge in professionalism. Figure 4 is a chart showing the distribution of students' responses on skills gained from the internship.

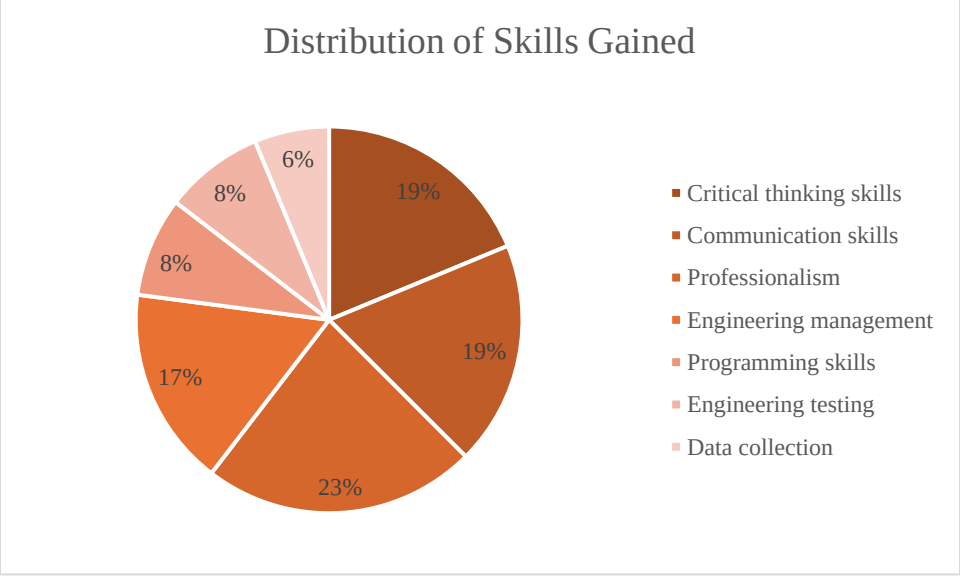

Figure 4: Distribution of Skills Gained from Students Who had an internship

Educational Impact:

For this category of questions, students were asked how the internship experience influences their understanding of engineering concepts on a scale of 1 to 5 where 1 was No influence on their understanding and 5 Significantly influenced their understanding respectively. The other question in this category asked where the internship provided practical application of theories from their coursework. For the first question, 50% of the students indicated that the internship significantly enhanced their understanding of engineering concepts, and 11% indicated that it moderately enhanced their understanding of engineering concepts. Whereas for the practical applications, 22% indicated that the internship provided practical applications, and 28% indicated that it probably provided practical.

Time Management Impact:

This category of questions was based on their time management skills and satisfaction gained from the internship. The two questions asked were how balancing their internship with academic responsibilities affects their time management skills on a scale from 1 to 5, with 1 being no improvement and 5 being significantly improved. The other questions asked if the internship experience enhanced their ability to prioritize tasks and manage deadlines. The scale was also from 1 to 5, 1 being definitely not and 5 being definitely yes. The results from this category showed that 22% reported that they significantly improved, 22% moderately improved, and 11% somewhat improved their time management skills. When it comes to prioritizing tasks and managing deadlines, 28% indicated that the internship definitely helped, and 28% indicated that the internship probably helped with prioritizing tasks and managing deadlines.

Overall Satisfaction:

For this category, students were asked about their overall satisfaction with their internship experience and if they would recommend an internship to a student who has not had an opportunity to experience one.44% indicated that they were extremely satisfied, 6% were very satisfied, and 17% were satisfied by the internship experience. In addition, 72% indicated that they would recommend students to do an internship.

Students who have not completed an internship

Since the students in this group did not have an internship, the questions were similar to those with internships. However, they were rephrased to gauge their perception of an internship either from their own knowledge or from the information from peers who had the opportunity to have an internship experience.

