# Exploring Women Engineering Students' Gendered Internship Experiences

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## Introduction

Gender disparity and inequality in engineering education and the workplace have long been a pressing issue despite concerted efforts by higher education institutions to encourage women students to pursue and persist in engineering majors [1, 2]. Women engineering students often perform equally well or better academically than men [3]. However, in the U.S., only 23% of the engineering bachelor's degrees were awarded to women in 2020, and as of 2019, women held about 14% of engineering positions in the workplace [2]. This persistent decrease in the representation of women from higher education to the workplace reflects a concerning pattern of women leaving engineering at critical transition points. This is evident by retention rates: only 26.8% of women engineers remain in the field 11 to 15 years after earning their degrees, compared to 41% of men [4].

Internships, as a critical first step in occupational socialization [5], significantly influence college students' post-graduation employment decisions and long-term professional satisfaction and aspirations. Data has shown that engineering students participate in internships at a higher rate than students in most other majors [6]. These internships offer numerous benefits, including hands-on experience, exposure to real-world challenges, networking opportunities, and the development of both technical and interpersonal skills [1], [7], [8], improving post-graduation employability [9].

However, research consistently highlights that the culture in engineering workplaces is predominantly masculine [10], which can negatively affect women engineering students' internship experiences. It has been found that women engineering interns often perceived this male-dominated culture in ways that range from being unsupportive to completely hostile toward women [11]. Research has shown that women interns often encounter interactions that demean women or draw undue attention to their gender, subjecting them to gender-based requests and expectations [12]. Additionally, unconscious bias among supervisors results in greater scrutiny of women interns, reducing their professional opportunities compared to their men counterparts [13]. Such experiences are referred to as "gendered" by Acker [16], profoundly shaping women interns' perceptions of the engineering field, potentially undermining their motivation to continue pursuing an engineering career.

## Literature Review

Acker's theory on gendered organizations [16] provides a conceptual framework to understand women's experiences in engineering internships. She argues that organizational structure is not as gender neutral but inherently male-dominated. Through seemingly neutral practices including assuming a disembodied ideal worker, defining abstract job complexity, and establishing hierarchies based on this complexity, masculinity has historically been prevalent in organizational processes in a subtle way, thereby marginalizing women. This framework illuminates how engineering workplaces are fundamentally gendered and create systemic challenges for women.

Building upon Acker's theory, scholarship increasingly acknowledges that individual efforts and strategies alone are often insufficient for women to thrive in gendered workplace cultures [17].

They need contextual support across multiple levels, as described by the ecosystem model perspective [18]. This perspective views support mechanisms as functioning within an interconnected system comprising three distinct but interrelated levels: micro (focusing on individuals and their immediate interactions), meso (addressing small to medium groups and organizations), and macro (encompassing broader systemic and institutional environments). Each ecosystem level provides different types of resources and assistance, with support across all levels often necessary for women to flourish in engineering environments. As a result, some research effort, though still limited, has begun to focus on the contextual support systems for women engineering interns [13], [15].

The most frequently discussed form of support for women is interpersonal interactions, usually coming from teammates and supervisors, with mentorship receiving the most attention in research. For example, mentors in cooperative education programs provided both social support and career-related support to engineering interns, and women interns reported significantly greater psychosocial benefits from this support compared to men [13]. In contrast, community-level or organizational-level support systems have been studied by a smaller body of research. For instance, professional networks like the Society of Women Engineers (SWE) offer essential community support and resources to help women students navigate the diverse challenges they encounter across various engineering internship environments [1].

Our literature review also highlights the organizational support provided by companies with internship programs. Organizational support is particularly crucial, as one study noted that interns often value company initiatives that build community and share resources for women [8], such as identity-based employee resource groups and policies designed to address women's unique needs. While these findings provide valuable insights, a critical gap remains in understanding the specific provisions and impacts of such meso-level support—particularly whether and how women interns perceive and benefit from these initiatives—warranting further in-depth investigation.

Finally, at the macro level of the ecosystem, researchers have identified the need for policymakers to create initiatives that influence the greater cultural sphere [19]. However, current research provides limited insight into the specific implementation and impact of systemic interventions like industry-wide initiatives on women's experiences in engineering internships.

**The Present Study**

This study aims to answer the following research questions:

1. What gendered experiences do women engineering students face during internships?
2. How do women engineering students interpret and react to these gendered experiences?
3. What contextual aspects contribute to these gendered experiences?
4. What support systems are currently available for women engineering students in internships?
5. What additional support do women engineering students need during internships and for their future career success?

This study contributes to the field in several ways. First, it provides a systematic analysis of support systems across organizational, team, and individual levels. Second, it addresses gaps in research that had primarily focused on available resources without considering additional support

women interns need. Third, it includes both women and men participants, offering a multivocal understanding of gendered dynamics in the workplace.

In the present study, we use a binary definition of women and men because only one student who responded to the recruitment flyer identifies as non-binary. Non-binary engineering students' experiences may overlap with those of women interns while also being distinct.

## Methods

This study was conducted at The Grainger College of Engineering at the University of Illinois Urbana-Champaign, which houses many high-ranking undergraduate engineering degree programs. Approved by the university's Institutional Review Board, this interpretive study featured one-on-one semi-structured interviews with 20 undergraduate engineering students who had completed at least one internship by the time of the study (fall of 2024). Students' internships occurred at various companies across engineering industry sectors, and data collection took place at the university.

