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Work In Progress: Through Their Eyes: Industry Mentors' Perspectives on Engineering Internships

Abigail N. Lehto, Utah State University

Abigail Lehto is a PhD student studying engineering education at Utah State University. She has a M.S. in engineering education and a Bachelor's degree in mechanical engineering, both from Utah State University. Abigail's research interests are engineering research with underrepresented groups, and industry-academia connections in engineering.

Prof. Ning Fang, Utah State University

Ning Fang is a Professor of Engineering Education at Utah State University, U.S.A. He has taught a variety of courses at both graduate and undergraduate levels, such as engineering dynamics, metal machining, and design for manufacturing

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Abstract

When engineering students earn an opportunity to complete an internship, they are usually assigned a mentor to guide them through their day-to-day responsibilities. Mentors may be faculty from the student's educational institution or engineers and managers from the company where the student does their internship. Previous research on mentor perspectives on engineering internships highlights many skills students can learn from internships and the value of an internship experience. While these findings lay the foundation for mentor perspectives of engineering internships, previous research focuses mainly on faculty mentors' perspectives. Research focusing on industry mentors' perspectives often compares those to student perspectives and is more surface-level. The current work-in-progress (WIP) study uses qualitative interviews to gain greater insight into industry mentors' perspectives on engineering students' internships. The researchers of this WIP study collected interview data from 5 industry mentors of different engineering companies around the region where the university was located.

Industry mentors in the current study noted strengths in soft-skills, such as time management and communicating directly with mentors. They also noticed strengths in students' ability to ask relevant questions. Lastly, mentors were cognizant of students' level of education when mentoring and assigning tasks.

Connecting learning topics to industry recommendations is expected in engineering education. The current study's findings will help engineering educators understand what skills industry mentors look for in engineering interns and potential employees. Engineering educators can then incorporate the training of these skills into their lessons.

Introduction of research backgrounds

In the engineering industry, it is common for companies to hire student interns to help with various tasks. At the beginning of a student's internship, they are usually assigned a mentor to help guide them through their day-to-day job responsibilities. Mentors may be academic mentors who are faculty from the student's academic institution, or industry mentors who are employees from the company where the student chooses to intern. For mentors themselves, mentoring a student intern could serve as an opportunity to help them gain insight into their own careers and how they have evolved since entering the workforce [1].

Relevant research on mentor experiences in engineering internships primarily focuses on academic mentors as opposed to industry mentors [2]-[4]. The research that focuses on industry mentors' perspectives on engineering internships is also limited in comparing students' and mentors' perspectives on mentorship and internship goals. Research in this latter area commonly reports discrepancies between students' and mentors' understanding of mentorship and what has been learned [5]-[9], but does so without going into specifics on what skills mentors value and look to highlight while working with student interns. While these existing research findings are valuable, in-depth research is needed to better understand industry mentors' perspectives on engineering internships. Having an understanding of industry mentor perspectives can help

engineering educators prepare students for internships and teach skills that industry mentors find valuable. This helps improve internship experiences for all parties involved and prepare students for the workplace after graduation.

The present work-in-progress (WIP) study aims to address the above research need by examining industry mentors' perspectives on engineering student internships. Using qualitative semi-structured interviews, the present study answers this research question: what are industry mentors' perspectives on student internships in engineering fields? In the following paragraphs, this paper will first detail a literature review. Next, this paper will discuss research methods and research findings. Finally, this paper will discuss research results and implications.

Literature Review

Academic Mentors' Perspectives

Studies on perspectives of student internships in STEM, specifically engineering, typically include perspectives of academic mentors [2]-[4]. This group of mentors is usually faculty at the student interns' educational institutions. Common perspectives from faculty mentors include potential student learning gains and the potential hardships students may encounter during their internships [2]-[4]. Some academic mentors see internships as an avenue to teach skills not as easily taught in the classroom [4]. Academic mentors may also see internships as an experience to teach industry-specific skill sets and soft-skills, such as communication, teamwork, and leadership [2][4]. These soft-skills are also mentioned in student outcomes for engineering program's ABET accreditation [10]. Research has also supported internships as a way to address ABET criteria and better align the engineering industry and education [11][12].