Perceptions on the Importance of Internships:

In this category, students were asked, on a scale from 1 (not important) to 5 (essential), how they would rate the importance of internships in engineering education and how crucial they believe internships are for securing employment in the engineering field. 48% of the students indicated that internships are essential, 4% indicated that it is very important, and 17% indicated that it is important to have an internship to enhance their education experience. In addition, 26%, 35%, and

9% indicated that it was absolutely crucial, very important, and important to have an internship for employment opportunities, respectively.

Expectations:

In this category, students were asked about the skills or knowledge they expected to gain from a potential internship. The skills listed were the same as those asked by the previous group. However, in this case, the students were only allowed to select one answer, which would be a priority skill they felt was important. The other survey question in the category asked their primary motivation for pursuing an internship. The list provided included gaining practical experience, developing professional skills, building a professional network, exploring career options, enhancing their resume potential job opportunities, understanding workplace culture, financial compensation, contributing to meaningful projects, and personal growth and confidence. For this question, they were allowed to select multiple responses. For the first question, the majority of the respondents indicated that they would gain critical thinking skills and professionalism, which were 26% and 22%, respectively. Figure 5 shows the distribution of the respondents for the second question in this category. Note that although the respondents had multiple

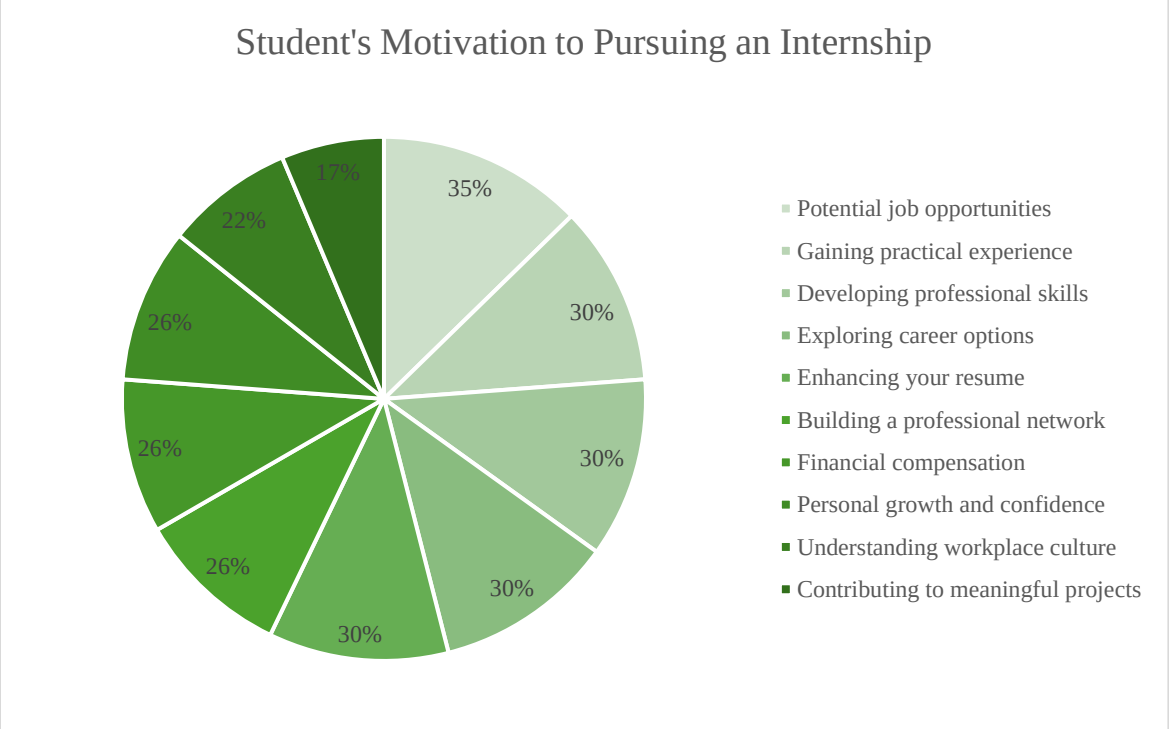

Figure 5: Distribution of Students' Motivation for Pursuing an Internship

Educational Impact:

For this category, the students were asked on a scale from 1 to 5 how they anticipate an internship would enhance their understanding of engineering concepts, 1 being no anticipated impact and 5 being transformative impact. For the second question, they were asked to scale from 1 to 5 how

they thought an internship could provide practical applications of their coursework. In this case, 1 has no practical application, and 5 has extensive application. For the first question, 48% indicated significant improvement, and 17% indicated that there would be a transformative impact on their understanding of engineering concepts. For the second question, 43% indicated that there would be a strong connection, and 22% indicated that there would be extensive integration with the coursework.