### *Procedure*

Participants were recruited through convenience sampling, facilitated by the university's Women in Engineering (WIE) program and Engineering Career Services (ECS). Recruitment advertisements outlining the study's purpose and procedures were distributed via multiple channels in the college, including websites, student newsletters, Slack channels, and physical and digital campus bulletin boards. Eligible respondents were identified through a pre-screening survey, with the first 15 women and 5 men selected for interviews.

The semi-structured interviews lasted between 45 and 60 minutes each, following an interview protocol that allowed for customized follow-up questions. This protocol (see Appendix A) was developed based on the study's primary research questions and refined after consultations with engineering education professionals, pilot testing with four engineering students, and review of the first three interviews. All interview sessions were audio-recorded. Participants received gifts valued up to $15 as compensation upon study completion. A demographic survey complemented the interviews, collecting information about participants' background, internship experiences, and the gender composition of their academic and workplace environments.

The demographic data indicates that participants were a diverse sample in terms of major, academic year, number of internships completed, and race and ethnicity (see Appendix B). All interviews have been completed, and data analysis is in progress. This article presents preliminary findings based on a randomly selected subset of 4 of the 15 women and 1 of the 5 men. To ensure anonymity, each participant was assigned a unique ID, and no personally identifiable information was recorded. Appendix B provides the demographic composition of the full sample, while Appendix C presents details of the five participants analyzed in this paper.

### *Data Analysis*

Inductive thematic analysis was conducted [22, 23] by two graduate researchers. First, they independently performed open coding on the same two transcripts by referring to the research and interview questions. They then compared the initial codebooks and resolved discrepancies through discussion. This process was repeated twice to create the codebook, with additional

input from the research team. Using this codebook, they subsequently coded three more transcripts.

Next, data interpretation was conducted, incorporating insights gained from team discussions. Specifically, this process involved organizing the data according to the codebook, selecting representative cases, reading the data in multiple rounds, and comparing cases to provide "realistic, concrete, and accurate representations" [22] of gendered internship experiences. Throughout this process, topical themes emerged from the data, revealing "unanticipated insights" [22]. This complex interpretation contributed to the methodological rigor of this study [21]. During data representation, the use of rich descriptions and the inclusion of multiple participant perspectives further enhanced the rigor of this study [21]. Afterward, preliminary findings as well as case examples were discussed among the team to incorporate diverse expertise.

*Positionality Statement*

The team defined the research questions and assembled a diverse group of experts, including engineering faculty, career services professionals for engineering students, advocates for women in engineering, and social science researchers. This cross-disciplinary collaboration enabled us to gain deeper insights into participants' gendered experiences by integrating perspectives from different contexts, such as the workplace, academia, and personal life. Our shared commitment to fostering a more inclusive work environment was driven by both personal and professional motivations.

Two women graduate researchers in education and psychology were primarily responsible for the study design, data collection, data analysis, and writing advised by engineering education faculty. Their internship experiences outside engineering helped them empathize with participants, while their academic backgrounds provided theoretical and methodological experience to interpret gender equity issues. In addition, two members of the team had college-level teaching experience related to social justice issues. To mitigate personal bias, researchers engaged in self-reflexive practice [21] and actively incorporated insights from team members with more experience working with engineering students in academic and professional settings.

## Results and Emerging Themes

*Representation of Women Matters*

Gender representation plays a key role in students' perceptions of inclusion in engineering, both in academic settings and the workplace. The gender ratio is the most noticeable aspect of gendered experiences for both women and men, and a balanced gender ratio positively impacts women in engineering internships. For example, participant A016 noted that the engineering department could "probably focus on hiring more females" to improve the gender ratio though she "felt very supported" within her core team. Participant A003 felt her gender identity did not affect her internship, attributing it to "a good ratio of women" which "was like 1:1." She emphasized that having other women in the same space signals "equal amounts of power" between men and women. It also maintains professionalism by discouraging "doing or saying inappropriate stuff". Furthermore, balanced gender representation shows that "no one is really more special than the other" and this power dynamic "brought everyone together".

Students experienced varied gender ratios in their internships and held differing beliefs about the ideal balance. While some expected a 1:1 ratio, others considered the presence of even a few women in the field as positive. Participant A016, who experienced a lopsided ratio of 10:1 in her engineering team, expressed, “If you are not the only woman or the one of two women, you might feel more comfortable if there’s like 5 or 10 of them, then you feel more supported at work just because of the people surrounding you.” In contrast, participants A003 and A011 had more positive experiences. A003 described the 1:1 ratio in her team and company as “very, very even.” A011, whose team had a 1:1 ratio and whose company had a slight male majority (3:2), felt this ratio was not as “drastic” as her male-dominated school experience. She further commented that it was better than the “horror stories about being the only woman in the room” she had heard. Participant A024 shared a similar perspective, using his school experience as a baseline. He noted that there were 3 or 4 women among the 15 interns at his workplace. To him, this “was not a bad ratio, I guess, in terms of engineering,” especially compared to that he “do[es] not see too many girls in any of my classes.” These comments about gender ratios suggest that women’s representation in the engineering workplace has an impact on quality of experience and perceptions of inclusion.

