



No, Really. Gender Does Still Matter:

Preparing Female Engineers for the Cooperative Education Experience

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Coming from a Career Services department of a heavily STEM focused university, specifically engineering, I often wonder about our role in STEM initiatives. Should we only focus on the goals of our departments and universities? Do we have any obligation or do we have any opportunity to participate in the national initiatives? Should we be thinking bigger? While engineers are in high demand, there is a severe drought of female engineers. >>> This is not new news. In fact, in recent statistics from the National Science Foundation (2015), **women represent only 14.9% of the engineering workforce**. Overall, the STEM fields are not completely deprived of women, there are actually some with near proportional showings (Cummins, 2015). However, engineering is at the bottom of the list, with the lowest percentage of women. In our universities, the numbers aren't much better. According to a 2014 NSF Study, females earned only 19.8% of the engineering degrees awarded, with the average since 2004 being only 19.2%. Only a slight increase has occurred over the past 10 years.

As members of Career Services, we have obligations to our universities, but we should also cast our attention on the larger initiatives. While focused on providing employment provision, career skills, and opportunities for students to begin and succeed in their careers, we do not do enough to empower women in engineering. In an effort to address this problem, I propose cooperative education programs as a site for careful and creative solutions to better prepare women for co-op engineering experiences. In this study, I interviewed female engineers who completed at least one semester of a co-op in order to gather information about their experiences, better understand the realities, and more effectively respond as a co-op practitioner. Using the results of these interviews, I propose key components of a cooperative education program to more adequately prepare women in engineering for a male-dominated workplace.

WOMEN IN COOPERATIVE EDUCATION

Cooperative education may be one way we can specifically focus on women in engineering and propose a small, but potentially significant solution. The inspiration for this work came from Sickle's chapter in the *Handbook of Cooperative Education* (Knowles, 1971) where she identified cooperative education as a method to break two major gender barriers for women — "the opportunity to enter new career fields and the opportunity to gain equal pay for equal work" (p. 269). This was the first indication in the research of the unique co-op benefits for women and these benefits were critical in significance because they addressed the current gendered workplace issues. Even today those goals seem spot on, but the chapter also provided evidence of the gender stereotypes at play. In the 1960-70s, one benefit for women in co-op was the expanded pool of potential husbands, not anything we would advertise today. Also discussed were specific problems women caused: they insisted on higher wages and showed a noticeable intolerance for bosses and co-workers. The source for this information, workplace supervisors, saw women as less tolerant and more likely to leave for insignificant reasons, but might there be more to that story? When supervisors used the term "grouchy bosses," as they were described, perhaps there was much more than grouchy, but there is no access to the insider information because the women's voices are not yet a part of the research. Mosbacker, W.B. (1973) explored the realities of working women and provided evidence for the changing world of work, women's improving status, and specific benefits, but simultaneously recognizing the work to be done. Kany (1973) reported on initial observations of a larger project, "Meanings of Work to Women Students

in a Cooperative Education Program." One of her two major conclusions pointed to the positive influence that cooperative education has on women's identities. Rowe (1980) conducted a study to specifically look at the effect of the co-op experience on women. "The results of this study have provided very little evidence in support of the notion that cooperative education has a greater effect upon women than men" (p. 57). However, this study was done strictly with mailed questionnaires and quantitative results. I have to ask — what did this study miss? If given a chance to share their perspectives, what would the women's full stories have told us about the realities of their workplaces and how the co-op may have been beneficial to them? Using interviews, Leventman and Horst (1985) did a study on women in engineering. Their goal was to address the role of co-op in preparing women for their career and the impact on their career development. The stories they collected told of the workplace realities and concluded, "there would seem to be no substitute for the kind of practical, hands-on experience co-op provides" (Leventman & Horst, 1985, p. 213). While this sounds like a replica of any description of co-op benefits, we have to better define what the practical, hands-on experience means for women, because it is different than men. Fifolt & Abbott (2008) identified the potential of co-op programs to serve in increasing the representation of women and minorities in the sciences and engineering. They suggested co-op programs' structures and programs more inclusively meet the needs of women. More recent work has focused on retaining female engineers, both at the university and in the workplace (Franchetti, Ravn. & Kuntz, 2010; Wilkinson & Sullivan, 2004). Raelin et al. (2011 & 2014) looked not only at the retention of female engineers in the university, but also whether the cooperative education experience affected their self-efficacy in the work, career, and academic sectors. As research has shown, co-op is one area that has the potential to make a difference in balancing the gender gap and filling the employment needs.

