

TWENTY YEARS OF PROGRESS TOWARDS DIVERSITY WITH THE ONTARIO NETWORK OF WOMEN IN ENGINEERING

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Abstract – The Ontario Network of Women in Engineering (ONWiE) was formed 20 years ago to address declining numbers of women in undergraduate engineering programs in a large Canadian province. Since then, ONWiE has been coordinating annual workshops on university campuses for girls and non-binary youth and now include workshops on coding and physics. Partnership with Girl Guides Canada allowed reach to increase tenfold through virtual workshops. We have reached over 150,000 participants.

The proportion of women in undergraduate engineering programs in Ontario has gradually risen to 29%. Disciplines vary dramatically, with Mechanical, Electrical, Software and Computer Engineering only attracting approximately 20% women. The proportion of women in graduate studies has risen to 31% and on faculty to 21% by 2025.

This collaborative effort between universities is unusual and effective. The advances that we have made have depended on data collection, intentionality, research and collaboration.

Keywords: Student diversity, Gender, Engineering recruitment, Outreach, Faculty diversity.

1. BACKGROUND

The Ontario Network of Women in Engineering (ONWiE) was formed in 2005 by Dr. Valerie Davidson, who wanted to ensure the outreach work she had begun as the Ontario NSERC Chair for Women in Science and Engineering was sustainable. At the time, the undergraduate representation of women in engineering was low and was declining (Figure 1), highlighting the importance of intentional efforts to improve the representation of diverse groups in engineering.

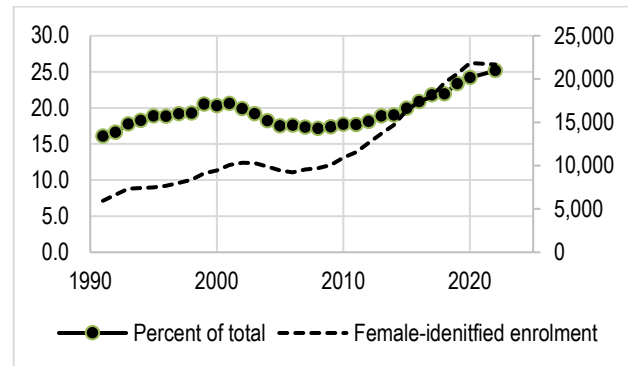


Figure 1. Percent and number of female students enrolled in undergraduate engineering programs in Canada (data from [1]).

The Council of Engineering Deans of Ontario (now Engineering Deans of Ontario, EDO) agreed that collaborative efforts would have mutual benefits. Since then, every Ontario Dean with accredited engineering programs has contributed ongoing funding (pro-rated by undergraduate student enrollment) to provide administrative support and teaching relief for the ONWiE Chair. Importantly, EDO meets three times per year with the ONWiE Chair, allowing valuable exchanges of information and perspectives.

When ONWiE began, there was very little literature about best practices to increase the participation of women in engineering. Very few other organizations bring together institutions in this collaborative approach. There are national organizations like Actua, Let's Talk Science and the Society for Women in Engineering (SWE, largely American) that do support outreach at scale, but they are not based at universities. More recently, IBET (Indigenous, Black Engineering Technology PhD project, <https://ibetphd.ca/>) has brought universities together with a similar collective goal of increasing diversity in engineering.

Through extensive consultation with the community, ONWiE chose to begin with hands-on workshops. ONWiE

continues to support Ontario engineering Faculties of engineering to offer on-campus workshops for girls in grades 7-10 and an information session for their parents called Go ENG Girl. The collaborative ONWiE efforts have now extended to most engineering Faculties across Canada and have expanded programming; the exception is Quebec which has its own ecosystem.

2. GOAL AND INQUIRY QUESTION

The mission of ONWiE is to support Faculties/Colleges of engineering across Ontario and Canada to build inclusive environments and to conduct outreach that inspires women and non-binary students to apply to engineering programs. ONWiE's goal is to pair intention with research-informed action and to measure reach and diversity in academic engineering spaces. Here, twenty years of action will be described while examining gender diversity in engineering in Ontario.

