Throughout 2019 *Canadian Consulting Engineer* explores the topic of diversity in the industry through a series of articles called Point of View; stories designed to get readers thinking about their profession, their day-to-day workplace and maybe seeing their surroundings through a new lens.

CANADIAN WOMEN in Engineering Academia & Industry

By Natalie Mazur, Bronwyn Chorlton, Jennifer Ellingham, and John Gales

Early findings from a collaborative research study by York University and the University of Waterloo into factors that are discouraging women from staying in engineering.

For decades, the challenge of recruiting and retaining women in engineering and other STEM fields has been well-documented. Women in engineering have remained the minority across their careers, from the time they enter their undergraduate degree and throughout their time practising. This has prompted several initiatives to encourage more women to enter the profession, and in particular initiatives that target recruitment of women into engineering.

One example is the 30 by 30 campaign set out by Engineers Canada, which strives to have 30% of newly-licensed engineers be women by the year 2030. Outreach to school-aged women, informing them about the engineering profession, and encouraging them to enter the profession are extremely important. It is critical that women (and all students) understand what the engineering profession actually is and know they are welcome to join.

Once women have decided to enter an undergraduate engineering program, however, the issue at hand changes from encouraging them to study engineering, to ensuring the environment they are entering is conducive to their retention. While recruitment initiatives are undoubtedly very important for working towards a gender balance in the engineering profession, it is equally as important to ensure that the women that have entered stay.

A person's first significant insight into engineering begins, usually, during an undergraduate degree. In this environment, the people who will impact their experience most heavily are professors and instructors. If these positions are filled overwhelmingly by men, it may paint a picture to students of who ultimately becomes successful as academics. It is notable that, in research, professors and instructors have been reported to be the second-most common sources of intimidation of students in engineering, especially towards students in upper years (Mazur, Chorlton, & Gales, 2019).

Peers have been found to be the most common sources of intimidation, but as professors and instructors often hold a great deal of influence over the culture of the institution, there may be a link between the behaviour of the students and the behaviour of professors (which should be explored through future research and analysis).

Professors need to take some responsibility in correcting any discriminatory words or actions they observe, which may alleviate some of the intimidation caused by peers. Thus, it is

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important that students have strong female role models in this setting as well as non-female faculty who are sensitive to diversity issues. This necessitates the retention of women who are already in these positions of authority, and the support of other women who may wish to join.

Women in undergraduate studies already see more discouragement than men (Mazur, Chorlton, & Gales, 2018). This has consequences for how many women will pursue engineering beyond the undergraduate degree, and what preconceived notions may have developed as women enter their professional careers.

Workplace retention

For graduates who enter the professional sector, many different factors will tie into how well they are enjoying their experiences in this setting—such as the people they are working with and the work environment, to name just a couple of examples.

Generally, employees report that the people they work with are respectful and supportive, especially their peers. When employees are encouraged to collaborate with others, they are more likely to report intending to stay on track in their current position and beyond (see Figure 1). *

This trend is identical for women and men. However, a trend that differs between men and women is the respect employees receive from their juniors. Women receive less respect from their juniors (1.67/3.0 – where 1 is "A Little Respect", 2 is "An Adequate Amount of Respect", and 3 is "Much More Respect than Expected") than men do (2.16/3.0). This may make leadership roles more frustrating for women in industry and therefore discourage them from pursuing higher-level roles, leading to career stagnation and abandonment.

Women in industry can feel more connected to the community of engineers when they have someone in the field who inspires them. If role models do not exist in higher-level positions, women may become disconnected from the industry and there is potential for them to leave.

If engineers in industry or in academia are not enjoying their careers, they may choose to switch from one to the other. Many of the challenges and issues that women are facing, however, appear to be similar in both sectors, and switching from industry to academia or vice versa may not necessarily remedy the situation.

As an example, collaboration has been linked to retention in both industry and academia. Figure 1 shows industry-specific results, but the graph for academia is near identical. Furthermore, for those who become parents, there is still an issue of job security when returning from leave.

Women are significantly more worried than men about keeping their job and their specific assignments when returning from an extended leave, where 66% of women surveyed in academia indicate that they worry about this sometimes, compared to 22% of men who indicate that they worry sometimes or often. Women in industry are worried that their leadership roles will be passed onto others or that their previous assignments will be reassigned, forcing them to start over when returning to work.

Women in academia are worried about how their leave will factor into grants and funding, as their productivity will be reduced. Those in industry who are not confident that their company will provide support for returning from a leave are much more likely to indicate that they intend to leave engineering, as shown in Figure 2 (next page).