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hear the women's stories.

In the Society of Women Engineers (SWE) 2015 annual literature review (Meilksins et al. 2015), the results were clear in identifying the presence of gender-related issues in the workplace. The research looked at why the number of female engineers continues to remain low, but also identified if and how an effort was being made to attract more women. There were also articles reviewed that assessed the current programs aimed at recruiting and retaining female engineers and scientists. Not unlike the gender-based stereotypes and discrimination of the 70's, this is further proof that gender related issues remain in the workplace, and these are only magnified for women in historically male-dominated fields. Knowing this, our obligation is to better prepare the women from our universities, and specifically, cooperative education programs should better serve the women in engineering to assist in both preparation and retention initiatives.

FEMALE ENGINEERS ON CO-OP: A QUALITATIVE STUDY

If we are to be more effective in serving the female engineers in our cooperative education programs, we need to better understand their experiences and their needs. The research on these realities cannot focus too heavily on quantitative data — Rather, we need to hear the women's stories. A quantitative approach with only numerical results, as earlier research has shown (Rowe, 1980), indicates little if any difference in the co-op experience based on gender. There is a lot missing when we focus only on the numbers. If we are to examine the conditions of women who are in cooperative education worksites, we need to hear their story, the whole story. In his text *Learning from* Strangers, Weiss (1994) offers seven reasons for qualitative research, and three are especially important to this discussion. First, with interviews, we can develop a detailed description and this allows us to better understand the women's entire experience. A holistic description is also possible with this method. Finally, Weiss suggests interviews provide insight into how events are interpreted, and this is an absolute must. As discussed previously, Sickle's chapter provided the perspective of co-op supervisors, but if the women would have been a part of the research, we may have better understood what was meant by a "grouchy boss" or the specific reasons women left. The interpretations would have most likely told a very different story. Numbers alone are not able to provide these insights that are possible with gualitative methods. We need to know the details of the women's experiences in order to address the women's issues in the workplace. As co-op practitioners, we need to pay attention to the women in engineering, as the need is even bigger than our institutions. We need the women's voices to tell their stories so we have a starting point from which to identify creative solutions that will assist in growing the numbers of professional female engineers who begin and are retained in their careers.

In the present study, I conducted interviews with female engineers who were participating in an off-campus co-op placement. Conducting interviews with females was purposeful in exploring the realities of their lives as female engineers in the workplace. These perspectives are crucial in not only understanding that reality, but also understanding what we can do to prepare them for the male-dominated field of engineering. If we are to access those realities and the details of their day-to-day experiences, qualitative methods were an absolute necessity. The overarching study asked undergra duate Cooperative Education students during the Spring 2016 semester to voluntarily participate in a study that was both quantitative and qualitative. The participants were asked to complete a pre- and post-semester survey, additionally, the females were asked to do a post co-op interview, with additional interviews being scheduled for Winter 2016. Women made up 28% of the study's population, an exact match to our institution's gender ratio. From the pool of women on co-op, 41% (11 women) agreed to participate in the interview portion of the study. All but one of the women were in the College of Engineering and worked in positions that were related to their major. The interviews for the first round were done by phone, with the exception of one emailed interview. The questions were given to the participants prior to the interview and followed a fixed question, open response format with minimal follow-up questioning or clarifying. The present study focuses specifically on the first-round of interviews and what we can learn about the realities of the workplace for a female co-op engineer. One question asked specifically focused on gender and ensured all participants had an opportunity to talk about any portion of their co-op experience that may have been affected by gender: "Did you notice any differences where gender played a role?" The interviews were transcribed and coded, and any responses coded as gender-related issues are included in this study.

LIFE AS A CO-OP IN A MALE-DOMINATED WORKPLACE

The first similarity between all of the women's' experiences were the number of other women, or lack of, in their divisions and departments. This was something all of the women mentioned, and while some downplayed the significance, they were well aware of their minority status and talked about the numbers.

