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“It’s not perfect, but the needle has moved”: Women’s Experiences in Academic STEM

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Executive Summary

This report is the final installment in HEQCO's *Women in Academia* project, which has used a mixed methods approach to explore current and historical gender disparity among faculty at Ontario's universities. In this qualitative report, we examine the personal experiences of women academics in STEM. To contextualize our data, we review legislative and institutional policy initiatives that address gender equity and consider previous research on the experience of academic women. We conducted 59 interviews with three groups of women academics — faculty, graduate students and former graduate students — in STEM fields across Ontario to better understand their experiences. This study is unique in the Canadian context because it incorporates the perspectives of current and former graduate students as well as faculty. Our conversations with women were guided by our research questions: What is the self-reported experience of women faculty and graduate students in STEM disciplines? How have women's experiences changed over the course of their careers? And how can STEM and academia be more welcoming to women academics?

Despite decades of progress both internal to universities and in society more broadly, our findings reveal that women in academic STEM continue to face gendered challenges. The women described a system that is changing too slowly and reported that sexist beliefs continue to influence their experiences negatively. They described academic STEM as an environment that excludes women and lacks diverse representation. Motherhood emerged as an important example of a persistent gendered challenge that has delayed progress toward gender equity. Interviewees spoke about the "leaky pipeline"[1] and power dynamics of academia and the ways in which these forces shape women's representation, indicating that the structure of academia itself impacts the slow pace of change.

Nevertheless, our interviewees also report an increasing awareness of gender bias that is improving the academic work climate. The women pointed to personalized support from administrators and colleagues, and more research focused on examining gender biases within course evaluations as important signals of progress. Late-career faculty women discussed a steady shift in culture and practice at the department- and institution-levels that positively impacted their experience. Early- and mid-career academics described their experience in academic STEM as generally positive, a finding which can be seen as confirmation of the positive transformations reported — and created — by senior-level faculty women.

For the women in our study, individual action and individually developed social supports are important features of career success. In addition to institutional policies and practices designed to reduce inequity, the women spoke about using their own social and human capital to manage the challenges they faced in their careers. Interviewees spoke about the value of role models, informal mentorship and networking groups for career achievement and progression.

Interviewees also provided suggestions for how to make academia more welcoming. They suggested that institutions can increase their support for women in academic STEM by implementing and enforcing supportive policy and emphasized the importance of the academic pipeline. This starts with a focus on encouraging more women to enter STEM in the first place, then continues with supports for success throughout their academic journeys. The women in our study desire immediate improvement through institutional action, but they also acknowledge that

[1] The "leaky pipeline" refers to a situation where some women either self-select or are pushed out of STEM because of systemic disadvantages they encounter as they move through the academic structure or career pathway.

true equity requires systemic changes in academic and institutional culture as well as society broadly.

Informed by our data, HEQCO recommends that institutions:

- Embrace accountability and institutional self-evaluation to ensure policies and practices are effective and relevant. These actions should include an expansion of Equity, Diversity and Inclusion (EDI) efforts and a commitment to collect and publish equity data by rank and field, as well as gender breakdowns in student enrolment by discipline and credential.
- Focus on supervisory relationships: review, update and implement guidelines for successful supervisor/student relationships and advertise supports for graduate students to ensure safe and equitable learning and working communities.
- Pay attention to the academic pipeline and encourage more women into and through STEM. Institutions and government should partner to grow STEM talent by investing time, effort and funding in programs and opportunities to encourage girls and young women to enter the field.

Introduction and Literature Review

Over 50 years of data collected by Statistics Canada reveals that women remain underrepresented in academic positions at Ontario universities, particularly in the disciplines collectively referred to as STEM: science, technology, engineering and math. Despite federal and provincial legislation to mandate gender equity in employment, institutional initiatives to correct imbalances in faculty appointments and pay, and widespread acknowledgement of the issue, gender inequity persists in academia. Previous HEQCO research has demonstrated that at the current rate of increase, women will not reach parity with men in faculty representation until 2070; parity in STEM disciplines will take even longer (Napierala & Colyar, 2022).

Considering these ongoing disparities, HEQCO interviewed 59 women to learn more about their direct, personal experiences as early-, mid- and late-career academics in the STEM disciplines. Findings from these interviews complement existing quantitative data by providing insights about how women in STEM personally experience inequity and progress. The foundational questions guiding our interviews were: What is the self-reported experience of women faculty and graduate students in STEM disciplines? How have women's experiences changed over the course of their careers? How can STEM and academia be more welcoming to women academics? Data from our three groups of interviewees — women faculty, graduate students and former graduate students — indicate that women in academic STEM continue to face gendered challenges, even as they report an increasing awareness of gender bias that is gradually improving the academic work climate.

Although women are better represented among full-time faculty at universities now than ever before, representation is not uniform across all disciplines, and women remain underrepresented in STEM across Canada (Napierala & Colyar, 2022; CAUT, 2018; Council of Canadian Academia 2012). Ontario is aligned with this national trend. In *Gendered Trends in Ontario University Faculty Employment* (Napierala & Colyar, 2022), we examined the representation of women across academic ranks and disciplines over time and found that overall gains in women's representation obscure continued disparities in STEM (Napierala & Colyar, 2022). In 2018-19, women represented 47% of assistant professors, 44% of associate professors and 29% of full professors in full-time university faculty positions in Ontario. Across ranks, women in STEM disciplines held only 21% of faculty positions. Earnings gaps have also decreased over time, but women faculty continue to earn less than men — across all ranks, women faculty earn about $0.92 for every dollar men earn (Napierala, 2022). Progress is slow, and women are not projected to achieve parity in STEM faculty roles at any point in the next 50 years (Naperiala & Colyar, 2022).