Industry Mentors' Perspectives on Mentorship

Regarding industry mentors' perspectives, research shows that some mentors don't view themselves as learners within an internship experience [13]. Mentors do, however, see internships and mentorship as a way to gain insight into their own career and career paths [1]. Often, students in internships have unclear expectations about mentorship [14], and there exists a gap between student and mentor expectations [5]-[9]. The present study lays a foundation for future research to make an effort to address these gaps and help create a positive internship experience for all stakeholders.

Research Methods

The present study utilizes qualitative semi-structured interviews to gain insight into industry mentors' perspectives on student internship experiences in engineering. Student participants were chosen as part of an externally-funded, two-year (2023 and 2024) internship and scholarship program through the authors' university, a public research university in the western United States. The two-year program involved two cohorts of student interns and industry mentors. Students applied for and earned internships based on academic achievement and future career goals. They provided contact information for their industry mentors to be contacted about this research opportunity. Industry mentors interested in participating in the present study were sent an informed consent form approved by an Institutional Review Board.

After completing the informed consent form, industry mentors were invited for a follow-up semi-structured interview [15]-[17]. This process was applied to two cohorts of industry mentors in 2023 and 2024, respectively. From the first cohort, 3 industry mentors completed interviews and from the second cohort, 2 industry mentors completed interviews. The sample of five to six study participants is typical for a sample of qualitative interview data [17]-[19].

Mentors come from two companies (1 and 2) based in the region of the authors' university; however, these companies are companies that reach out across the United States. Company 1 is a global company focusing on aerospace, defense, and security. Company 2 is a global company supplying analytical instruments, life sciences solutions, etc. It is important to note that one mentor from the first and second cohorts is the same mentor but was mentoring different students during each summer, so his experiences are treated as separate. Table 1 details more information about each mentor. The student interns working at Company 1 focused on coding and numerical methods. The student interns working at Company 2 focused on design and testing.

Table 1: Industry Mentors' Information

Industry Mentor (Pseudonym)	Company	Industry Mentor's Role	Student Intern's Education Level
Ed	Company 1	Head of Operations	Sophomore
Ty	Company 2	Engineer	Junior
Jacob (1)	Company 2	Senior Manager	Junior
Josh	Company 1	Senior Manager	Junior, Sophomore
Jack (2)	Company 2	Senior Manager	Sophomore

Semi-structured interviews lasted about 30 minutes for each mentor, were conducted over Zoom and recorded with the participants' permission. Interview data was transcribed and coded. Coded interviews were analyzed to find common themes or patterns among interviews [17][21].

Research Findings

From the coded interviews and thematic analysis, three key themes emerged: the importance of asking questions, soft-skills, and the level of education. Each theme is described below.

Importance of Asking Questions

When asked about student interns' strengths, each industry mentor brought up the ability to ask questions in some capacity. Mentors admired students' timing when asking questions as well as the kind of questions they asked. When commenting on how asking questions helps an intern, mentor Ed said, "*…he was eager to learn, he asked a lot of good questions. He definitely didn't hold back, and I think that helps an intern to be successful if they feel very free to ask questions.*" All mentors' names in this paper are pseudonyms to protect their privacy.

Some mentors even looked to assess interns' ability to ask the "correct" questions in a given scenario. On the first day of Jack's mentorship, he purposely gave his intern a lot of different tasks in a small timeframe to see how he would react to this and prioritize certain tasks. Jack commented, "*it's important to be able to divvy up those pieces and ask the right questions. You*

know, the question isn't, how can you give me so much? That's not the question. The question that needs to be asked is, what do you want me to work on first? And how can I get this? And where can I get more help?" It is interesting to note that Jack and Ed come from different companies in different industry sectors, and both commented on the importance of asking questions.

Mentors also admitted to giving student interns open-ended tasks, reinforcing the importance of the questions interns ask. Again, regarding the kind of questions asked Jacob noted, "*The quality of the questions are important to me, to listen to what is being said or what's not being said, and what's not being asked…And that goes back to his methodical thought process. He knew what to ask and when to ask*."