// I guess I always realized I was the only girl out of
all the engineers. //

// The only female electrical engineer. // // There were three in the entire department. //

Most interesting was that while this was something they had noticed, many did not consider it an issue, more of a given. Having come from a university setting where the ratios were also unbalanced, this had become their life, their reality, and nothing they could change. "Of course engineering is male dominated," stated one of the women. Another mentioned she "just stopped noticing after a while. It's just kind of a thing." With these comments, it is difficult to see the progress we have made since 1971. At that time, the expectation would have been a male-dominated work culture, but here we are forty-plus years later and the only evolution we see for these women is the expectation that they just stop paying attention after a while.

One problem with this unbalanced gender ratio is the lack of mentors and role models available to these women. In *Everyday Feminism*, Patricia Valoy, a Civil Engineer, feminist blogger and STEM activist cited one key reason why the lack of women in STEM is a feminist issue: the need for more female role models. Valoy herself has had many effective role models, but when they are not women, it changes the outcome.

I don't see myself in them. When I see a woman in a position I'd like to be in, I internalize that, and my goal becomes that much more tangible. What I see is an individual who also faces the unique challenges that I face, and she has succeeded. (We Need Role Models section, para. 3-4)

These women may think the lack of other women in their professions doesn't matter, but I don't believe they can even recognize the detriment that occurs due to the gender imbalance. They haven't ever seen it any other way. It has been their reality, so they don't know any differently. And to ensure their school and work is not affected, they do not spend time dwelling on the facts. Again, what can they do? Valoy's point is key in determining a solution — we need more female mentors available to our female co-op engineers. These women do not understand the increase in potential possibilities if there were more women.

The presence or lack of a female mentor plays a crucial role, and two of the women's stories show just how polarizing the results can be. The first student had a female mentor whose role was to oversee the entire unit. The student said this about her mentor. "And as a woman engineer, I really looked up to her and how she handled things, and how she displayed her leadership skills." As she went on to describe her mentor, there were traits that the student saw in her mentor that reminded her of herself, specifically her soft spoken demeanor. Identifying with that aspect of her mentor's personality, the student had always assumed it was not conducive to a leadership position. Her mentor was able to provide an example of someone who can be a leader and step up when needed, while still maintaining her true self. This was truly inspiring to the student. Enough so that she is returning to school with plans for pursuing

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leadership positions, because she realized it was possible. She saw herself in her mentor, someone with similar circumstances, and that one woman has shown her future possibilities. The second student had an older male mentor, nearly 40 years her senior. In her experience, she did not have a mentor she could relate to, nor did she see herself in him. And even worse, there were gender related issues significant enough to warrant a formal HR complaint. At this point, it is too early to predict what the long-term consequences may be, but the second woman did not have someone who inspired her, nor showed her what is possible as a woman. Instead, she saw the realities that some women face in a male-dominated culture. Though her retention as a female engineer is still yet to be determined, the workplace culture and harassment is something she will not soon forget. Her experience also confirms that not all mentors are effective. In the end, she did seek out her own female mentor, mostly because this woman had a similar harassment experience. The student knew what she needed - someone who had encountered similar workplace issues and persevered in spite of them. This is not to say that a male mentor cannot be effective, but when you compare the experiences of these two women, there is clear evidence of the payoffs from female role models and the prodigious difference they can make in not only their co-op experience, but even their long term goals as female engineers.

Overall, the results from the gender question covered a range of responses, yet provided evidence that there are issues, some issues even the women did not recognize. Many of the women began their response to the question with something like, "No, not really." Gender was a non-issue. It was just life, and something they learned to ignore. It wasn't until they continued to talk about their co-op experiences as it related to gender that I found out the rest of the story. Actually, half of the women did not cite any issue with gender, other than the ratios. But when they