There is a rich history of research about gender equity in Canadian academia that has influenced efforts to improve representation and wages for women faculty (Acker & Muzzin, 2019; Tamtik, 2022). These efforts have also been shaped by national and provincial legislation, institutional policies aimed at addressing disparities and research that has explored women's experiences in the academic context. Each of these efforts has contributed to the growing societal awareness of gendered inequality, which has inspired new legislation, policy and research. In recent years, researchers and policy makers have focused on the specific experiences of women in STEM disciplines.

Policy reforms intended to advance gender equity in Canada have been in place for more than 50 years and are well documented in the literature (Agocs, 2014; Universities Canada, 2019). The 1967 *Report of the Royal Commission on the Status of Women in Canada* and the 1984

Report of the Commission on Equality in Employment examined and outlined principles and practices for achieving employment equity for designated groups, including women (Silberman Abella, 1984). The Federal Contractors Program (1986) and the *Employment Equity Act* (1996) followed from these earlier reforms with the goal of realizing equal opportunity in the workplace for all persons (Government of Canada, 2021). More recently, federal government reforms (*The Pay Equity Act, 2018*) have focused on ensuring equal pay for work of equal value for men and women in federally regulated workplaces (Raymer, 2021). Government has also focused on improving the experiences of women in STEM working in federal agencies. For example, Shared Services Canada developed a Community-First Action Plan to promote positive social change for women working in STEM fields within the Government of Canada (Women in Tech World, 2020). Canada's federal research funding agencies have undertaken initiatives to foster a more equitable research ecosystem in Canada. Efforts to increase equitable and inclusive access to granting agency funding opportunities have been implemented through the Tri-Agency Equity, Diversity and Inclusion (EDI) Action plan, Dimensions: EDI strategy and the Canada Research Chairs Program (Government of Canada, 2022).

In Ontario, the *Ontario Employment Standards Ac*t (2000) and the *Ontario Human Rights Code* (1990) legally protect workers from harassment or discrimination on the basis of sex or gender (Government of Ontario, 2000; Government of Ontario, 1990). Pay equity legislation in Ontario goes back as far as 1952 with the *Female Employees Fair Remuneration Act*. Ontario's *Pay Equity Act* (1987) required all public sector employers and private sector employers with more than ten employees to develop pay equity studies and enact plans to address disparities. This law has been internationally recognized for its proactive approach (Ontario Equal Pay Coalition, n.d.; McDonald & Thornton, 2016); rather than relying on employee complaints, this law requires employers to identify and address wage discrimination. In 2018, the Ontario government introduced Bill 3, which focuses on both wages and representation: *The Pay Transparency Act* requires employers to complete pay transparency reports, including detail regarding workforce composition and compensation.[2] The Ontario Task Force on Women and the Economy was established in 2021 to help address the unique and disproportionate economic barriers that women face in the labour market. And one area of focus for the task force was removing barriers for women to enter fields in which they are underrepresented, including STEM (Government of Ontario, 2022).

Over the past 20 years, postsecondary institutions have made formal commitments to EDI (Universities Canada, 2019) and many Canadian campuses have developed missions related to gender equity that extend to women faculty and students (Tamtik & Guenter, 2019). Recent coverage in *University Affairs* and *The Globe and Mail* suggests that EDI commitments have evolved over time, with most postsecondary institutions — at minimum — taking pay equity measures and working to identify barriers in gender equity on their campuses (Doolittle & Wang, 2021; Universities Canada, 2019). For example, Wilfrid Laurier University, McMaster University, University of Toronto and the University of Waterloo have conducted recent reviews of salary disparities and implemented adjustments (CBC News, 2017; CBC News, 2015; U of T News, 2019; Mojtehedzadeh, 2016). However, Momani et al. (2019) caution that such efforts have not yet resulted in equitable pay for women faculty across Ontario. Their analysis shows gender pay gaps in 16 out of 20 publicly assisted Ontario universities — including institutions that have undergone an equity review. Momani et al. further suggest that pay gap research focused on fields of study such as STEM could prove beneficial for more completely understanding wage disparities.

[2] The Act was planned to come into force in 2019, but it was delayed following the election of a new provincial government.

Employment equity policies are also embedded in faculty recruitment processes at institutions across Canada (Doolittle & Wang, 2021). Nearly two decades ago, a task force on women's recruitment at the University of Waterloo described common strategies undertaken by various Ontario institutions in their recruitment of women faculty (Waterloo, 2002). The task force found that most Ontario universities were trying to create "women friendly" campuses by actively instituting strategies for hiring women. These included widespread family-friendly policies, faculty relocation and support programs and formal policies about the preparation and composition of search committees (Waterloo, 2002).