3. DESCRIPTION OF PRACTICE

ONWiE's flagship program, Go ENG Girl, is now hosted on campuses by 26 Faculties of engineering across Canada. Go ENG Girl has steadily grown since its introduction in 2005 and has reached over 24,000 total participants over twenty years (**Figure 2**).

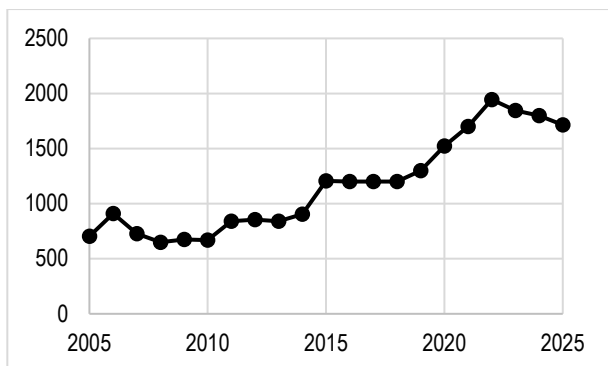


Figure 2. Annual participation in Go ENG Girl workshops from 2005-2025.

Girls in grades 7-10 were targeted as the early teen years often coincide with girls losing interest in math [1], students still have options to select STEM classes in high school that are prerequisites for engineering, and there is no conflict with competitive recruitment efforts by higher education institutions (HEIs).

ONWiE primarily offers programming to girls and non-binary students to build a safe space for exploration and experimentation [2]. In recent years, ONWiE has considered intersectionality and gender diversity; while specific references to "Girl" and "Women" continue, any interested participants are welcome.

All Faculties running Go Eng Girl are encouraged to engage parents through panels, presentations, tours and/or

activities. The intention is to ensure parents have a better understanding of the engineering profession and the prerequisite high school courses required. The workshops themselves are mostly facilitated by women engineering students, providing near-peer role models, who are particularly effective at helping participants imagine their future [3]. Often, alumnae speakers are included as part of the program, providing more role modelling opportunities to help students see themselves as engineers. On-campus experiences also help students picture themselves in a university environment.

More recently, ONWiE has been encouraging host Faculties to design engineering activities that explicitly show how engineering can improve lives and that focus on the disciplines in which women are the least represented [4]. During the pandemic, ONWiE created online resources to allow host HEIs to provide live virtual workshops (hydraulic arm, space recovery, Alexa skills, earthquake design and better work VR simulation).

An important contributor to the success of ONWiE events is the distributed nature of the organisation. Member institutions have the flexibility to choose their dates within a semester. They select and design their own workshops, recruit their own local participants, book the rooms, purchase the materials, organise speakers, volunteers and/or staff and even recruit local sponsors. ONWiE has a bank of possible workshops available and provides funding per participant. ONWiE runs as a lean organisation, with the Chair (a faculty member in Engineering) and a part-time coordinator. Its outsized impact is due to the significant labour done by member institutions' outreach staff and/or volunteers.

In 2013, ONWiE partnered with Girl Guides Canada to provide activities to support earning an ONWiE badge (e.g. **Figure 3**). For the first few years, these workshops, like Go ENG Girl, were held on HEI campuses (and some still are), but the pandemic forced virtual delivery of these workshops. This had the unanticipated effect of increasing annual participation more than tenfold. Partnered with ONWiE, McMaster Engineering provides Guide leaders with new resources every year to run the workshops themselves for all levels of Guides, without having to manage the logistics of a trip to a HEI campus. With this ease and increased geographical reach, the program has continued to grow and has now reached over 121,500 participants (**Figure 4**). ONWiE badges (recently designed by Guides themselves through a contest) are mailed out to participating Guide leaders. Funding the badges requires contributions from outside sponsors, due to the popularity of the program.