continued with their story, there was so much more. As they spoke of the non-issues, they were actually describing clear examples where gender was in fact at play, but they did not recognize it as that. In one interview, the student described the environment and the number of women, and then after talking about the ratios, she casually mentioned at the end of her response that she noticed conversations abruptly ending when she was present. "I guess women can be harder to read or potentially be more sensitive. And so some of the men would have obviously pointed that out." Though she noticed the actions, she was not seeing the gender stereotypes at play. She was one of few women and men sometimes acted differently around her, yet she did not consider this an issue nor a problem. This is not surprising, however, because the same held true in SWE's 2015 Gender Culture Study. When asked about gender, there was a denial that gender was a factor because women do not want to be identified as a complainer or an advocate for women in the workplace. What is happening is so embedded and so normal that it is no longer even recognized by women as being bias at all. These were clear instances of second generation bias. Not only was there a denial, but the women were also very careful as to not complain about their situations. In their attempt to avoid complaining or whining, there was a unique commonality between multiple women when they were describing an aspect of their experience that was unfavorable. They steered clear of any negative language and used the term "different." When one was describing her experience as a female in the oil refinery, she said, "It was a little different because most of them are guys." She went on to describe being treated like everyone else, yet received looks from men in the refinery when she walked through in her "steel-toes, hard hat, and flame resistant clothing." In concluding her response to the question, she cited "being lucky" as the reason she did not have any issues related to gender, after discussing her "different" experience in the refinery.

When the women continued to speak and tell their stories, it was clear that gender was an issue in the workplace for some, and most evident for those whose positions placed them in specific industries or sectors of their company. Examples included the pipeline industry, shop floor, and an oil refinery. In these areas, the gender issues were magnified. These were the places where it was clearly communicated that it was a "man's job." When these women shared their experiences, there was no denying that gender clearly played a role and even more significant were their shifting identities to compensate for their own gender. In these environments, the women spoke specifically about the actions they needed to take to earn respect or prove their abilities to their male co-workers. Their lack of membership in the male culture was immediately evident, but luckily, none of the women in these roles let it get in the way. However, upon arrival they were aware of not only the discourse they were entering, but also the requirements to become an authentic member of that particular team. In any co-op experience, the students may feel they have to prove their worth coming in as a student, but as a woman in these particular environments, the necessity was magnified. Not only did they have to prove that a co-op could do this work, but they also had to prove they were simultaneously "man" enough. One woman realized she was beginning with a disadvantage that she would have to work to eliminate. "I maybe had to prove myself a little bit more." Another was given the message that she would not cut it. "You can't handle this. You won't get your hands dirty." Another immediately recognized the kinds of actions necessary to enter the discourse. "These guys are going to dish out crap all day long. If you can't dish it right back, they will not respect you nearly as much." These women had a hard job ahead of them, not only were they needing to prove to themselves as capable engineers, but also as a minority. They had to recognize the discourse and then devise their plan of action for how they would begin to enter that discourse and become a member.

Through these transitional periods of proving oneself, the women experienced a transformation. Their identities had to shift to become a part of the discourse. They understood the unwritten rule to be more man-like, so they strove to show themselves as less stereotypical female and more male. "You start acting like a guy." Another said, "Once they got to know me, I was just one of the guys." When the women spoke of their identities, they were proud of their ability to become accepted and prove they could do the work. They were not despondent of their new work identity, nor did they resent the men for requiring this. The women who spoke of their success in becoming accepted in their male-dominated workplaces were proud of both their technical accomplishments and their memberships. They didn't credit their identity as the key to their success, but rather their abilities to get the job done, to see a project from beginning to end, and ultimately the value their project brought to the company.

Despite the challenges these women faced, their success came in multiple forms. First, there was a transformation in identity from student to engineer. Another success came from their accumulation of new professional skills, which are key to future employment but sometimes difficult to gain from academic study. These professional skills included strategies to succeed in a male-dominated culture. Another measurement of success were their abilities to become team members. And not only did they become a part of their teams, but some even served as team leaders. Lastly were their accomplishments on the projects they completed. This was the most tangible measure of success, especially when their projects were being implemented. One participant had just received a photo of the part she had developed and was now installed. These women persevered despite the additional work required to be accepted as female engineers in the workplace.

PREPARING WOMEN FOR CO-OP

This group of women all found their co-ops to be valuable, but can we do more to better prepare women for their co-op experiences? It is not fair to assume that we can prepare men and women with the same information, when in reality their experiences may be very different. Our role in preparing students for co-op is one place to target women, especially those in the engineering and scientific fields, so that these realities do not come without warning. We can better prepare them with strategies and mentors before they leave campus, so they are ready for whatever may come. Knowledge is power. The knowledge we have, and should continue to collect, about the experiences of our female engineers should not be the end of our responsibility. With this knowledge, we need to identify what we can do to better prepare female engineers for their cooperative education experience. In our own university's Cooperative Education Handbook and pre-departure presentations, the topics covered are meant to prepare all students for their experience. The topics range from course requirements, university information, professionalism, and policies on sexual harassment. These topics are not adequate if we want our female engineers to be properly prepared.

