

Insights from the Field: A Study on Integrating Non-Engineering Work into Engineering Education (Work in Progress)

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Introduction

In higher education research, commuter students are generally defined as those who live off campus and commute to the university for classes and other activities. They often juggle work, commuting, and family responsibilities outside the academic environment. By 2012, commuters made up 87% of the student population at U.S. universities [1].

This work-in-progress paper describes the process and outcomes of an exploratory study that examines how skills developed in non-engineering roles can be effectively applied in engineering education contexts and beyond. By collecting professional practice reflections from undergraduate engineering students (years 2022 and 2024) and conducting focus groups with engineering students, faculty, and support staff at a southwestern Hispanic-serving institution in the United States, the study highlights the significant value of competencies acquired in non-engineering roles, which positively impact students' academic and professional development beyond the professional skills traditionally emphasized in the literature.

The motivation for this study comes from the need to expand understanding of student learning and skill development, especially in commuter and community-serving schools, where students often navigate multiple responsibilities outside of their engineering courses. By recognizing and including these transferable skills, the study seeks to support more inclusive teaching methods and institutional resources that reflect students' real-life experiences during their educational journeys.

Background

This work is based on the framework of student competencies proposed by Reason et al., who argue that, from early experiences in college, students face social, personal, and academic changes and challenges that require support to achieve their goals and navigate the various stages of their education. Additionally, these authors argue that out-of-class experiences positively influence academic and career success by providing students with important skills, attitudes, and competencies that contribute to their growth [2], [3].

Additionally, this research emphasizes the importance of transferable skills that are developed in one context and applied in another, an area that has not been fully explored in research [4]. Skills such as communication, teamwork, self-confidence, and others are critical for student success. However, these are often acquired through everyday experiences rather than solely through schooling. Despite their relevance, engineering students may not always recognize the positive influence of these skills on their academic development, creating an opportunity to examine their impact in research [5], [6], [7].

Moreover, there is a significant relationship between full- and part-time employment and college students' academic outcomes. Some authors emphasize that although students' motivations to

work vary, these motivations can affect not only their academic performance but also other areas of their lives [8], [9], [10]. Furthermore, gaining work experience is often another key factor in undergraduate students' job search in the United States [11]. These notions are familiar to engineering students who often balance academic demands with employment. While engineering education often emphasizes the value of professional skills gained through internships or co-ops, these competencies are often framed within engineering-oriented jobs, and the richness of non-engineering jobs is commonly overlooked. As a result, there is a limited understanding of how these non-engineering skills are perceived, articulated, and applied within engineering pathways.

The two research questions guiding this work in progress are:

RQ1: What skills from non-engineering work transfer to academic and post-graduation outcomes for undergraduate engineering students?

RQ2: How can non-engineering work during an undergraduate engineering degree program be leveraged to benefit engineering student outcomes?

We are studying non-engineering work on a continuum with respect to its adjacency to engineering as well as how the work is (or is not) compensated. An experience can be considered work if there are defined responsibilities and expectations for performance.

Methods

This exploratory study analyzed student reflections and conducted focus groups with students, faculty, and supporting staff from across engineering. We employed a qualitative approach, including a secondary content analysis of student professional practice reflections, and thematic analysis of multiple transcriptions of five focus groups conducted at a Southwest Hispanic-Serving Institution in fall 2025. Reflections included prompting questions and multiselect prompts with identified skills. Focus group protocols were semi-structured and tailored for each population. The goal was to explore how participants experienced and understood students' professional experiences outside engineering, and to identify the valuable skills they could draw on from these non-engineering experiences.

Following data collection, a deductive coding process was implemented. In this context, Qualitative Deductive Analysis (QDA) is defined as the systematic application of theory to refine, verify, and model research [13]. The procedure was aided by the Copilot analytical tool, which enabled deductive coding by matching codes and tracking their frequency throughout datasets. Specifically, Copilot assisted researchers with:

- a) Importing and systematically organizing textual data derived from reflections and focus group transcripts.
- b) Creating frequency counts to determine which skills, such as communication, teamwork, and self-confidence, appeared most consistently.
- c) Visualizing coding patterns and comparing data sources.

This approach ensured that the analysis was theory-driven and transparent, highlighting the transferable skills students acquire in non-engineering work experiences and how such skills enhance their academic and professional pathways. Copilot results were compared to the manual coding and preliminary thematic analysis conducted by the research team and found to be in alignment. Validation is ongoing as the research project continues. Table 1 summarizes the methodological process.