New Research and Recommendations

There are many unique experiences that women are facing as they progress through their engineering careers. At York University, in collaboration with the University of Water-

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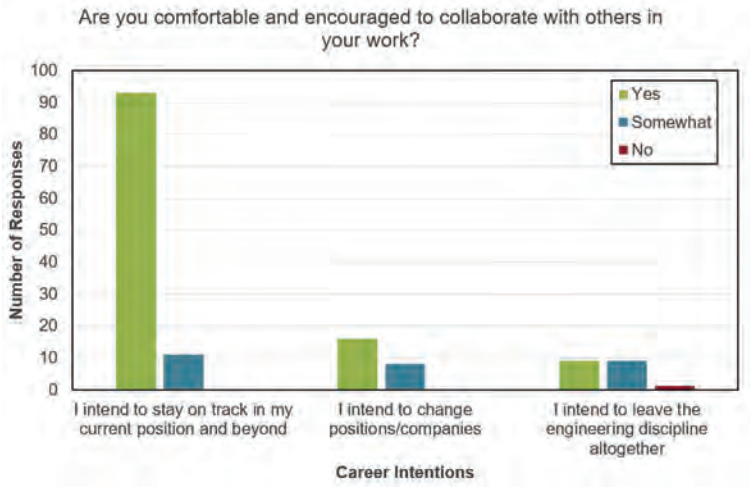

Figure 1. Responses by industry members to the question, "Are you comfortable and encouraged to collaborate with others in your work?", sorted according to career intentions.*

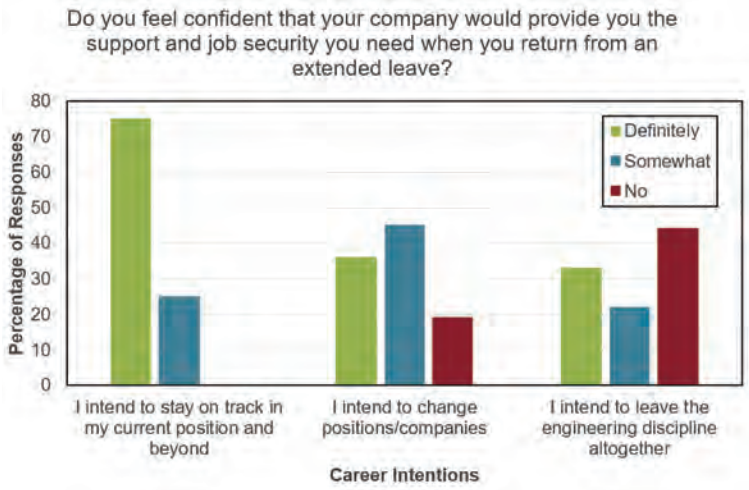

Figure 2. Responses to the question, "Do you feel confident that your company would provide you the support and job security you need when you return from an extended leave?", with answers sorted by career intention.

". . . If role models do not exist in higher-level positions, women may become disconnected from the industry and there is potential for them to leave."

loo, a multi-year study is being conducted by the authors in an attempt to understand what factors are discouraging women from staying in the profession. Once identified, these negative influences and experiences can be alleviated, promoting the retention of women in the engineering profession.

So far, several surveys have been distributed to undergraduate students at five institutions, as well as to women in professional and academic sectors. This survey, at the time of writing, is being expanded to capture the experiences of graduate students, as well as students in co-op programs.

Once well documented, a timeline on women's experiences can be created, enhancing our understanding of what factors may be causing women to leave the profession.

There are many ways in which men, women, and others who are currently in academic or industry positions can enhance the experiences of women, to the benefit of everyone else as well. For example, it is clear from our research that men worry about their career prospects when returning from a parental or extended leave. Having explicit policies in place to help re-integrate those who have taken leave would benefit everyone who wants to grow their family. These policies should be well communicated.

Peers and coworkers make up a significant part of the work culture created by a company or institution. Their behaviour towards others, especially towards minoritized persons, can significantly impact those minoritized persons' choices to remain in the field. Running occasional workshops or training on diversity, such as unconscious bias training, can help create a more welcoming atmosphere where employees are encouraged to collaborate respectfully with one another.

Overall, we recommend that people who hold authority (e.g., team leads, managers, supervisors, instructors) take care to be good role models for their juniors, regardless of gender. Transparency and communication can go a long way to motivate everyone.

It is uplifting to see many of the recruitment initiatives for students in Kindergarten to Grade 12. Many of these outreach programs will likely be successful in encouraging women to begin an undergraduate engineering degree. Once these students have entered engineering, everyone plays a part in creating an inclusive environment which will promote retention. From undergraduate studies to the end of one's career, it is clear that issues remain in terms of welcoming women and other minoritized persons in to the engineering field. However, we are at a point in time where we are seeing increased interest in change as well as the introduction of policies for inclusion that are working to keep everyone motivated and interested in their work.

There are several changes that need to be made in the engineering community before we can reach true equity, but many of the initiatives being pushed so far show promise for the future. **CCE**

References

- *Mazur, N., Chorlton, B., & Gales, J. (2018). The Experiences of Women in Undergraduate Engineering. Proceedings from the 2018 Canadian Engineering Education Association (CEEA-ACEG18) Conference.*
- *Mazur, N., Chorlton, B., & Gales, J. (2019). Comparing the Experiences of Women in Undergraduate Engineering Across Different Schools. Proceedings from the 2019 Canadian Engineering Education Association (CEEA-ACEG19) Conference.*

** Data on industry and academia reported in text and in figures is from the joint York University/University of Waterloo Retention of Women in Engineering Research Project*