We have an obligation to prepare our female engineers who will be entering a male-dominated culture. First, we could better prepare them for the interview by providing questions to ask when determining a potential employer's workplace culture. Any insight into the company may help a woman determine if it will be a good fit for her. Prior to entering the workplace, it is more challenging to accurately determine the culture, but there are tools available that will assist in finding a good fit. To start, there are details in the position description that will provide some insight into the work environment. This document can serve as a start. Online, most companies publish their mission, vision,

values, and other rhetoric that provides their representation of their culture, but this information may not match the actual day-to-day culture. However, it is still very valuable because it may provide insight into their policies for employees. Insider information about the workplace could be available through a variety of networking sources. Any alumni who are currently working at the company, or who have previously, would be a great connection for the student. A university alumni department could also be of assistance in helping the student make those connections. Students and alumni who have previously interned or co-oped at the company are also useful sources. Though not as personal, networking through LinkedIn could provide an employee connection to ask these questions. During one student's co-op, she realized the importance of finding a company with values that match her own, and she spoke at length about this priority when she searches for a full time job. When I asked her how she will get this insider information, she had a clear strategy. First she will ask very pointed questions in an interview, such as "What does the company do to create camaraderie within its employees?" She would also visit the worksite to speak directly with potential co-workers. Here she would ask questions about their experiences — "What do you like about working for this company?" Finally, she understood the value of a network and would use hers to make connections with those who may have insider knowledge.

One of the women completed her co-op with the same company she had done an internship. With previous experience, she was more aware of what she was getting into and understood she may need to shift her identity. When she described the culture of her co-op department, she used the old adage — if you can't take the heat, get out of the kitchen. This particular department's discourse also included colorful language in their day-to-day operations, and she was comfortable with her "little bit more of a sailor's mouth." Having been previously with the company, she was much more aware of what to expect, so she was better prepared. Women can participate in any organizational culture they choose, but the key is to find the right fit. Not all women may have been up to the challenge of the "heat," nor participating in the linguistic discourse of the shop floor. Women can participate where they choose. What is least effective is to send a woman onto the shop floor when she is unaware of what that may mean. In hiring these co-ops, the employers should assist in finding a fit, but there is an opportunity for Career Services to take a more active role in better preparing women to understand how a male dominated environment and culture may affect their experience in the workplace.

In addition to understanding the environment, women also need to understand the choices that are available to them once they are working as co-ops. It would be easy to assume that these environments require a woman, or a man, to shift their identity to fit in, but this is not the case. It may be easier at times for the student to make the change, but that is not the only option. When a student enters the workplace, there may be a clearly definitive discourse, but does this require the student to become someone new? I would argue that the answer is no. Students do not need to leave themselves behind. In fact, companies hired them for who they met in an interview and that is who they want and expect to show up for work. Though it may seem easy or necessary to change who they are, that is not the only choice. As the one student said, her female mentor was able to be a leader as herself. The student had expected her mentor to be forced to act in a way that was unnatural, but she was shown that a leader can come in many different forms. There is not one way to be a leader. There is also not one way to be an engineer. To understand these types of choices, these women need more models from which to observe the many forms that are available.

To expose female engineers to other women like them, a panel of alumni and previous female co-ops would be a valuable opportunity for current students to understand other women's experiences, challenges and success. These experiences can serve as an arsenal and help them to prepare for what they may face, but also the confidence that they can be successful. They can be more confident in their own strengths and potential. They need to see women working as professionals and leaders who have made the choice to do the work as themselves, not as the environment would indicate. In addition, a few well-chosen readings can also be effective, especially if a panel is unavailable. The Women in Engineering Proactive Network (WEPAN) and the Society of Women Engineers (SWE) are two organizations that provide excellent resources. The key is to provide them with a voice. A voice they can recognize. The women need to understand the challenges and the choices available to them as female engineers.