Data source collected	Year	Participants	Participant breakdown	Methodology
Professional practice reflections of undergraduate engineering students	2022	6	6 unique students in an integrated engineering undergraduate program	Thematic analysis
Professional practice reflections of undergraduate engineering students	2024	6	6 unique students in an integrated engineering undergraduate program	Thematic analysis
Five focus groups with undergraduate engineering students, engineering faculty, and support staff	2025	14	6 faculty; 4 undergraduate students; 4 staff across the College of Engineering	Thematic analysis (supported by Copilot QDA and enhanced with manual coding)

Table 1. Methodological process

Limitations

The professional practice reflections are from an integrated engineering program that emphasizes communication, business acumen, and leadership. However, the data for this study was a subset of reflections specifically from professional practice experiences that were outside of engineering. The reflections were not designed for the study, but they were created by the integrated engineering program for students to receive credit for their professional practice.

Results

In this section we present some *preliminary* results derived from our analysis of the professional practice reflections and focus group transcripts.

With respect to RQ1 (*What skills from non-engineering work transfer to academic and post-graduation outcomes for undergraduate engineering students?*), after deriving emergent themes from each type of data source and looking for patterns across all of the data, there are six skill areas developed in non-engineering work opportunities that transfer to academic and post-graduate outcomes. Each of these skill areas is briefly described below with representative quotes.

Communication

Acquiring communication skills is among the most important skills that higher education students can develop, particularly in academic experiences during and after the COVID-19 pandemic [14]. Students emphasized that, in their non-engineering work experiences, they found communication to be a crucial skill they learned and applied effectively in their roles to interact efficiently and professionally with diverse environments and people like managers, coworkers, customers, clients, and others.

“While doing this professional practice I have earned many experiences that had me learning many things this past few months. An example is the importance of communication and how important it is when running an attraction, is key to have excellent communication, since safety is the first and most important responsibility we have, in order to offer an excellent service is key to have good communication” (Student professional practice reflection, working at an attraction park, spring 2022).

“For me, it's been professionally speaking with other people because I interact with principals, different teachers, a lot of panelists from different school districts. So, I have developed a greater vocabulary, also communication skills, which are not widely seen in engineering students” (Participant 1, transcript from focus group on November 07, 2025).

“[...] the main thing that you can get that's applicable in a career and even in education, is communication skills” (Participant 2, transcript from focus group on November 07, 2025).

Additionally, faculty emphasized that communication skills distinguish between students working in non-engineering jobs, as they reflect the level of maturity they have achieved.

“I think for me it's maturity, but I'm not saying that's not present in engineering internships or other kinds of jobs, understood or in students who don't have jobs. It can be communication and how they communicate with me, how they're not intimidated to communicate like many students can be” (Faculty participant, transcript from focus group on November 07, 2025).

Financial acumen

Financial knowledge and related skills are important for university students and young adults, as they can improve their economic outcomes and support better future decision-making [15]. In the following example, the student emphasizes that mastering this basic skill in their non-engineering professional practice translates into valuable real-world experience.

“One of the things that sounds very basic, but it is one of the things that I still use to this day is how to handle money. Because I was often in charge of handling relatively large sums of money and dealing with cash deposits and banking transactions, I am now more capable and more comfortable with handling money” (Student professional practice reflection, working at a store, spring 2022).

Leadership

Leadership is driven by people's willingness to achieve specific goals or meet social expectations. In higher education, there are external factors (such as providing students with formal leadership training) and internal factors (such as offering students opportunities to lead) that can enhance university students' leadership skills [16]. In the following example, the student reflects on how leadership affects their work environment.

“As a leader your attitude and composure is what sets the mood for the day. If you come in with a negative attitude it resonates to the people you are leading. It works the same with a positive attitude though it's not reciprocated as much. Adapting to change without panicking is also a key behavior I learned, when I first started” (Student professional practice reflection, working at a home improvement store, spring 2024).

Establishing meaningful relationships and building networking confidence

Good relationships are valuable for the development of people and students and can even impact their persistence in school [17]. In the following example, the student reflects on how observing their managers fostered a positive environment for expressing their voices and concerns, thereby positively influencing the team's development.