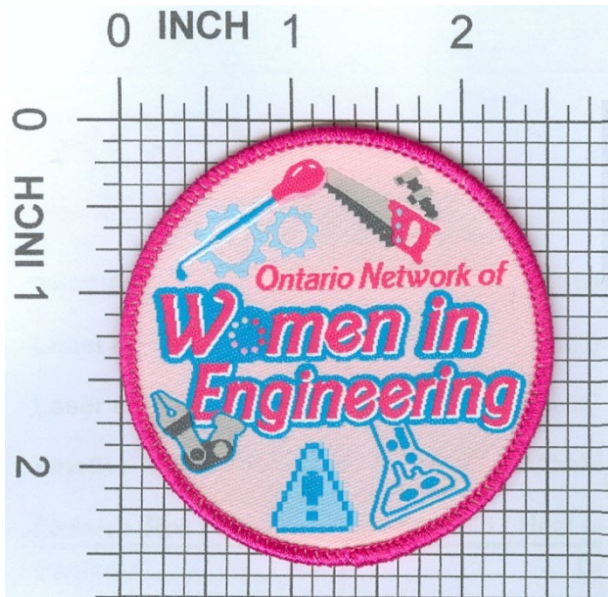


Figure 3. Sample ONWiE Girl Guide Badge.

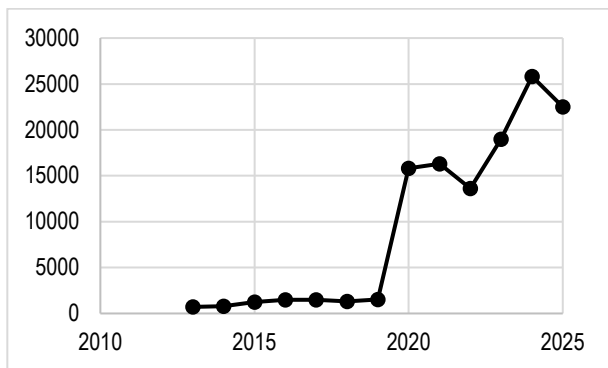


Figure 4. Annual participation in Girl Guide Badge Day programs from 2013-2025.

Go CODE Girl began in 2015, recognising that the representation of women in computer science and software engineering was extremely low. The Go CODE Girl hands-on one-day workshops are hosted at campuses of HEIs. These workshops are typically held in the spring and reach the same age range as Go ENG Girl. To date, Go CODE Girl has reached approximately 10,000 participants (Figure 5).

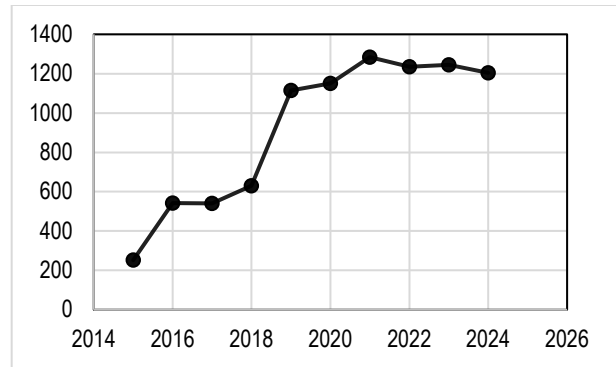


Figure 5. Annual participation in Go CODE Girl programs from 2015-2024.

The second ONWiE Chair, Dr. Mary Wells, highlighted that high school physics courses restricted the pool of potential women applicants to engineering, with girls representing only a third of grade 12 high school physics students [5], [6]. Physics is a prerequisite for most engineering programs (exceptions include Guelph and Calgary). Initiated at the University of Guelph and under the leadership of the third ONWiE Chair, Dr. Kim Jones, ONWiE initiated Go PHYS Girl in 2023 to connect physics principles to relevant and interesting applications for girls and non-binary youth in grades 6-12 (depending on institution). This program is still growing and attracted 400 participants in 2025.

ONWiE also produced teaching units for grade 11 physics teachers that specifically connected physics principles to applications affecting people and communities [7]. For example, principles of speed, velocity and acceleration are introduced by considering the travel times of an ambulance between a hospital and a home (email onwieteachertraining@gmail.com for details).