Researchers have explored the persistent structural and cultural barriers within academia that have contributed to women's underrepresentation in faculty roles (Kelly et al., 2018). In North America, academics move through career structures with distinct points of assessment and promotion (Acker & Armenti, 2004).[3] This career structure can be particularly challenging for women because progression milestones overlap with key stages of life and family building, such as pregnancy, maternity leave and childcare or eldercare duties (De Welde & Laursen, 2021; Ward, Wolf-Wendel, & Marco, 2019). There are "critical transition points" of evaluation and promotion in academia during which "women are vulnerable when it comes to navigating transitions" given societal expectations and organizational structures that are not gender-neutral (Ward et al, 2019, p. 16; Acker, 1990; Acker, 2006). Many researchers have used human capital theory, which describes inequity as a consequence of individual productivity, to describe women's experiences of balancing individual responsibilities and work expectations (Wijesingha & Ramos, 2017; Perna, 2001; Morgan et al., 2021). Women faculty report spending more time on childcare and housework than men, which represents a threat to the "ideal worker" norm (Morgan et al., 2021). The "ideal worker" in human capital theory is always available and focused, with no responsibilities outside the workplace (Sallee, 2012; Ward & Wolf-Wendel, 2016); this reflects a neoliberal framework focused on productivity, corporatization and managerialism (Acker & Webber, 2016; 2017; Newson, 2012). Academic "ideal worker" expectations are often carried by faculty themselves: In a survey of men and women faculty in the U.S. and Canada, Morgan et al. (2021) found that faculty believe parents (especially mothers) are likely to be less productive than colleagues without children.

Literature related to motherhood and academia suggests that women may feel pushed to choose between their academic careers and having children (O'Connell & McKinnon, 2021). This is not a universal reality, of course; not all women academics have children and the experience of having a family does not always negatively impact a woman's career success (Morgan et al., 2021). In a report examining the motherhood gap, Moyer (2012) noted that, in some cases, having children means women are less likely to acquire faculty positions and earn tenure. Other research indicates that women are more likely to perceive academia as unwelcoming toward parents, causing them to seek alternative careers (Nicholas et al., 2008). In contrast, a study on academic motherhood in STEM fields found that women with children can and do have satisfying academic careers, but this is achieved through their own sense of agency rather than through the support and assistance of institutional policies (Ward & Wolf-Wendel, 2016).

Recent research examining the underrepresentation of women has pointed to existing cultural and individual barriers as continuing to drive the small number of women in these fields. Themes of lack of confidence and imposter syndrome emerge in the literature as barriers to career progression (O'Connell & McKinnon, 2021; Kelly et al., 2018; Martinez et al., 2007; Hill et

[3] Canada's university sector differs from the U.S. context because of high rates of unionization, stability of tenure, a lack of institutional differentiation and few private institutions. Most universities offer policies designed to support women faculty.

al., 2010; Darisi et al., 2010). For example, various studies of undergraduate students in STEM have found that women students have less confidence in their own abilities than men students, even when they outperform men academically (Singh et al., 2007). A Canadian study of women and men graduate students (Darisi et al., 2010) had similar findings; women in graduate science and engineering fields reported lower levels of self-efficacy and confidence than men graduate students. O'Connell and McKinnon (2021) proposed that a lack of confidence may be exacerbated by the lack of representation of women in leadership roles. They reported that existing cultural barriers such as entrenched biases, stereotypes, double standards, bullying and harassment all negatively impact academic women's confidence and sense of belonging.

There is also an increasing body of literature related to the intersectional experience of racialized and Indigenous women faculty, who experience additional burdens that include unequal pay, unequal hiring processes, Euro-centric curricular biases and racial animus within the university community (Tamtik, 2022; Dua, 2018; Henry & Tator, 2017; Wijesingha & Ramos, 2017). There have been sustained discussions about the overwhelming patterns of racism and whiteness in Canadian academia (Dua, 2018; Henry et al., 2016). Racialized and Indigenous women faculty not only contend with similar experiences to non-racialized women faculty, but they are also burdened by additional layers of marginalization that impact their career trajectory and experiences (Wijesingha & Robson, 2022; Henry, 2015; Kobayashi, 2009).

Despite the various policy initiatives, institutional reforms and academic research that has shed light on women's experiences, disparity persists in the academy. Equity policies at Canadian universities have had only a "moderate" effect in addressing gender-based discrimination (Dua, 2018; Drakich & Stewart, 2007). For Kelly et al. (2018), gendered inequity is so deeply embedded in academic culture that it has led to desensitization regarding pay disparity and representation gaps. Further research that explores women's experiences in academic STEM can add to an understanding of structural, cultural and individual obstacles that continue to shape women's success.

Research Questions and Methodology

Representation and wage data show equity improvements for women faculty at Ontario universities, but progress is uneven and has slowed in recent years. For women in STEM disciplines, gaps in representation are particularly concerning. This qualitative research project focuses on understanding the experiences of women in STEM, with a focus on their socialization over the course of their careers. Our study is unique in the Canadian context because it incorporates the perspectives of current and former graduate students as well as faculty.

Research Questions

The questions guiding this research are: What is the self-reported experience of women faculty and graduate students in STEM disciplines? How have women's experiences changed over the course of their careers? How can STEM and academia be more welcoming to women academics?

Methodology

We identified a selection of STEM fields in which women academics are underrepresented at Ontario universities: biology, chemistry, engineering, mathematics and physics. We then selected seven Ontario universities that represent a range in terms of size and geographic location. Our interviewees include three groups of women: faculty, current graduate students and women who undertook graduate study in STEM but did not pursue careers in academia. We asked women faculty about their career stage and have identified early-, mid- and late-career categories.[4] The large majority of faculty respondents were full-time with teaching, research and service responsibilities; many were tenured or tenure-track. Relative to the number of women full professors in STEM disciplines, our sample skews toward late-career academics — this gives us a fuller picture of changing perceptions over the course of an academic career. For the purposes of this study, we did not collect additional demographic data.

We used institutional websites to identify faculty and graduate students working in our targeted STEM disciplines and reached out to those individuals using publicly available email addresses. We undertook best practice processes around research ethics, privacy and consent to ensure that participants understood the goals of our project (see Appendix A). We conducted semi-structured interviews with 31 faculty members and 22 graduate students between April and June 2021 (see Appendix B for sample interview questions).