“I was grateful to have a few managers that allowed me to express my opinions on how to create a better environment for staff and customers. In a typical retail industry, the opinions of lower-level positions normally don't get heard but this management team allowed input. With my input, they allowed changes to help create a safer environment and developed a more effective team” (Student professional practice reflection, working as a team leader, spring 2024).

Students working in non-engineering roles have opportunities to enhance their network skills not only in their workplaces but beyond them. Such experiences can enable them to explore broader possibilities that contribute to their professional development. Networks enhance other competencies, such as alliances, innovation, and cooperation [20], and can enable students to gain multiple perspectives that enhance their careers.

[...] Yeah, uh networking is the word. It will help a lot with that. By communicating to other people that are recruiting. Sometimes it's pretty you feel pretty intimidated when you're getting interviewed or also recruited. So, you have to get out of your comfort zone, and be able to express yourself to other people (Student participant, Work-study job, transcript from focus group on November 07, 2025).

Time management as process thinking

Time management significantly influences the experiences of university students. As a skill, it is a multi-layered process in which individuals can reflect on how they will behave in the face of specific challenges, tasks, and priorities by applying various strategies to organize themselves. This has benefits for their academic, professional, and personal development [18]. The following examples illustrate the importance of students learning to cope with diverse activities, self-direct their needs, and organize their activities more effectively.

“I think I genuinely enjoyed like my work and stuff like that. So, and since I was like one of the co-managers, I was able to, I guess, input some homework while at work. And then after that, I kind of would go home and I would just do work as well” (Student participant, Fast food work, transcript from focus group on November 05, 2025).

“You have to learn time management, learn how to work cohesively in a group, and then you have your final result” (Staff participant, transcript from focus group on November 10, 2025).

“Sometimes it's because the machine broke down, because the material was backed up or something. And they have to learn to be able to face that and say, we didn't complete it because of this, and now we have to extend it or in our next available, we're going to have to work more or something” (Staff participant, transcript from focus group on November 10, 2025).

Workplace adaptability

Adaptability is a skill students can develop to boost their confidence and help them navigate unfamiliar workplace situations and ways of being [19]. In the following example, the staff participant reflects on the skills they have learned from student workers in non-engineering roles and how this diversity allows them to face not only work-related demands but also external ones.

[...] “they learned how to be professional, right? How to interact, write, read, communicate, also how to handle different situations. The adaptability increases because when you are in front of dependent, no matter what it is, it's like, it's different from when you read it in a book than when you actually are out there” (Staff participant, transcript from focus group on November 10, 2025).

All the skills presented in this work in progress are crucial because they highlight the importance of valuing the transferable skills that students develop in non-engineering work experiences. These skills not only enhance their professional readiness but also nurture their ability to adapt to diverse challenges, goals, and social environments. By identifying these patterns, the results underscore the importance of celebrating students' holistic approaches to enhancing their professional futures.

Preliminary results for RQ 2 (*How can non-engineering work during an undergraduate engineering degree program be leveraged to benefit engineering student outcomes?*) are derived from the focus group transcript analysis, as the focus group protocols were developed intentionally to explore this research question. Participants emphasized the essential role of faculty in shaping the academic experiences of students working in non-engineering roles, with three themes emerging through analysis.

Faculty connecting with students to meet their needs

Participants reflected on the importance of students connecting with faculty, as this helps acknowledge their needs, make them feel seen, and scaffold their learning experience for their future as professionals. Connections between faculty and undergraduate students can significantly influence student persistence, retention, and success rates. Faculty members play a

crucial role in addressing student needs by demonstrating an attitude of acknowledgment toward students. This attitude must be reflected in teaching styles and in how faculty adapt their approach once they recognize students' needs, thereby creating more inclusive environments for them (Miller, 2020).

“... the more successful [faculty] are the ones that I can think mainly about too right now, because they're the ones who are, have a more warm approach. They humanize themselves, you know, they talk to their students or they're not too serious, and I've seen those relationships become very successful to where now there are the alumni that come back.” (Supporting staff participant 4, transcript from focus group on November 10, 2025).

“After my first semester teaching, I realized that students were really struggling to meet some deadlines. So, I decided to think about my assignments in a different way...what is extremely essential for me to be able to assess whether the students are meeting the learning objectives ... so those are the assignments that I need, so they are going to be mandatory. And then what I did with the other assignments is that they are optional, so, I encourage the students to work on those assignments and submit them, but if they don't want to do it, it's OK. There is no penalty for that, so I have two different ways of calculating their final grades, one that includes the optional assignments and one that doesn't.” (Faculty participant 2, transcript from focus group on October 30, 2025)

Connection, engagement, and faculty responsiveness to students' needs positively impact students' academic experiences while working in non-engineering roles.