In addition to exposing women to role models, ensuring they have a suitable mentor, as discussed previously, can be invaluable. The key is not to assume or rely on the worksite to provide the only mentor, rather Career Services should play a more active role. Fifolt and Searby (2010) conducted a mixed-methods study on STEM co-op students and mentors. As a result, they offered key skill sets, areas of knowledge, and dispositions that were necessary for a successful STEM protégé and emphasized the importance of providing training prior to a co-op experience. I would argue that not only is mentoring important for STEM students, but in particular, women. Co-op pre-departure programs for female engineers should include a component on mentoring. First, these women should be provided training on how to effectively use their mentors, realizing that assigning a mentor and mentee is not nearly enough to make the relationship valuable and effective (Fifolt & Searby 2010). Both parties need to understand their roles, and our job in Career Services is to ensure this

I am an engineer. I belong. I do good work.

happens. We most likely will not have control over who the mentor may be at the workplace, nor the credentials they hold to make them a suitable mentor, but we can better prepare the women on how to use their mentors or seek out additional mentors. And because we cannot assume the assigned mentor will be effective, an on-campus mentor program is a valuable addition. The current co-ops could be paired with another female engineer who has completed a co-op and participated in a training program to be a mentor. A peer mentor can sometimes be even more effective because the hierarchy and differences in power and authority are eliminated. This can provide a safe space for frank conversations and questions, without the threat of status in the workplace. As mentioned previously, we need to provide as many role models as possible to ensure the women have someone they relate to, someone with similar experiences and challenges. We need to ensure that we adequately prepare our female co-op students with the best chances to gain confidence and a new professional identity.

FROM CO-OP STUDENT TO ENGINEER

Cooperative education is a beneficial component to engineering education for women because it gives them three key confirmations they may be unable to achieve through academics alone, yet crucial in ensuring they have the confidence to continue and thrive in their fields.

I am an engineer. I belong. I do good work.

This may seem basic, but I would argue that this transformation in identity is even more significant for women than men. Early on Kany (1973) recognized evidence of this. A woman's identity changes as a result of a co-op, and this change looks to be extremely important for our female engineers. In the identity shift from student to engineer, the students interviewed who had already done other co-ops or internships were further ahead in their transformation. They consistently referred to themselves as an engineer or part of the engineering group. Women with only one co-op experience were beginning the transformation, but in earlier stages. Because they were working alongside other professional engineers, doing the work of a professional engineer, and completing projects as an engineer, their identities were shifting from student towards "engineer." With fewer female role models to observe, however, our female co-op engineers have fewer examples to serve as confirmation they will be able to do it. With the plethora of successful male engineers, some men may have less doubt of their own future success because they have observed other men, much like themselves. Women do not have that luxury. With so few women working as professional engineers, it is not as easy to assume that women will be successful in the field. There are fewer examples to prove it is possible. Thus, it may be more challenging for women to feel that they belong when they are the minority, but feeling like they belong is crucial in their identity as an engineer.

Female engineers who participate in a cooperative education program also receive confirmation that they can do the work of an engineer and do it well. To participate in our co-op program there is a GPA requirement, so all of these women were academically strong. Initially, they did not assume that the transition from academics to the workplace would be seamless, and they were skeptical of the usefulness of the knowledge they were bringing. Once acclimated and given more meaningful work, they began to see the worth and applicability of their knowledge and skills. One woman talked about the mid-term evaluation process. Until that time, her supervisor had not commented on the quality of her work, but after receiving a very positive report, she had the confirmation that she was doing good work and it gave her the confidence to speak up, contribute, and continue the work.

When we listen to the stories of women in engineering who have completed a cooperative education experience, there are key factors contributing to the recruitment and retention initiatives for women in engineering. When the women speak, it is easy to recognize their pride in proving they can do this work and do it well. We better understand what it was like for them in a male-dominated workplace, not only as a co-op, but as a woman. We realize what we can do as co-op coordinators to participate in increasing the number of female engineers. We see why it is so important to have these women working in the field, so our future co-ops will have strong female role models whom they will recognize. This is what we can do and this is what we should do to ensure our co-op programs are not a one size fits all model and meet the diverse needs of our students.

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