To connect with former graduate students, we leveraged HEQCO social media platforms and used snowball sampling to recruit participants. We used the same semi-structured process to conduct interviews with six women. The data collected from this group provides important context to the themes that emerged from our interviews with faculty and current graduate students.

There are limitations to our research design. We attempted to recruit participants from a variety of disciplines and institutions, but our sample is not representative. Our participants self-

[4] Our study is oriented around the stages of the academic pipeline. We delineate interviewees using three stages: early-career, mid-career and late-career (See Baldwin, Lunceford, & Vanderlinden, 2005). Early-career faculty are those with six or fewer years of teaching in higher education. Mid-career faculty are those with 12 to 20 years of teaching in higher education. Late-career faculty are those with 25 years or more of teaching in higher education.

selected by responding to our invitation email and booking and keeping an interview appointment with us. Because we used publicly available information to identify prospective participants for our study, we made assumptions about gender based on names and images. We did not ask our participants to disclose details about their age, race or disability status.

We took notes during interviews which were anonymized and uploaded into NVivo for analysis. We developed an analytic framework and coded the data by themes. Figure 1 provides an overview of the educational disciplines, positions, career stages and educational levels of interviewees.

Figure 1: Educational Disciplines of Interview Participants

Faculty Characteristics	
Educational Discipline	*Count*
Engineering	8
Biology and Chemistry	9
Physics	7
Mathematics	6
Biomedical	1
Current Position	
Contract Lecturer	1
Assistant Professor	8
Associate Professor	4
Professor	18
Career Stages	
Early-Career	7
Mid-Career	13
Late-Career	11

Graduate Student Characteristics	
Educational Discipline	*Count*
Engineering	9
Biology	7
Mathematics	1
Environmental Science	1
Physics	4
Current Educational Level	
Masters	5
PhD	17

Former Graduate Student Characteristics	
Educational Discipline	*Count*
Math	1
Agriculture	3
Biology	2
Highest Educational Level	
Masters	3
PhD	3

Data Presentation and Analysis

The findings presented below reveal our interviewees' complicated perceptions of gender inequity and progress. Where possible, we provide direct quotations from our interviews to capture participants' experiences in their own words. From the 59 interviews, we distilled descriptions into four major themes:

- increasing awareness and gradual positive change;
- the slow pace of cultural and institutional transformation;
- the importance of individual networks and actions in women's success; and
- participants' policy advice to institutions aimed at enhancing progress.

Growing Awareness. **Awareness of gender bias in academia has increased within institutions, in society broadly and among the women themselves, resulting in a more positive atmosphere for our participants.**

Interviewees across career stages shared stories of a changing atmosphere characterized by increasing awareness of bias and its impact. When discussing perceived shifts in academic culture, participants pointed to an increasing acceptance of women in STEM and acknowledgement of the importance of gender equity. One late-career faculty member noted how things changed over the course of her career: "People are much more aware of what [behaviour and language] is appropriate" (Faculty Interviewee 3).

A mid-career faculty woman noted that she has seen changes in the kinds of discussions taking place, drawing comparisons between her early and current experiences in the field: "It does feel different. Conversations about equity are happening now that could not have happened five years ago. It's not perfect, but the needle has moved from the time when I was a student" (Faculty Interviewee 6). She reflects upon how the changing atmosphere has encouraged her to advocate for herself and other women in department meetings:

> It wasn't something that people used to have conversations about. Now it's something that can be discussed at work both formally and informally. I recently called out a colleague who restated my idea, which is something I wouldn't have tried even a few years ago. (Faculty Interviewee 6)

Her comments point toward shifts in gendered communication patterns — a challenge observed by O'Connell & McKinnon (2021). Women are judged according to stereotypes about how they 'should' interact with colleagues. This interviewee highlights her own behaviour, but also focuses on the actions of others.

Another faculty woman gained awareness of gender inequity through stories offered by older women colleagues. She explained:

> Colleagues for the most part have been very supportive. I don't feel discriminated against as a woman, but I know that the women before me did because I've heard those stories. I got lucky and became an academic during the time when discrimination was less prevalent. (Faculty Interviewee 13)

The women we interviewed did not attribute progress to a specific initiative but to a confluence of factors that have shaped policy and practice. For example, a late-career faculty woman

described how internal and external changes have resulted in her institution being “the most inclusive now since I’ve been here”:

> I have an amazing chair who is setting a very good tone. I have worked under three different chairs and this one is fantastic; the others were more old-school. The guidance of the department and general social awareness of 2021 vs. 2005 is better. (Faculty Interviewee 22)

Interviewees also expanded on the importance of leadership. For example, one interviewee described her chair’s efforts to disrupt gendered communication patterns:

> The chair is conscious of these issues and does make an effort. Educational programs for deans/chairs are making an impact. My dean called out an older colleague who interrupted me during a lunch conversation. That was huge. It might not sound like a big deal, but it really is. The small things matter (Faculty Interviewee 5).

Other interviewees pointed at progress associated with institutional self-study efforts, such as examinations of gender equity in course evaluations, as critical steps in shaping the environment for women. These comments align with literature that emphasizes the importance of leadership, allies and advocates — especially male colleagues. These comments also echo previous research describing how incremental changes to reduce biases shape culture and improve the work atmosphere for women (O’Connell & McKinnon, 2021; Meyerson & Fletcher, 2000).