Role models are important for inspiring career decisions [8]. ONWiE highlights role models in several ways beyond near-peer mentors and guest speakers at workshops. Examples include featuring ONWiE Ambassadors on our website (ONWiE.ca) and social media and videos of inspirational engineers.

ONWiE's approaches are guided by research and collaboration. ONWiE Summits bring together stakeholders to share best practices and current research. Inclusion within engineering continues to be an intentional consideration as it is both unethical and ineffective to recruit for diversity if the experience is unwelcoming. ONWiE is a partner in the Engendering Success in STEM research consortium (successinstem.ca), working with social psychologists to understand the forces that hinder underrepresented people from considering and entering engineering.

ONWiE continues to consult with numerous organisations to share best practices for inclusion,

including the Ontario Ministry of Education. The EDO has also been very receptive to this research. In addition, ONWiE is a founding member of the Forward Engineering Collective (<https://forwardengineeringcollective.ca/>), a collaboration of like-minded organizations with the common purpose of highlighting engineering through inclusive outreach efforts.

4. APPROACH

ONWiE encourages host institutions to collect feedback from participants. Although survey completion rates are low, the responses consistently indicate that the workshops are enjoyable and participants have more knowledge about the engineering profession and are now more enthusiastic about pursuing engineering.

Canada's privacy laws make it very challenging to follow individual participants through the university application process, which takes place 2-5 years after participating in an ONWiE workshop. In addition, only a couple of institutions have a robust registration system that would allow this information to be collected. It is also challenging to measure changes in inclusion through the outreach, recruitment and undergraduate phases.

In collaboration with EDO, ONWiE collects data about the gender of various academic engineering populations across Ontario. Because data were supplied in aggregate, the Research Ethics Board confirmed that Ethics approval was not required in this case. Identity-based data beyond gender is not currently available and, until recently, only binary gender data was collected. Data are collected every November using a headcount basis (except for faculty members, reported as full-time equivalents) which therefore differs slightly from the data collected by Engineers Canada at the end of an academic year using a full-time equivalent basis.

Since 2007, ONWiE has collected data about gender representation at the undergraduate, graduate and faculty level. Data collection has since expanded to include information about selected engineering disciplines, types of graduate degrees, and faculty appointments.

ONWiE recognizes that its activities are not the sole cause of changes in gender representation in engineering and that broader cultural changes also influence diversity. However, it is valuable to share important data with the engineering community.

5. RESULTS

Engineers Canada shows a relatively steady increase in the percent and number of women in undergraduate engineering programs across the country (Figure 1, [9]) and the data collected by ONWiE is consistent with this observed trend, with 29% of Ontario's undergraduate engineering population being women in November 2025. The aggregated data reported by Engineers Canada masks disparities between institutions. Figure 6 shows a box and

whisker plot of the distribution of the proportions of women as undergraduates at each of EDO's member Faculties from 2007-2025. The range between Faculties has increased over time. On average, U6 institutions (large and research-focused) had 33% women while the rest had 20% women in undergraduate engineering in November 2025. Institutions with direct entry to disciplines in first year had slightly lower representation of women than those with common first year programs.

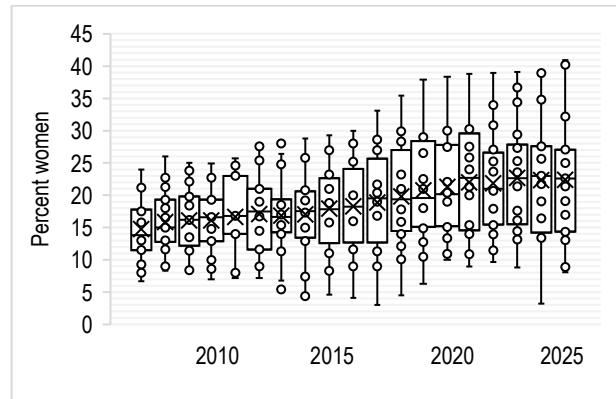


Figure 6. Box and whisker plot of the percent women in undergraduate engineering programs at all the accredited Engineering Faculties across Ontario from 2007-2025.