Students’ varied expectations of gender representation may stem from comparisons with other departments within their internship companies and with their school experiences. For example, A032 observed that “I see a lot of women, but they are more in like administrative roles, rather than technical ones.” Within the engineering department, she noted the presence of some women engineers but a significantly higher number of women project managers, commenting that “the ratio [in the engineering department] wasn’t super ideal.” Her observations suggested that women in her company might be less likely to hold roles that required engineering skills, both within and outside the engineering department.

When comparing gender representation in their school and workplace experiences, participants’ perspectives on which setting had better representation varied and appeared to be influenced by their specific engineering fields. For example, A003 described the 1:1 gender ratio in her internship program as drastically better than typically having only two or three women in her male-dominated computer engineering classes. Similarly, A011 noted that representation of women in her office was slightly better than that in her chemical engineering program, though she remarked, “it was not as big of a difference.” Conversely, A016 found her college experience more positive in terms of gender representation. She pointed out that having 25% women in her program was “a ratio you cannot find at a workplace”, where in her internship the ratio was close to 1:10 or 1:15. These observations underscore the differences in gender representation across engineering fields, both in the workplace and academic settings, and that participants use comparisons when evaluating gender representation in their engineering internships.

*Gender Neutral Versus Negative Gendered Experiences in Internships*

Students reported more positive than negative experiences regarding gender in their internships. On the positive side, A011, A032, A016 (in her most recent internship out of three), and A003 described gender neutral environments characterized by the absence of gender-based divisions of labor and discrimination. For example, A016 said, “They treated me the same as everyone else, which felt the best knowing there’s no reason to point out the fact that I’m a female engineer because everyone’s doing the same thing.” This suggests that individual expertise was emphasized over gender in this internship. Besides, A011 said she “was lucky in that I didn’t feel

any external comments about it." Moreover, she shared that tasks were evenly split between members of a mixed-gender team. Similarly, A032 said she never "got bullied" or "got spoken down to" because of her gender. As a comment, A003 described the environment in her company as "everything was kept really neutral" because "we really don't discriminate against anyone".

However, gender "had more of a role" in a negative way in A016's first two internships at the same company. She faced gender stereotypes in multiple ways, leading her to "almost shy away from wanting to pursue an engineering field". The engineering team at her company (an oil refinery) managed contract workers who performed manual labor at the refinery. The contract workers were mostly men, creating a challenging dynamic. One incident occurred when A016 and her mentor, a woman engineer, went to monitor a crew of contract workers installing a new piece of equipment. Upon seeing them, the workers reacted with visible surprise like "Oh". Even though nothing was said outright, based on the way they looked at them and their seeming reluctance to interact with A016 and her mentor, she perceived that these workers didn't want to take orders from the two women despite their role as supervisors. She felt "it was an awkward, uncomfortable interaction mower out there" and it "discredited my knowledge as an engineer". In another instance, a contract worker commented dismissively, saying, "What are you doing? Oh, you look like my niece. Why are you out here?" This "weird situation… rubbed me in the wrong way" and she felt "they don't have credibility for me."

Beyond interpersonal interactions, A016 observed systemic lack of support for women at the organizational level. For example, the refinery's facilities for women were inadequate. Although locker rooms and showers were essential for changing clothes and maintaining personal hygiene at work, the women's locker room was significantly smaller than the men's, and the showers were broken. As a result, A016 could not shower. She noticed that her manager, also a woman, appeared to have accepted the situation, as the showers had been broken for a long time. A016 interpreted this as a reflection of the oil company's lack of effort in providing suitable facilities for women, further highlighting the challenges women faced in that environment.

*Contextual Aspects Influencing Gendered Experiences*

Students identified several contextual aspects that either positively or negatively influenced their gendered experiences. These aspects include organizational or team culture, the sector in engineering or department, the presence of women leaders as role models, and mentor support.

The most frequently mentioned aspect was an organizational or team culture that prioritized employees' expertise over their gender. This culture was usually not explicitly stated but evident in daily interactions. For example, A003 described her internship as "amazing" because the engineers she worked with were very "humane". She elaborated that they had more "common sense" in areas such as professionalism, nondiscrimination, mutual respect regardless of gender, and maintaining a gender-neutral perspective. While acknowledging individual differences in maturity and behavior, A003 emphasized that this group of engineers stood out for their maturity and humanity. Additionally, her fellow interns supported her by addressing a situation in which a male colleague was not contributing—they spoke to him and "forced" him to collaborate with her. A003 attributed this support to her personality rather than her gender as she consistently demonstrated a strong work ethic. Similarly, A016 reported that her colleagues in her core engineering team were very supportive and treated her presence as a woman engineer without undue focus. However, she contrasted this positive experience with interactions involving

contract workers, who expressed gender stereotypes through indirect but pronounced behaviors such as a visible surprise like “Oh”. These interactions reflected an underlying social norm within that group that was less supportive of women.

The importance of organizational or team culture was echoed by participant A024. He described his company as having a positive environment where women were well-represented and not subject to oppression. He did not observe any influence of gender on professional interactions such as collaboration on projects. However, he observed that in his male-dominated team, informal conversations tended to revolve around topics typically associated with men, such as sports, with women contributing less to these discussions. This suggests that gender ratios may influence informal conversation topics. The long-term impact of such gender differences in informal interactions warrants further exploration.