Faculty bridging students' skills with the curriculum

A key dimension of institutional support is when faculty are aware of the skills students can leverage, they can create meaningful bridges between those skills and the curriculum. This alignment enhances students' learning process and supports them in balancing and meeting the expectations of their diverse engineering programs. Such faculty practices can impact persistence and provide integrated access to learning, allowing students to apply critical thinking, problem-solving, and other essential skills in classroom contexts.

“They're not only tested on their written skills, but also like if they're able to give a presentation, how they explain things to others, how they work in groups. So all of that is part of how they are evaluated. So I'm acknowledging that all students learning different ways, they have different ways to show what they know.” (Faculty participant 2, transcript from focus group on October 30, 2025)

“I use essay questions for my quizzes and exams. I'm not a proponent of multiple choice quizzes, and that gives me a window into their critical thinking and analysis skills.” (Faculty participant 1, transcript from focus group on October 30, 2025)

Students working in non-engineering roles may understand course content, but analysis shows that faculty can help them extend their existing skills within the learning process. When faculty intentionally bridge students' knowledge, experiences, and the engineering curriculum, they create pathways for students to make sense of their competencies and how these matter academically.

The role of faculty in helping students to advocate for themselves

Students' ability to advocate for themselves is closely tied to the support they receive from faculty. Within the broader category of institutional support, faculty also play a pivotal role in helping students develop confidence and strategies for effective self-advocacy. Faculty can create conditions where students feel empowered to express their needs and navigate academic demands. In the subsequent examples, participants discussed recognition, confidence, responsibility, and acknowledgment as favorable outcomes of students' self-advocacy efforts.

“Students reach students better that way. That's the one thing I've noticed is like students can lead by example. So, there's power in... [for] students that have figured it out, how am I equipping them to then model it for their peers and be able to communicate?”
(Faculty participant 4, transcript from focus group on November 17, 2025).

“Yeah, I think it's important for the students to learn how to sell their skills and show that they can be transferable. And I think we have a role in that as educators” (Faculty participant 2, transcript from focus group on October 30, 2025)

The role of faculty in self-advocacy is key to helping students learn to identify and understand what they want in everyday life and professional situations. This self-advocacy skill can begin in the classroom, but with faculty support, it can extend to future life.

In summary for RQ2, the diverse participants' perspectives underscore that the academic experiences and outcomes for students working in non-engineering roles are impacted by the support faculty can offer. By cultivating meaningful connections and responding to student needs, intentionally bridging skills to the curriculum, and nurturing self-advocacy practices, faculty can equip students to navigate complex academic and real-life expectations with increased confidence, which may improve academic and career outcomes.

Conclusion

This work in progress examines how non-engineering work experiences during undergraduate engineering programs can enhance students' transferable skills and benefit their academic and professional outcomes. With respect to RQ1, (*what skills from non-engineering work transfer to academic and post-graduation outcomes for undergraduate engineering students?*) preliminary results emphasized six key themes that emerged from the analysis of student reflections and focus groups: communication, financial acumen, leadership, establishing meaningful relationships and building networking confidence, time management as process thinking, and workplace adaptability. These findings validate the hypothesis about the value of transferable skills across various non-engineering experiences. This supports the Reason et al. [2] framework that illustrates the impact of out-of-class experiences during college [9], [21]. These findings also challenge existing literature that takes a deficit view of working during college. Moreover, the role of faculty in supporting students in non-engineering roles adds an essential dimension to the relevance of this work. With respect to RQ2, (*how can non-engineering work during an undergraduate engineering degree program be leveraged to benefit engineering student' outcomes?*) the analysis emphasized three crucial themes: faculty connecting with students to meet their needs, faculty bridging students' skills with the curriculum, and the role of faculty in helping students to advocate for themselves. Together, these themes illustrate how faculty

engagement can transform students' experiences into assets that strengthen their academic and professional trajectories.

Overall, the findings establish essential benchmarks for action by acknowledging the relevance of engineering students' diverse skills and by customizing support strategies that relate their academic learning to their skills developed through non-engineering work. This effort contributes to students' academic development and promotes their professional trajectories by cultivating inclusive, supportive, and appreciative environments grounded in the recognition of their multiple capabilities.

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