Discipline also makes a dramatic difference (Figure 7). Biomedical programs would be included in "Rest". Chemical (47%), Environmental (46%) and Civil (29%) Engineering had neared or exceeded Engineers Canada's 30x30 goal by November 2025, while Mechanical (21%), Electrical (22%), Software (24%) and Computer (21%) Engineering continued to struggle. There were large disparities between institutions, particularly in Mechanical and Electrical Engineering.

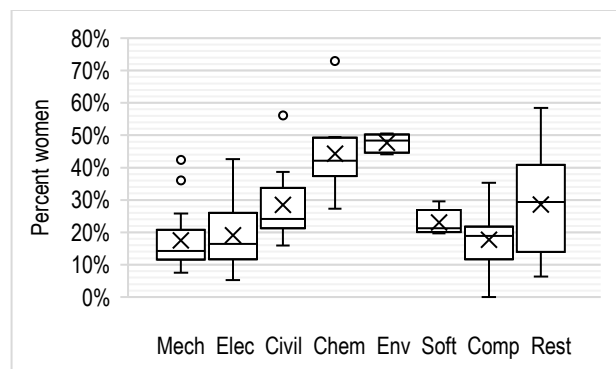


Figure 7. Box and whisker plot of the percent women in different disciplines of undergraduate engineering programs at all the accredited Engineering Faculties across Ontario in 2025. Disciplines are Mechanical, Electrical, Civil, Chemical, Environmental, Software, Computer and Rest (which includes Biomedical).

Graduate studies have consistently attracted a relatively high proportion of women (**Figure 8**) and, overall, representation of women has gradually grown, with only a few outlier Faculties below 20%. Research-based master's attract 32% women, course-based master's attract 29% women and PhD programs attract 33% women (**Figure 9**). Women seem slightly less likely to pursue post-doctoral studies (29%), which can make faculty recruitment more difficult.

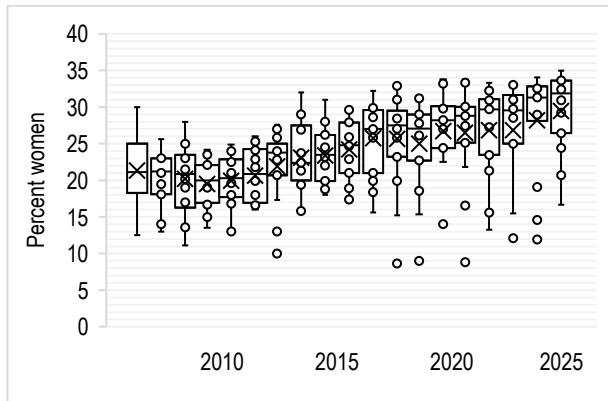


Figure 8. Box and whisker plot of the percent women in graduate engineering programs at all the accredited Engineering Faculties across Ontario from 2007-2025.

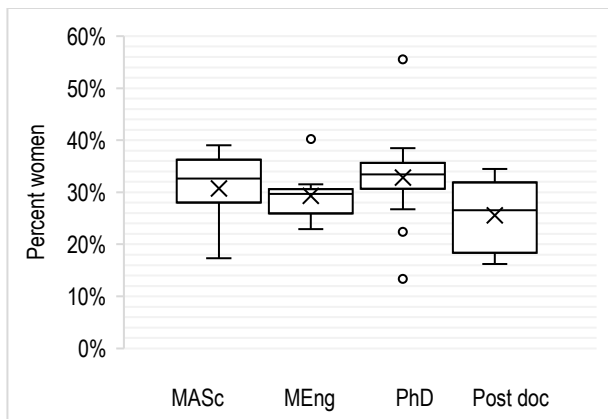


Figure 9. Box and whisker plot of the percent women in different graduate engineering programs at all the accredited Engineering Faculties across Ontario in November 2025.