The second aspect influencing gendered experience is the department within an engineering company or the broader engineering field. For example, A016 observed that corporate settings were generally more welcoming to women than places where extensive labor work was required. She compared her experiences at the oil company involving fieldwork with those at the second company where work happens mostly in the corporate office setting. While neither did anything special to support women, the second company succeeded in fostering a positive environment because its overall culture was already inclusive, requiring no additional effort. A016 also noted that the business department in her second company had a higher ratio of women employees, which she appreciated as it allowed her to make women friends. These comparisons between environments inspired her decision to prioritize corporate settings in her future job applications.

The third aspect is strong representation of women in leadership. For example, A011 mentioned it was nice that about 50% of the vice presidents in her company were women. Similarly, A032 shared that women engineers’ perspectives can be heard in her company due to the organizational hierarchy. While men outnumbered women overall, the engineering department had significant women representation in leadership roles, enabling these leaders to address issues related to gender bias effectively. This aspect was also recognized by the man participant, A024, who remarked that he was surprised to see women playing “a bigger role” in his company.

The fourth aspect is support from mentors or managers. For instance, A011 shared that her man manager was quite supportive, assuring her that she could always talk to him if she ever felt she was being treated unfairly. This open communication significantly enhanced her psychological safety in the workplace.

While many women participants reported positive gender-related experiences in the workplace, it is worth noting that some of them already experienced unequal treatment during their undergraduate programs or prior, particularly in interactions with men peers. These negative school experiences might carry over into the workplace, creating a sense of burden for some women as they transition into professional environments. For example, A032 shared that she experienced more discrimination against women engineers in her college than during her internship in her home country. She attributed this to either the general lack of maturity in a college setting or cultural differences. As a result, her reaction to gender discrimination was to avoid it rather than actively seek resources that support women. A024, the man participant, offered a similar perspective. He rarely saw women in his college taking on leadership roles or being expressive during office hours or extracurricular activities. However, at the workplace, he was surprised to see so many women engineers and leaders. He admired these women for their

"strong, independent" personalities and their ability to navigate the company. He expressed gratitude for having the opportunity to meet such strong role models.

*Support Systems for Women Interns*

Support systems for women interns were primarily interpersonal and team-based, often informal rather than formally structured, yet generally perceived as supportive. For instance, A011 had a supportive man manager who took a proactive approach. During their second one-on-one meeting, he brought up that she could always come to him if she felt uncomfortable in any situation. This initiative integrated the mitigation of gender disparities into her professional experience. A011 interpreted the message as she could seek help from her manager if needed. In contrast, A016's negative experience at the oil company highlighted the challenges of gender discrimination and inadequate amenities for women. Despite her man mentor being supportive, she did not expect him to fully understand the struggles women faced in that environment. Participant A024, expressed his perspective on fostering team-level support. He suggested that, if he were a manager, he would focus on creating more opportunities for women to contribute to projects. In his current role as an intern, what he could best do to support women colleagues was ensuring their voices were included in conversations and project discussions.

Organizational initiatives primarily addressed general intern needs, such as professional development and fostering a sense of belonging, while fewer efforts specifically targeted women. These initiatives could be either explicit or intrinsic in nature. For instance, A003's internship program was an initiative targeting young students from public schools, public universities, and community colleges. The vision was to ensure equitable access to research and learning opportunities for underrepresented groups. This strong organizational emphasis on diversifying the workforce was because her company received government funding and collaborated with public universities and IT companies. Additionally, many leaders within her company had prior experience in educational innovation, which further strengthened the implementation and success of such efforts. As a result, her company achieved a 1:1 gender ratio.

Some organizational efforts aimed at promoting gender equity may be poorly received if they reinforce gender-based divisions or stereotypes. For example, there is a trend of hiring more women engineers [20]. In one of A016's job interviews, the hiring team excessively highlighted their women-in-engineering and minorities support groups. It was overwhelming to her, making her feel that the entire interview was more about gender equity than the position itself. She wondered whether their only reason for hiring her would be to add her to one of these minority groups rather than valuing her expertise. Fortunately, her most recent internship was enjoyable, as she was treated the same as everyone else in situations that should be gender neutral.

Participants shared their perspectives on the types of support needed for women interns. A016, who had a negative gendered experience in her first company, suggested organizational measures such as creating a small community for women and increasing the number of female hires in the engineering department. In contrast, A011, who had a generally positive experience, emphasized the importance of maintaining mutual respect among colleagues. Similarly, A032 proposed fostering general empathy among employees, inspired by the success of her company's DEI effort. Interestingly, some participants (A016 in her most recent internship and A024) noted that

their experiences in a gender neutral environment were already positive, suggesting a minimal need for additional organization-level support for women.

Lastly, women and men participants had different perspectives on the practices of hiring more women in engineering. Women interns like A016 were often cautious, concerned that their gender might be prioritized over their expertise. In contrast, the man participant, A024, viewed this push more positively, viewing it as a great way to create a more equitable environment given the historical lack of opportunities for women. He emphasized that he would attribute women's career success to their intelligence and hard work, rather than their gender identity.

## Discussion

The topic of the current study is both timely and critical [21]. Internships serve as a pivotal first step for women engineering students transitioning into engineering workplaces [5]. Understanding the challenges they face and identifying ways to support them is essential for improving their retention in the field, which has been and remains a concerning issue [4].