New academics reported that their experience in academic STEM was generally positive — a confirmation of the positive transformations reported and created by senior-level faculty women. In fact, a quarter of the graduate students in our sample (seven out of 22) cited that being a woman was not an issue in academic STEM. One student stated: “The community is very pro-women in science. I have never really felt specifically segregated by being a woman in my field” (Graduate Student Interviewee 18). Another student agreed, saying,

> I’ve never been told anything negative about the fact that I’m a woman. I’m in a sub-field where there’s not a lot of women and so far the men I’ve worked with have been very helpful by giving me the space I needed to learn and to be. (Graduate Student Interviewee 15)

This quotation reinforces the complexity of progress: evidence of support exists within an environment with continued underrepresentation of women. These comments offer a similarly qualified description of progress: one participant noted that her institution is not “inclusive,” but the “most inclusive” since her arrival; another observed that departmental and broader social awareness is “better” rather than “complete” or “fully aware.” Another interviewee describes herself as “lucky” to be an academic in an environment marked by “less” discrimination, even as she reports not feeling discriminated against. As these quotations show, increased awareness and new perspectives shed light on both progress and continued inequity.

Slow Change. **The system is not changing fast enough, and sexist beliefs continue to influence women’s experiences negatively in academic STEM.**

Despite reporting positive change over time, many of the faculty women described feeling that there is still a long way to go to eliminate inequity in their environment, and that progress is

happening too slowly. The women described an exclusive culture that lacks representation — challenges identified by many other scholars (O'Connell & McKinnon, 2021; Ward et al., 2019; De Welde & Laursen, 2011). One early-career faculty woman noted: "Progress is not as quick as we'd like. In my field specifically, the undergraduate population is still overwhelmingly white men with very poor representation from other groups, including women" (Faculty Interviewee 29). A late-career faculty woman noted, "There is still a lot of discrimination and pressure to fit into a particular mould" and discussed the impact of subtle messaging that mathematics was a field for men: "[People imagine that] mathematics or stats is men at a blackboard, rather than a woman at a computer" (Faculty Interviewee 19).

Many of our graduate student interviewees described uneven changes in women's representation, with clearer gains at certain parts of the academic pipeline (i.e., the undergraduate level) but notable absences at the PhD level. A graduate student in biology described shifts in her awareness related to the different stages in her academic pathway:

> My undergrad was super female-dominated (60% women or more), and with every step the ratio changes. I didn't think too much about how being a woman in STEM affected me until I got into my PhD — and now there aren't any women at my level or above. (Graduate Student Interviewee 22)

Our data also reveal the influence of powerful societal narratives that complicate participants' perceptions of gender disparity and slow the pace of change. A late-career faculty woman who had held an administrative position described a negative shift in her experience as she rose through the ranks:

> As a junior professor, people were supportive and wanted to see me do well. As I went through the ranks, it has gotten worse. People would probably be okay if I stayed in my box. Men view women as being privileged and, in some cases, it's true. Opportunities have opened to fill quotas. Some people see it as a privilege, but it is a double-edged sword. (Faculty Interviewee 11)

This woman recognizes that she has been constrained (in a "box") even as she articulates her experience of "privilege" and opportunity. The "double-edge sword" offers an interesting summary of her perspective — she accepts the view that quotas and women's progress are a form of privilege while also highlighting the challenges she encountered. Her comment also illustrates the gendered issues encountered by women who take on administrative responsibilities, a finding supported by previous research (see Council of Canadian Academies, 2012).

The "leaky pipeline" narrative describes that women self-select or are pushed out of STEM because of systemic disadvantages they encounter as they move through the academic structure (Sato et al, 2021). Interviewees described this phenomenon and the power dynamics in academia that shape women's representation. One faculty member described how women are still dropping out of the pipeline because of unequal opportunities: "It's sad, but it's also a little bit understandable. There is still work to do. Pay equity still doesn't really exist. There are many opportunities that women aren't exposed to at the same level as men" (Faculty Interviewee 13). A former graduate student described the "leaky pipeline" via an instance in which she was overlooked for experience and pay:

> During my final semester, a male colleague was offered a one-semester lab position. I didn't even know that was an option. It wasn't discussed and I found it

> really offensive and insulting that they went directly to him. It was a paid position. Work experience. (Former Graduate Student Interviewee 4)

This woman's frustration is compounded by her perception that she had been excelling in her work while her male colleague struggled. She noted: "The only difference between us in terms of experience was that I'm a woman and he's a man. I can't help but think that the supervisor saw him as more reliable because of that fact."

Interviewees indicated that the structure of academia itself slows the pace of change. For example, many pointed to the power dynamics inherent in the supervisor/graduate student, employer/employee and administrator/faculty relationships, which provide foundation for the academic training and work environment. One graduate student depicted the one-sided delicacy of the student/supervisor relationship: "They [the supervisors] hold your entire future, and if the relationship becomes toxic, the person it harms is the student" (Graduate Student Interviewee 14). Another graduate student noted that because there are few women faculty in her discipline, her supervisors, role models and mentors are, by necessity, men. She states that they "don't understand how pressures might feel different" because she's a woman (Graduate Student Interviewee 22). We also heard from graduate students whose faculty supervisor had minimized their research contributions. A former graduate student describes feeling dismissed and underestimated:

> I would suggest something, and my male colleague would say the same thing and the prof would say no to me and yes to him. My friends who were female said the same thing. We were never taken as seriously and had a heavier workload compared to our male colleagues. (Former Graduate Student Interviewee 6)

Some faculty interviewees felt obligated to accept dissertation and service-type committee positions because they were the only woman invited, and representation was important. These examples illustrate how power relationships shape participants' experiences both subtly and overtly.