In contrast, the growth of gender representation amongst faculty role models has grown relatively more slowly (**Figure 10**). This hysteresis is expected as an academic career is nearly ten times as long as the time to earn a degree. **Figure 11** shows that women are well-represented in teaching-stream and contract roles (which have in the past held less prestige or have been more precarious) at an overall average of 29%. However, they are slower to gain traction in research-based roles. Women represent only 18% of Associate and 15% of Full

Professors with tenure. Promisingly, women do represent 32% of research-based Assistant Professors, showing that institutions are beginning to make changes.

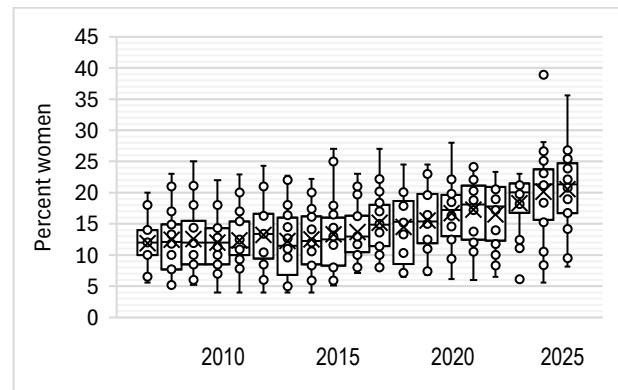


Figure 10. Box and whisker plot of the percent women on Faculty in engineering programs at all the accredited Engineering Faculties across Ontario from 2007-2025.

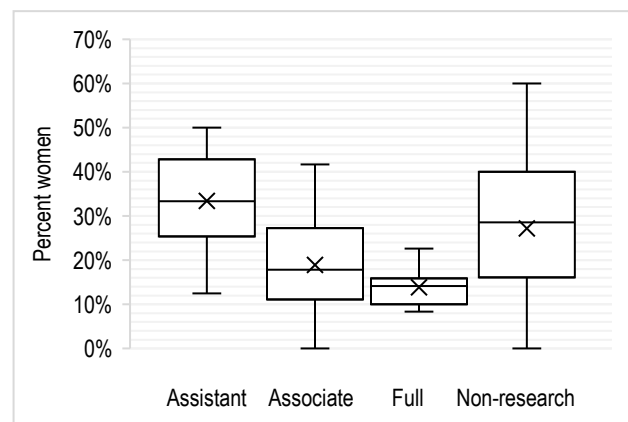


Figure 11. Box and whisker plot of the percent women on Faculty in different categories of employment at engineering programs at all the accredited Engineering Faculties across Ontario in November 2025. In order, Assistant Research Professor, Associate Research Professor, Full Research Professor, all Non-research instructors (includes Assistant Teaching Professor, Associate Teaching Professor, Full Teaching Professor, Contract Instructor and Other).

6. DISCUSSION

Over the past twenty years, the Ontario Network of Women in Engineering (ONWiE) has evolved from a small collaborative initiative into a province-wide network with measurable influence across Ontario's engineering Faculties and increasingly the rest of Canada. Its scope, programming, and research engagement have expanded significantly, and while progress toward greater gender diversity is clear, it has not been uniform across institutions or disciplines.

ONWiE has broadened its initiatives to align outreach and messaging with the cultural contexts that shape how girls and young women see themselves and their futures. It has placed particular emphasis on disciplines where women remain significantly underrepresented and has invested targeted effort in strengthening pathways through high school physics, an area that continues to influence participation patterns. The network has also contributed to and mobilized research to inform evidence-based approaches to equity, diversity, and inclusion, while building strong collaborations with like-minded organizations across the province.

Member institutions commit significant resources to holding ONWiE workshops. Many are facing financial pressures, which often affect staff positions, like the outreach coordinators who form ONWiE's core support. Preliminary data suggest that fewer institutions hosted Go CODE Girl most recently, which might reflect these pressures. On a more positive note, a major contributor to ONWiE's success is the ongoing and consistent support from the Engineering Deans of Ontario. Their financial support is essential and their engagement with the purpose behind ONWiE is also critical and helpful.

As much as on-campus, one-day workshops offer girls and non-binary youth role models and compelling narratives around the impact and opportunities provided by engineering, they are still just a single experience. Ideally, these workshops would lead to longer-term engagement with engineering by their participants. Future work could support longer-term mentorship or engage participants as engineering role models within their own schools.