### *Summary of Findings*

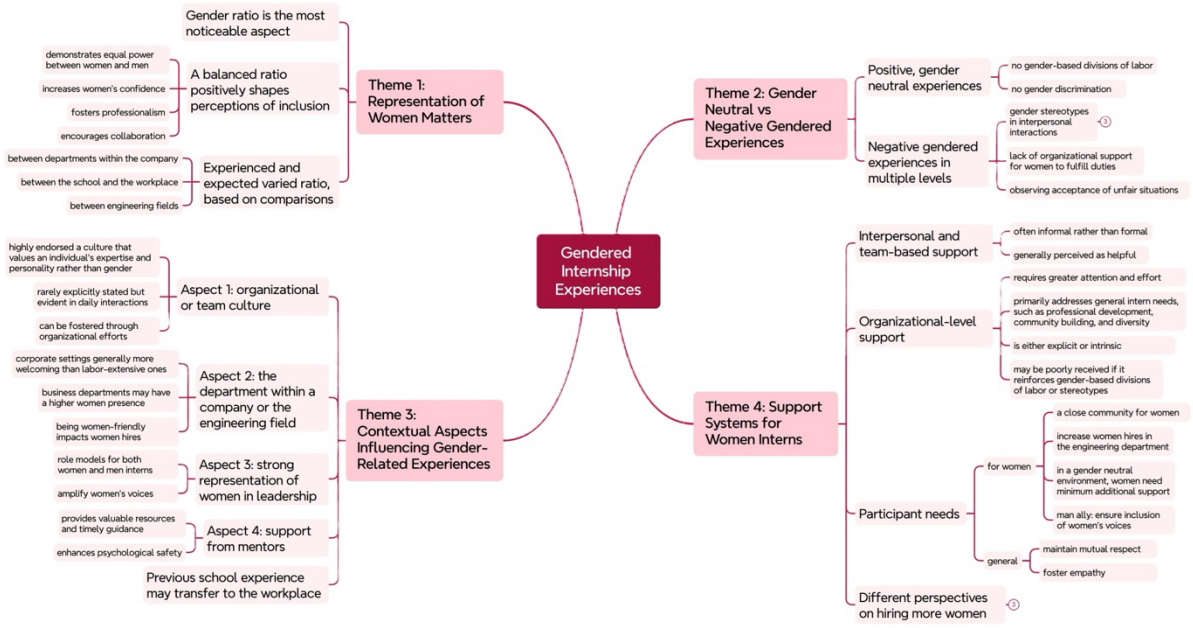


Figure 1: Concept Map of Findings

Four major preliminary findings were identified in this study, as shown in Figure 1. First, gender representation plays a crucial role in shaping students' perceptions of inclusion in engineering, both in the workplace and academic settings. A more balanced gender ratio positively impacts women students in ways such as increasing their confidence, fostering professionalism, and encouraging collaboration. Furthermore, workplace gender ratios vary widely, ranging from near parity in some environments to extreme male dominance in others. Students' expectations of an ideal gender ratio also vary and often depend on comparisons between different departments of their internship companies and with their school experiences. Interestingly, in some cases, schools achieve better gender balance, while in others, workplaces outperform academic settings.

The second finding is that despite the prevalence of positive gender-neutral experiences, negative gendered experiences at various levels produced diverse outcomes. Instances of uncomfortable verbal language and other unsettling situations suggest a failure to meet women's professional needs. Students reported more positive than negative experiences related to gender during their internships. This higher-than-expected ratio of positive experiences may be attributed to several reasons. First, internships are relatively short-term, which may limit students' ability to recognize deeper or more subtle gendered dynamics. Second, students may view internships primarily as learning opportunities and, as a result, adopt a more appreciative perspective focusing on personal growth rather than a critical one. Third, students may lack awareness of certain gender-related issues. We cannot determine whether they were able to observe and reflect on all implicit gender stereotypes and biases because we did not assess their knowledge of complex gender equity challenges (e.g. microaggression) or long-term issues that could arise after several years in the workforce (e.g. limited promotion opportunities and parental leave policies). Finally, this finding could reflect progress toward gender inclusion within the engineering field, at least within this sample of students, but studies at a larger scale are needed.

The third finding is that individual efforts alone are insufficient to transform a gendered workplace; structural change must consider ways to achieve meaningful organizational, cultural, and systemic transformations. These considerations include organizational or team culture, the sector in engineering or department, the presence of women leaders as role models, and support from mentors. Among these, a culture that values employees' individual characteristics such as expertise, personality, and professionalism rather than their gender is particularly appreciated. This culture can be fostered through organizational efforts. Besides, the extent to which a sector or department is welcoming to women significantly attracts and retains women employees. Further, women leaders can serve as powerful role models for all interns, while also amplifying women's voices within the organization. Finally, mentors and managers play a key role in supporting women interns by providing valuable resources and timely guidance. This finding aligns with [13], which found that mentorship provides significantly greater psychosocial benefits to women interns compared to their men peers.

The fourth finding is that women engineering interns have received interpersonal, team-based, and organizational support. The support systems such as the mentor's proactive assistance are often informal rather than formally structured, and are generally perceived as helpful. Students reported receiving interpersonal and team-level support more frequently than organizational-level support, suggesting that the latter requires greater attention and effort. Existing organizational initiatives primarily address general intern needs rather than targeting women interns, which could benefit women as well. As suggested by participants, a humane environment that supports everyone inherently benefits women. In contrast, some organizational efforts aiming to promote gender equity may be implemented in an ineffective way. For example, hiring teams may overemphasize women support resources while overlooking discussions about the candidate's fit for the position. This practice not only leaves women candidates questioning whether their qualifications are valued but also reinforces gender stereotypes.