Consistent with related women-in-STEM literature (Ward et al 2019; O'Connell & McKinnon 2021; Morgan et al., 2021; Sallee, 2012; Ward & Wolf-Wendel, 2016), motherhood emerged in our interviews as an important example of a persistent gendered challenge that delays progress in gender equity. For women in some STEM disciplines, there is limited flexibility to conduct research from home while caring for children (Ward, Wolf-Wendel, Marco, 2019). Those in a field-based science often spend long periods of time in the field, which could be especially difficult for those who have children. As Morgan et al. (2021, p. 3) note, "parenting represents a threat to the ideal worker norm" and introduces new pressures for all parents, mothers in particular.

Some participants in this study reported that they experienced inequity for the first time when they became parents and attempted to balance motherhood with academics. One faculty member noted:

> I took 10 months [of leave] and tried to keep up, but the clock was still ticking, and I still needed to do research. It was very stressful. I had to hold my baby and edit a paper and meet with students … that experience of management was very different from my male colleagues. (Faculty Interviewee 8)

This comment captures the predicament of parental leave. Women often feel pressured to keep active in their research while away for fear of falling behind professionally (O'Connell & McKinnon, 2021; Morgan et al., 2021). Parental leave is an example of a policy that can be extremely effective in supporting women faculty, but can unintentionally widen the gap it was intended to close (see Wolfer, 2016).

Women graduate students in this study also commented on the sometimes-conflicting responsibilities of work and family. One interviewee noted:

> I never felt different as a woman, actually — it was difficult mostly because I have a family. Household things, my child needing my attention, etc., could be a distraction from my educational track. There wasn't anything different from the university. It's difficult because of all of these responsibilities and trying to balance everything. (Graduate Student Interviewee 4)

This highlights the dual identities some women navigate — as women academics and mothers — and raises questions about progress. While the academy has taken steps toward admitting and accepting women scientists, a bias against mothers persists (Morgan et al., 2021). A former graduate student described wrestling with this bias in her career planning:

> As a student, I watched the hiring process at the university. It seemed like it was geared toward men entering the field and being hired. That was a bit discouraging to see. I did have conversations with other women scientists about the pros and cons of being a woman in academia. A lot of it has to do with the fact that the time you work the most and the hardest during an academic career is also the time when you are family planning and having kids. That has always stuck out as not being super fair. (Former Graduate Student Interviewee 3)

A faculty member expressed the impact of broader cultural expectations of women as people pleasers and describes the perceived image of a woman academic:

> Saying no goes against societal expectations of agreeableness for women. It also goes against the image of the woman academic as an invincible superwoman, which is difficult to live up to. We don't want to say no, so we try to do everything. You don't want to appear weak. (Faculty Interviewee 27)

This language of perceived weakness was also raised by a former graduate student: "A lot of the time women won't speak up … you don't want to look weak" (Former Graduate Student Interviewee 6).

These women are identifying the unfavourable status quo in academia while also describing their commitment to it. The faculty member above pushes against "societal expectations," then acknowledges that she submits to these expectations by trying not to "appear weak." This articulates a slightly revised but no less potent version of the ideal worker: invulnerable "superwomen" who never say no and do not allow their caregiving responsibilities to influence their role as scientists. It is not surprising that broad cultural expectations of women and workers are echoed and reinforced by the women themselves; these are powerful narratives and women are part of the societies that create and protect them.

***Social Support, Individual Action*. For women in academic STEM, individual action and individually developed social supports are important features of career success.**

Our data reveal that career success was strongly influenced by our interviewees' own actions, including the development of personal characteristics such as confidence and resilience. Our participants spoke about developing personal support networks and their own self-efficacy. Mid- and late-career faculty acknowledged that they grew more secure over time and reported increasing confidence as women in STEM. An early-career faculty woman highlighted a shift in her sense of responsibility: "Many things are easier … if someone doesn't like seeing me where I am, that's their problem" (Faculty Interviewee 5). A tenured, mid-career faculty member discussed increased comfort in her skills and abilities, noting: "I have become much less afraid to voice concerns or to contribute during a department meeting. I've gained confidence in my skills and judgment" (Faculty Interviewee 26). Interestingly, this interviewee focuses on self-assurance and judgement — not her expertise in her particular STEM discipline.

It is difficult to unpack whether women academics gain confidence as they acquire experience and practice their skills or whether the security afforded by tenure enables these feelings. The complexity of women's experience in the tenure system is captured in a series of qualitative studies with Canadian women academics (Acker, 2003; Acker & Armenti 2004; Acker & Feuerverger, 1996). Achieving tenure is a key accomplishment, but the process may be challenging. Acker et al. (2012) describe the tenure process as part of an apparatus of regulation that in some cases contributes to "acute level[s] of anxiety for women academics." Women may experience more confidence once they are promoted to the associate professor level both because of the milestone and because the subsequent review and evaluation processes are not associated with such high stakes.

Some participants acknowledged that their increased self-confidence comes in part from having intentionally practiced how they present themselves. One faculty interviewee explained her decision to wear polo-style shirts when lecturing rather than dresses (Faculty Interviewee 28). Dressing in a less conventionally feminine manner is a strategy she adopted to avoid drawing attention to her femininity in a traditionally male-dominated field. It also reflects the broader social perspective that "woman" and "scientist" are incompatible (Banchefsky et al., 2016). A mid-career faculty woman noted, "I come across now as more confident. I have thought a lot about how I present myself and consciously worked on not apologizing for myself" (Faculty Interviewee 7). This comment suggests the participant's awareness of limiting societal narratives about gender and commitment to embrace behaviours she thinks will help her succeed. The behaviours she associates with success — presentations of unapologetic confidence — are stereotypically masculine. In these examples, interviewees accept and reflect the dominant social narratives that shape their success.