Soft-Skills

Another common area of perception for industry mentors in engineering was soft-skills. Among the specific soft-skills mentors noticed from their interns were: teamwork, communication, and demeanor. While teamwork and communication are more self-explanatory, demeanor was represented in different ways. When asked about his interns' strengths, Ty noted,

"*He did a good job introducing himself to lots of people and being very, you know, friendly. I feel like anytime you have any new employee, not just an intern, you know, they can either lean to be really shy or maybe they can lean to be outspoken…But I thought he was a great medium of being friendly and, remembering people but not being weird about it.*"

This also speaks to the intern's ability to build a rapport and positive work relationships with those around him. Similarly, Jack noted about his intern, "*This is, you know, sounding kind of weird, but he was very likeable. You know, he had that likeability…He communicated well. He was willing to get his hands dirty and not afraid to pick up new things, and learn*." Lastly, in terms of demeanor, Josh noted, "*It was interesting. It's fun to have 2 [interns] simultaneously, because I could see differences in personality*." In each of these cases, one can see how mentors view something like demeanor as an interesting, and maybe uncommon, attribute to notice, but one that stood out regardless. It is clear that representing oneself positively has an immediate impact on those around them.

Level of Education

One common discussion about industry mentors' perspectives was the level of education of interns. Usually, around a students' junior year of college they begin taking major-specific classes that relate more to industry settings. Among the sophomore students' mentors, it was common to mention where the student was at in their education. Ed's student was a sophomore, and he noted some challenges related to this, "*He didn't really know much about what we do, but he is fairly early in his education too. I mean, he's not ready to graduate next year. So, there was a little bit of a learning curve on his part*."

Jack, who also mentored a sophomore engineering student intern commented,

"*To me one of the major points of an education is just learning how to learn…How to learn how to do something he doesn't know. So, I don't think I gave him anything that I needed a senior level classman to be able to do…So I think it's experience. You know, he needs to… experiment and do some of these things, and that comes with more classes, more lab work.*"

While experience in the classroom prepares students for internships, students may also use internships to prepare for the workplace. This may lead to a discrepancy in student and mentor expectations of an internship.

Discussion and Implications

In terms of mentors' perspectives on engineering internships, the findings of the present study show an agreement on the use of soft-skills, such as communication and teamwork, in an internship [2][4]. The present study adds to this skill set the characteristic of demeanor, which industry mentors took notice of in student interns. Mentors noticed and were impressed with interns' likability and how they presented themselves. This new research finding has further implications for engineering education in terms of how ABET criteria relating to soft-skills are addressed, and where those skills should be taught as well as refined [10].

The second new research finding the present study contributes is the concept of asking appropriate questions. Each of the five industry mentors commented on students' ability to ask questions at appropriate times, and the quality of questions being asked. Mentors related this to open-ended tasking, noting that the questions student interns asked could help or hurt them in being able to complete open-ended tasks and solve open-ended problems. This again relates to academia in terms of learning problem identification and problem solving [9].

The third interesting research finding from the present study is students' level of education when entering an internship. This could be a case, similar to previous research, where students and mentors have different expectations of engineering internships [5]-[9]. This is also consistent with existing findings from a previous study where interns noted some difficulty during with not yet having professional skills as they completed their internship [3]. From a student's perspective, earning an internship experience earlier in one's education may be an opportunity for more experience upon graduation. From a mentor's perspective, students may need to have reached a specific level of education or taken specific classes in order to be able to do some tasks in an engineering internship. This research finding has implications for both students and mentors as they look to organize internship experiences.

Conclusions

The present WIP study looked to fill existing research gaps by gaining more insight into industry mentors' perspectives on student internships in engineering. Overall, the present study corroborated results from previous studies (i.e. teamwork, communication, level of education) and presented new results on the value mentors see in student interns' demeanor as well as their timing and ability to ask good questions.

The present study has implications for engineering students seeking internship opportunities as well as in academia and the skills industry wants to see in interns and potential employees.

Future directions of this research could involve comparing student and mentor perspectives on engineering internship experiences and addressing discrepancies between the two.

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