*Implications for Practice*

To create a welcoming engineering workplace, we call for organizational, cultural, systemic, and sustainable transformation. This transformation will have a greater impact through collective

effort between both women and men, and through collaboration between employers and universities [24].

Our findings suggest the following actions for engineering employers to support women interns and employees:

1. Continue improving gender balance, particularly in leadership positions.
2. Create a respectful and empathetic work environment with commitment from high-level leaders and coordination across all levels of an organization. Encourage mutual respect among colleagues and foster empathy in workplace interactions.
3. Foster a gender-neutral culture that values employees' individual characteristics such as expertise, personality, and professionalism rather than their gender.
4. Ensure onboarding process includes gender and unconscious bias training for both interns/employees and mentors. If possible, consider assigning both a woman mentor and a man mentor.
5. Regularly assess and address the needs of women interns and employees. Expand both the organizational initiatives that support all interns and those targeting women.
6. Adopt successful strategies from other departments, companies, or engineering fields.

The university can equip women students with skills to navigate a gendered internship experience and partner with employers to provide training opportunities. For example, universities can:

1. Provide engineering students with deep insights into gender-related issues. Topics include understanding the variability of gender representation across different environments, recognizing nuanced gender stereotypes and microaggressions, and developing effective strategies to navigate workplace gendered dynamics.
2. Expand outreach beyond the university setting. In addition to recommending the above best practices to employers at career fairs on campus, consider offering workshops to companies or providing online training to reach a broader audience.
3. Help women students understand equity issues at societal and organizational levels. Educate them ways to drive structural change in creative ways. Many students are already passionate about supporting gender equity in the workplace. They are ready to learn how to think critically about systemic issues to elevate their efforts to a higher level.
4. Teach women students how to identify and utilize existing resources within companies, universities, and broader society.

*Limitations*

This study is subject to several limitations. First, the current preliminary findings are based on the analysis of five interview sessions, comprising 25% of the data. As data analysis continues, the results and findings may reveal a broader and more diverse range of perspectives. Second, there may be limitations in participant perspectives due to voluntary participation during participant recruitment. Participants who responded to the recruitment flyer might be more socially active and, as a result, have relatively more positive experiences during their internships. In future research, we will explore alternative recruitment methods to ensure a more representative sample.

## Future Work

By the end of the full study, all 20 transcripts will be coded and analyzed to provide an in-depth discussion. The codebook will be further refined, and analytical consistency measures will be implemented to enhance the reliability of the findings.

Future research could explore several directions. First, beyond the gender ratio, it could examine other indicators of women's representation, such as their level of engagement. Second, the long-term impact of gender differences in informal interactions warrants further investigation. Third, large-scale studies could examine whether women engineering interns are experiencing increasingly positive environments in certain contexts, providing insights into recent progress toward gender inclusion in the engineering field. Finally, it could examine how different indicators of gender equity, such as representation of women in leadership, affect interns' job expectations and satisfaction.

As the first phase of a larger project, the findings of this study and its full version will inform the development, implementation, and evaluation of professional development programs aimed at improving women engineering students' internship experiences and outcomes. Specifically, findings will be used to engage women engineering students in human-centered design activities, enabling them to co-create inclusive internship resources and support programs in collaboration with engineering educators, gender equity activists, and career service counselors. We will explore new recruitment methods and expand outreach efforts within the College of Engineering to reach a wider participant pool to ensure a broader representation of students.

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## References

[1] C. Seron, S. S. Silbey, E. Cech, and B. Rubineau, "Persistence Is Cultural: Professional Socialization and the Reproduction of Sex Segregation," *Work and Occupations*, vol. 43, no. 2, pp. 178–214, May 2016, doi: 10.1177/0730888415618728.

[2] P. Meiksins, and P. Layne, "Women in Engineering: Analyzing 20 Years of Social Science Literature - Society of Women Engineers." Accessed: Dec. 27, 2024. [Online]. Available: https://swe.org/magazine/lit-review-22/

[3] R. King, *Addressing the Supply and Quality of Engineering Graduates for the New Century*. Sydney, Australia: Carrick Institute, 2008.

[4] "Retention in the Engineering Workforce - Society of Women Engineers." Accessed: Dec. 27, 2024. [Online]. Available: https://swe.org/research/2023/retention/

[5] A. McManus and A. H. Feinstein, "Internships and Occupational Socialization: What are Students Learning?," *Developments in Business Simulation and Experiential Learning: Proceedings of the Annual ABSEL conference*, vol. 35, 2008, Accessed: Dec. 27, 2024. [Online]. Available: https://absel-ojs-ttu.tdl.org/absel/article/view/396

[6] "National Survey of College Internships." Accessed: Dec. 27, 2024. [Online]. Available: https://www.collegeinternshipsurvey.org/