Our interviewees also spoke about using their own social and human capital to manage their career challenges. One faculty member described the resilience she needed to persist: "Back then, there was not very much support. You had to be very strong to survive" (Faculty Interviewee 13). Social networks emerged strongly as a factor essential for participants' career success. Interviewees spoke about the value of role models, informal mentorship and networking groups — findings that echo the importance of collaboration and networking as prominent features of women's research careers (Council of Canadian Academies, 2012). Interviewees described networks as "a big deal" and "important" for their career success. One faculty woman discussed how role models factored into her socialization: "Having role models is super important ... The only reason I thought I could have an academic job was because I had a mother who modeled that for me" (Faculty Interviewee 5).

In some cases, relationships cultivated in graduate school continued to be important throughout participants' careers. For one of our interviewees, support was both academic and personal:

> I was mentored unofficially by some of the women scientists during my postdocs. One woman gave me a bunch of baby stuff. It was a big deal to have this other woman academic notice that I was having a child. She encouraged me and demonstrated that you could be a woman scientist and mother. (Faculty Interviewee 13)

This 'unofficial' mentorship was hugely influential. Our interviewee felt seen and understood by a woman colleague at a pivotal time in her life and career. Interestingly, in this quotation, the faculty member expresses the separation of identity between "woman scientist" and "mother" even as she comes to believe — with support from her colleague — that being both is possible.

In describing the individual actions that support their successes, our interviewees point to institutional policy and practice that can impact their careers. Women in all groups noted that they often feel alone in the world of academic STEM. For instance, one faculty woman said: "My institution has made some things pretty hard. There's no mentoring in any organized sense of the word … I was going to have to figure out things by myself" (Faculty Interviewee 30). Another faculty woman called for institutions to "use merit or other kinds of promotion and make it as systematic as possible rather than putting the onus on the individual. It's more likely that women will participate [in academic STEM] if there's a process/system" (Faculty Interviewee 7). She and others noted that such supports and intentionality around equity not only help women, but they help everyone.

***Making Improvements*. Policies to support women in academic STEM can also contribute to broader cultural change.**

Interviewees reflecting on their experience provided both practical and ambitious suggestions for how to make academia more welcoming for women in STEM. These women desire immediate improvement through institutional action, but they also acknowledge that true equity requires systemic changes in academic and institutional culture and broader society over time.

Faculty and graduate students emphasized the importance of the academic pipeline, starting with a focus on encouraging more women into STEM in the first place, then helping them succeed in their careers. They discussed the challenging cultural biases about women and science that take root in early years, advocating for postsecondary institutions to target outreach in the K-12 system. Gendered perceptions of careers and abilities happen early in elementary school and are reinforced through the school system as well as within families and society (Febrarro & Pickering 2015; Council of Canadian Academies, 2012; UNESCO, 2007; Eccles, 2007). A faculty participant described this phenomenon and its impact:

> Girls lose or hide interest [in science] at 11 or 12 years old and I can see why. They try to accommodate to groupthink where the groupthink is girls shouldn't do math. We need high schools to show girls that it's cool to be a scientist. We need more activities or programs to show that science is cool. (Faculty Interviewee 9)

Reinforcing the literature about the impact of representation (Council of Canadian Academies, 2012; Xie & Schuman, 1997), especially in male-dominated fields, our interviewees spoke about visible role models. A graduate student noted,

> In physics, we see the divide between boys and girls start around age 11 or 12. Not all physicists are like in *The Big Bang Theory*. If you can't see yourself in a role, it makes you feel like there is a major barrier to overcome. Diversity makes a huge difference, especially for kids. (Graduate Student Interviewee 7)

This woman, still in graduate school, spoke about the impact of popular culture and social expectations on decision making and confidence for girls. Her comment echoes findings from a Council of Academies (2012) study, which argued that socialization, gender schemas and stereotypes define social roles and contribute to the lack of encouragement for girls to forge non-traditional paths. Providing support and encouragement to girls during elementary and high school encourages them to stay in STEM, just as support from advisors encourages women to stay in graduate school (Darisi et al., 2010).

Visibility of other women in their specific field or discipline was also important to the graduate students and early-career academics in our study. Our participants are learning from norms on campus and make decisions about their career trajectory based on their perception of gender equity and their chances of developing a successful career without undue stress. One former graduate student described this calculus:

> Part of the reason I didn't do a PhD originally was because I knew I wanted to start a family right away. I had seen male graduate students do that successfully but hadn't seen a single example of that happening for women. There could be some real improvements there. Canada's maternity benefits are really good, but I knew that if I had a full-time job, I could take a full-year maternity leave. I knew that I really wanted that. As a graduate student it is really difficult to take that time off. (Graduate Student 14)

Another graduate student described visibility in a slightly different way, suggesting that hiring more women should be a primary focus for institutions, but also suggested offering targeted scholarships and "showcasing women faculty or researchers in the department" (Graduate Student Interviewee 6). Another graduate student said, simply: "If you can choose a woman, do that" (Graduate Student Interviewee 21). These practical suggestions indicate that there is room for institutions to expand their supports for women in STEM in ways that can have immediate positive impacts on women's visibility.