Time Management Considerations:

This category gauges students' perceptions of how the internship will improve their time management skills. The first question in this category asked to scale from 1 to 5 how they plan to balance an internship with their academic responsibilities, where 1 has a minimal plan, and 5 has a highly structured plan. The second question asked the students about the challenges that they foresee in managing their time effectively during an internship. For this question, they were provided with a list of challenges, which included workload management, balancing academic commitments, unpredictable work hours, distractions and time management, networking and relationship building, self-care, and downtime. Similar to the question in the expectations category, the respondents were allowed only one choice for this question to determine the significant challenge they have or anticipate. For the first question, 39% indicated that they have a well-thought-out approach, 13% indicated that they have a highly structured plan, 9% indicated that they have a basic strategy, and another 9% indicated that they have moderate flexibility. For the second question, the majority of the respondents indicated that the challenge would be workload management, which was at 39%. The next highest challenge was balancing academic commitments, self-care, and downtime, with 9% of the respondents responding to each of those responses.

Intentions

For this category, students were asked questions to gauge whether they were seeking or planning to seek an internship and the factors that would influence their decision to pursue an internship. The list of factors included in these questions were career goals, compensation, flexibility, impact on academic performance, interest and passion, networking opportunities, and skills development. The students were allowed to select one response for this question. For the first question, 57% of the respondents indicated that they are planning on seeking an internship, and 4% indicated that they may be seeking an internship. For the second question, the majority of the respondent indicated that skills development, career goals, and flexibility would influence their decision to pursue the internship, with each response getting 17% of the responses.

Discussion of the Results

The survey results indicated that most students recognized the significance of internships in achieving their career goals. Both students with and without internship experience exhibited similar perspectives on the role of internships, not only in securing employment but also in supporting their academic success. However, there were some limitations in data collection, including incomplete responses to certain questions. Despite receiving 41 survey responses—18

from students with internships and 23 from those without—33% of students with internships and 30% of those without did not answer specific questions within their respective categories.

Conclusions and Future Works

This paper continues to underscore the importance of pre-professional employment training as being part of student's learning process for their academic and professional success. It is encouraged to have internships as a requirement as opposed to being an option in the curriculum. Some institutions do not have advanced technologies, but with internships, students have the opportunity to train and be ready for industry or graduate school, reducing the learning curve when joining the workforce. Botchway and Mohamed (2024) note that not all students have access to advanced technological tools during internships, which can lead to disparities in skill acquisition. In addition to making the internships a requirement, rubrics need to be shared with the employers to make sure that there is a clear understanding of the outcomes of the internship. The rubric should align with the curriculum and industry expectations, as Ghaleb et al. (2024) highlighted that it is important to develop comprehensive internship curricula that integrate reflective practices. Having these outcomes will not only assist in making sure that the students gain the knowledge needed to be employable, but it will also help the industry get individuals who are ready for the workforce with minimum on-the-job training. Since universities and colleges play a pivotal role in facilitating impactful internship experiences, there is a need to establish strong partnerships with industry stakeholders to offer diverse and meaningful internships comprehensively, as reported by Boettcher & Kempler [2].

Future work calls for a more targeted survey to understand each program's needs and skills and provide guidance for specific outcomes for each program. Although there are some common skills that are shared among the four programs that were studied in this paper, which also need to be prioritized to support the technical skills [10], there needs to be specific outcomes for each program. This will help provide guidance to the industry on how to evaluate a successful internship program and also provide guidance to the institutions on what areas need to be addressed when preparing students for the workforce.

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