[7] A. Ayob, S. A. Osman, M. Z. Omar, N. Jamaluddin, N. T. Kofli, and S. Johar, "Industrial Training as Gateway to Engineering Career: Experience Sharing," *Procedia - Social and Behavioral Sciences*, vol. 102, pp. 48–54, Nov. 2013, doi: 10.1016/j.sbspro.2013.10.712.
[8] K. N. Smith, B. Pincus, A. M. Wofford, and B. L. Branch, "'Do I even belong?': Internships as gendered career socialization experiences in engineering," *Journal of Diversity in Higher Education*, early access. Oct. 2023, doi: 10.1037/dhe0000532.
[9] B. V. Krishna and J. S. Babu, "Impact of Internship on Employability of Undergraduate Engineering Students: A Case Study," *Journal of Engineering Education Transformations*, vol. 34, no. 4, Jun. 2021, doi: 10.16920/jeet/2021/v34i4/153410.
[10] K. Beddoes, "Guest Editorial – Men and Masculinities in Engineering: Volume 1," *Engineering Studies*, vol. 11, no. 3, pp. 169–171, Sep. 2019, doi: 10.1080/19378629.2019.1672992.
[11] K. N. Smith and J. G. Gayles, "'Girl Power': Gendered Academic and Workplace Experiences of College Women in Engineering," *Social Sciences*, vol. 7, no. 1, Art. no. 1, Jan. 2018, doi: 10.3390/socsci7010011.
[12] S. A. Male, A. Gardner, E. Figueroa, and D. Bennett, "Investigation of students' experiences of gendered cultures in engineering workplaces," *European Journal of Engineering Education*, vol. 43, no. 3, pp. 360–377, May 2018, doi: 10.1080/03043797.2017.1397604.
[13] M. M. Fifolt and G. Abbott, "Differential experiences of women and minority engineering students in a cooperative education program," *Journal of Women and Minorities in Science and Engineering*, vol. 14, no. 3, 2008, doi: 10.1615/JWomenMinorScienEng.v14.i3.20.
[14] T. Bowen, "Examining students' perspectives on gender bias in their work-integrated learning placements," *Higher Education Research & Development*, vol. 39, no. 3, pp. 411–424, Apr. 2020, doi: 10.1080/07294360.2019.1677568.
[15] N. A. Mozahem, C. M. Ghanem, F. K. Hamieh, and R. E. Shoujaa, "Women in engineering: A qualitative investigation of the contextual support and barriers to their career choice," *Women's Studies International Forum*, vol. 74, pp. 127–136, May 2019, doi: 0.1016/j.wsif.2019.03.014.
[16] J. Acker, "Hierarchies, jobs, bodies: A theory of gendered organizations," Gender & Society, vol. 4, no. 2, pp. 139–158, Jun. 1990, doi: 10.1177/089124390004002002.
[17] A. Powell, B. Bagilhole, and A. Dainty, "How women engineers do and undo gender: Consequences for gender equality," *Gender Work & Organization*, vol. 16, no. 4, pp. 411–428, Jul. 2009, doi: 10.1111/j.1468-0432.2008.00406.x.
[18] J. Gesun, R. Swan and B. Watson, "An ecosystem analysis of engineering thriving with emergent properties at the micro, meso, and macro levels", in 2024 ASEE Annual Conference & Exposition, June 2024.
[19] M.-T. Wang and J. L. Degol, "Gender gap in Science, Technology, Engineering, and Mathematics (STEM): Current knowledge, implications for practice, policy, and future directions," *Educ Psychol Rev*, vol. 29, no. 1, pp. 119–140, Mar. 2017, doi: 10.1007/s10648-015-9355-x.
[20] Society of Women Engineers, "Employment - Society of Women Engineers." Available: https://swe.org/research/2024/employment/. [Accessed: Jan. 14, 2025]
[21] S. J. Tracy, "Qualitative quality: Eight 'big-tent' criteria for excellent qualitative research," *Qualitative Inquiry*, vol. 16, no. 10, pp. 837–851, Oct. 2010, doi:10.1177/1077800410383121.

[22] C. A. Bailey, “Chapter 13: Thematic Analysis,” in *A Guide to Qualitative Field Research*. Thousand Oaks, California: SAGE, 2023. doi: https://dx.doi.org/10.4135/9781071909614.
[23] J. W. Creswell, “Chapter 8: Data Analysis and Representation,” in *Qualitative inquiry and research design: Choosing among five approaches*, Thousand Oaks, California: SAGE Publications, 2013, pp. 179–212.
[24] S. Batliwala, “All about movements.” CREA, https://creaworld.org/wp-content/uploads/2020/12/All-About-Movements_Web.pdf (accessed Mar. 10, 2025).

**Appendix A: Interview Protocol**

1. Internship experience overview
   In the previous survey, you mentioned your internship experience at [employer].
   - 1.1. What were the primary responsibilities of it?
   - 1.2. [IF they mention 3 or more internships in the pre-screening survey] Ask them to specify the total number of internships they have completed. Confirm whether the internship mentioned in the pre-screening survey is the one they consider most impressive or the one they are most interested in discussing.
2. Positive and negative aspects of the internship
   - 2.1. Which aspects of your internship did you find satisfying? Why?
   - 2.2. Which aspects of your internship did you find unsatisfying? Why?
   - 2.3. Can you describe a challenge you faced during your internship, such as realizing your weak spots, getting stuck in a task, or a situation that made you concerned?
     Follow up questions:
     - 2.3.1. What did you think about this challenge?
     - 2.3.2. How did you deal with this challenge?
       - 2.3.2.1. prompt: personal strategies; extrinsic resources
       - 2.3.2.2. prompt: what made you persist or give up to this point
     - 2.3.3. What would have been helpful to you in dealing with the challenge?
3. Support systems
   - 3.1. Did you have access to any support in your internship? How did they impact your internship experience?
     - 3.1.1. Prompt: peer, mentorship, organizational - company, school, etc
   - 3.2. Did you receive any specific support from men colleagues? What kind of support did you hope to receive from them?
     - 3.2.1. Prompt: interns, teammates, supervisors, mentors
   - 3.3. What additional support do you need to thrive in engineering workplace settings?
     - 3.3.1. Prompt: both external ones like organizational change, manager training, improvements of onboarding, culture shifts and internal ones like training in professional skills
4. Perception of gender in the workplace during internship
   *Women's version*