Participants are also likely to already have some knowledge and interest in engineering or have parents who support an engineering career choice, since they have made the choice to spend their spare time on engineering workshops. This is not in itself problematic, but it does highlight that ONWiE workshops do not reach many students who might benefit. The partnership with Girl Guides has been very rewarding, because ONWiE reaches many participants who might otherwise not engage with engineering workshops, or who might be geographically limited. There might be future, similar partnership opportunities, which the Forward Engineering Collective might foster.

Engagement with research on diversity and inclusion in engineering has also paid dividends for ONWiE. Encouraging evidence-based approaches for outreach means that our members are more likely to be effective as they focus on disciplines in which women remain deeply under-represented. Research has informed approaches that highlight human-centred applications of engineering principles. Engagement with social psychologists has highlighted the importance of building inclusive spaces within Canada's Faculties of Engineering (e.g. [10],[11]) A challenge in this space is that Canadian funding agencies

remain siloed, and that the American research upon which ONWiE has depended has recently been largely de-funded.

Importantly, ONWiE has developed increasingly granular data collection and reporting across Ontario's engineering higher education institutions (HEI's). Measurement is key in ensuring that ONWiE focuses on priorities that will make a real difference. Province-wide averages show steady increases in the proportion of women at the undergraduate, graduate, and faculty levels over the past two decades.

In some Faculties and programs, gender parity is within reach, with research focus appearing to contribute to appeal for women. A perception of an inclusive, diverse environment and an emphasis on collaboration over competition likely also play a role in attracting women.

However, discipline-specific data reveal stark differences. Women are more strongly represented in fields where applications are often perceived to be closely connected to life-based systems, such as biomedical and environmental engineering, where participation approaches and in some cases exceeds parity (see also data from Engineers Canada [9]). In contrast, representation remains considerably lower in other traditional engineering disciplines such as mechanical, electrical and computer engineering. These should be a focus moving forwards.

Admission data (not shown) further demonstrate that academic preparation is not a barrier for women entering engineering. The academic profile of women applicants has remained strong and, in many cases, higher than in previous years. While the proportion of young women enrolling in high school physics remains lower than that of their male peers, current admission criteria do not indicate that grades are a limiting factor. The challenge is therefore not one of capability, but of interest, belonging, and sustained inclusion.

Dr. Lauren Tribe will soon begin her term as ONWiE's fourth Chair, marking the next phase of the network's evolution. The collaborative model that has defined ONWiE's success remains a strength; however, additional targeted support will be needed for institutions and disciplines where gender representation continues to lag. Looking forward, ONWiE aims to deepen its understanding of identity beyond gender and to support research that designs, implements, and rigorously evaluates interventions that foster more inclusive engineering environments.

ONWiE's twenty-year journey reflects meaningful and sustained progress. At the same time, the uneven nature of that progress underscores the importance of continued commitment, data-informed action, and collective responsibility as the network works toward a more diverse and inclusive future for engineering in Ontario.

7. CONCLUSIONS

ONWiE has supported Faculties of engineering across Canada to host inclusive workshops to expose girls and non-binary youth to engineering. Partnering with Girl Guides Canada has significantly extended ONWiE's reach through virtual offerings. Over the last twenty years, there have been over 150,000 participants in ONWiE's initiatives and steady increases in gender representation in engineering.

Acknowledgements

We are deeply grateful to Dr. Valerie Davidson for her pioneering work supporting women in engineering and for having the vision and drive to start ONWiE. The Engineering Deans of Ontario are gratefully acknowledged for their stable and consistent support of ONWiE. All ONWiE members are acknowledged and appreciated for enthusiastically devoting resources to host ONWiE workshops. The support of the faculties of engineering that have hosted the ONWiE Chair are acknowledged: University of Guelph, University of Waterloo, McMaster University and now Western University. In addition, the sponsorship support over the years from various organizations including GM Canada and TD is very much appreciated.

Disclosure Statement

Generative AI was not used in the preparation of this manuscript.

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