   Now let's shift focus and explore how your gender may have influenced your time in the internship, if at all.
   - 4.1. Do you think being a woman influenced your experience? If so, how?
     - 4.1.1. Prompt 1: comments, expectations, requests, interactions, dynamics
     - 4.1.2. Prompt 2: It can be both your experience or what you saw/heard
     - 4.1.3. [IF they only mention the gender ratio, dig deeper] Besides gender representation, there might be something deeper in people's minds influencing the numbers, such as social norms, beliefs, attitudes, etc. What do you think could possibly lie behind these numbers?
   - 4.2. In your internship, do you think there is any difference between the experience of women and men workers? Why?

4.3. (SKIP if their experience is mainly within the team or if they reported no gender difference) Based on your experience, did men and women that you know in your company receive different treatment?
    4.3.1. prompt: emphasize workplace culture at the organization level; if the participant finds it hard to summarize, ask them to think about one example; still focus on their direct experience
4.4. In what ways do you think the work environment supported or failed to support women?
4.5. Do you think the engineering field is becoming more inclusive for women or not? What changes have you observed? What changes would you like to see?
    4.5.1. Follow up: can be either your specific field or the general engineering field. Can compare with different engineering fields.
    4.5.2. What made you choose this career? Have you thought about gender when you selected your major?
4.6. Is the gender difference that you previously shared in the workplace the same as in school?

*Men's version*

Now let's shift focus and explore how your gender may have influenced your time in the internship, if at all. We are interested in knowing the experience of both genders.

4.7. To begin with, do you think being a man influenced your experience? If so, how?
4.8. In your internship, do you think there is any difference between the experience of women and men workers? Why? About the whole company?
4.9. Would you like to share anything else about men's experiences?
4.10. [IF they reported women being unfairly treated]
    4.10.1. How did you perceive the experiences of your women colleagues or interns during the internship? (If not, what makes you think so?)
    4.10.2. In what ways do you think the work environment supported or failed to support women?
    4.10.3. How do you think you can support women in the workplace? Have you taken any actions to support women colleagues during your internship?
    4.10.4. Do you think the engineering field is becoming more inclusive for women *or not*? Follow up:
        4.10.4.1. What changes have you observed?
        4.10.4.2. What changes would you like to see?
4.11. Is the gender difference that you previously shared in the workplace the same as in school?

5. Career development
    5.1. How does this internship experience affect your perceptions about your career plans?
        5.1.1. prompt: general OR a particularly positive OR negative experience
    5.2. What are the next steps you will take to advance in your engineering career?
        5.2.1. prompt: job preparation, technical skills, professional and soft skills…

**Appendix B: Demographic Compositions of the Full Sample**

| Characteristic | Category | Count |
|---|---|---|
| **Major** | Computer Science | 5 |
| | Mechanical Engineering | 5 |
| | Electrical Engineering | 4 |
| | Chemical Engineering | 2 |
| | Civil Engineering | 1 |
| | Computer Engineering | 1 |
| | Materials Engineering | 1 |
| | Systems Engineering and Design | 1 |
| **Academic Year** | Senior | 7 |
| | Junior | 8 |
| | Sophomore | 4 |
| | Freshman | 1 |
| **Number of Internships Completed** | One | 9 |
| | Two | 6 |
| | Three or more | 5 |
| **Racial Background** | White | 6 |
| | Asian or Asian American | 12 |
| | Multiracial | 2 |
| **Ethnicity** | Hispanic or Latino | 2 |
| | Non-Hispanic or Latino | 18 |

**Appendix C: Participant Information for Preliminary Analysis**

| **Participant ID** | **A016** | **A032** | **A003** | **A011** | **A024** |
|---|---|---|---|---|---|
| Gender | Female | Female | Female | Female | Male |
| Race and ethnicity | Multiracial | Asian | Multiracial | White | Asian |
| Major | Mechanical Engineering | Computer Science | Computer Engineering | Chemical Engineering | Electrical Engineering |
| Year in school | Senior | Junior | Junior | Senior | Junior |
| Number of internships | 3 | 1 | 2 | 1 | 2 |
| Estimated gender ratio in team (men vs women) | 10:1 | 3:1 | 1:1 | 1:1 | 5:1 |
| Estimated gender ratio in company (men vs women) | 8:1 | 1:1 | 1:1 | 3:2 | 5:2 |
| Internship satisfaction (1-5) | 5 | 4 | 4 | 5 | 3.5 |
| Internship supportiveness (1-5) | 3.5 | 3.5 | 4.2 | 4.3 | 3.3 |
| Internship length in months | 3 | 3 | 3 | 3 | 2 |
| Mentorship situation | My internship program assigned a different mentor who is not my supervisor | My supervisor was my mentor | My supervisor was my mentor | My internship program assigned a different mentor who is not my supervisor | My internship program assigned a different mentor who is not my supervisor |