Having knowledge of the system emerged in several ways. Some women suggested that coaching and career development training would be welcome, particularly workshops that help women academics develop negotiation, self-advocacy and communication skills. One mid-career faculty participant described the need for such training by accepting the first offer from her dean without asking questions: "I only had one offer; how could I negotiate? It didn't occur to me. I had no negotiation skills" (Faculty Interviewee 27). In addition to the opportunity to practice professional career development skills, students wished there had been more discussion during graduate school of how to pursue an academic career. One student observed that, "The process seemed hard and unattainable. Support to make the pathway more visible and information about the different types of careers both within and outside of academia [would have been helpful]. I did a lot of research on my own" (Former Graduate Student Interviewee 3). This

woman's comment reinforces our finding that, for women in STEM, success is connected to their own social networks and self-advocacy.

Participants also spoke about the importance of equitable workload expectations within departments, noting that some women — particularly those who are members of more than one equity-deserving or traditionally underrepresented group — get overloaded with service requests that take them away from research. One faculty member offered this perspective:

> Women do more teaching and sit on more committees. There is no oversight; nobody is looking at this. The onus shouldn't always be on women to advocate for themselves and investigate whether they're teaching more than their male colleagues, particularly for more junior faculty. (Faculty Interviewee 4)

Research activity is a key factor used to assess performance and inform decisions about tenure and promotion (Acker et al., 2012); taking on additional service and/or bearing the responsibility to self-advocate can negatively impact women's career trajectories, especially for academics at research-intensive universities (Misra et al., 2011; Wjiesingha & Ramos, 2017; Acker et al., 2016). This phenomenon is referred to as "cultural taxation" and is used to describe the extra burden of service responsibilities placed upon minority faculty members because of their racial backgrounds (Hirshfield & Joseph, 2011).

Institutions' roles in expanding supports for women balancing academia with motherhood and other caregiving responsibilities was a strong theme in our data. Given the expansive literature on motherhood and academia, this is not surprising (Ward & Wendel, 2016; Ward et al., 2019; Mason, Wolfinger & Goulden, 2013; Kelly & Grant, 2012; Muhammad & Neuilly, 2019). Policies such as parental leave, spousal hiring and funding to support research activity during caregiving leave were cited as a helpful but not always perfect fit. One mid-career faculty interviewee described this policy/reality mismatch:

> We need support that is more realistic. I had a huge problem when my kids first went to school; there was no after-school program and school ended at 2:50 p.m. [It's great to have] 1.5 years off for maternity leave, but if you could solve the after-school problem, that would be better. (Faculty Interviewee 2)

Another late-career faculty woman described the work/life balance issue for academics and pointed to both institutional and societal culture around caregiving.

> Unfortunately, for women, having a family is not a neutral event. It takes something out of you, but it doesn't mean you're a different scientist. Too many male colleagues still think in those rigid terms, and now that universities are run as businesses, there are too many people who subscribe to rigid pathways/metrics. How can you encourage the best people in that environment? Until we can agree societally and institutionally that there can be flexibility and that it doesn't mean that you're not as serious as [those without family responsibilities], it will be a struggle. (Faculty Interviewee 15)

Participants acknowledged that policy implementation is impacted by structural and societal norms. They referred to well-intentioned policies, such as parental leave, that can inadvertently exacerbate inequities. One faculty woman said, "Dads on parental leave continue to come into the lab," an option that is much less feasible for a woman scientist who is dealing with the physical demands of new motherhood (Faculty Interviewee 26). Participants appreciated efforts

to increase equity in application of policies; for example, NSERC grant applications consider career gaps due to maternity leave. Another faculty interviewee noted that women academics, like mothers everywhere, still bear the brunt of caregiver responsibilities, echoing the literature (Misra, Lundquist & Templer, 2012). She noted: “Women have more family business. My husband is a professor and I always joke that I work harder than him … I feel that we [women] have more pressure than them [men]” (Faculty Interviewee 8).

Participants urged institutions to support accessibility and inclusion policies with better transparency in hiring, promotion and evaluation processes, and to gather and share data about equity within the professoriate. An early-career faculty woman described the ways transparency can be a powerful educational tool for institutional leaders: “Education at the management level goes a long way and makes an impact. For example, sharing numbers and information and explaining how decisions or behaviours might impact women more than men is helpful” (Faculty Interviewee 5). For graduate students and early-career academics, communication about and enforcement of institutional guidelines for faculty supervisors could raise awareness about power dynamics that undermine women’s confidence and success. One faculty interviewee said, “You feel like you have to play nice to get a good reference — they have so much power over your future if you want that academic track (Faculty Interviewee 17).

Participants also described the importance of everyday practices that support women’s sense of belonging. Such practices are not necessarily about or for gender equity; rather, they provide opportunities for communication and help build a culture of respect. A late-career faculty member described her department’s weekly gathering:

> We have a longstanding tradition to have coffee together once a week, which might seem trivial or a waste of time, but it’s so important to how the department runs, to teaching well, to supporting one another. We recognized during the pandemic how important it is to us as a team and did it virtually. Creating the culture of connection and being respected are perhaps particularly important to people who might not feel they belong. (Faculty Interviewee 7)

Recommendations and Conclusions

For many women, building and maintaining a fulfilling career in academic STEM is harder than it should be. Women academics contend with institutional structures, power dynamics and cultural biases that place them at a disadvantage compared to their colleagues who are men. Even after efforts on the part of institutions to develop policies to encourage and support women and to rectify historical imbalances in hiring, promotion and earnings, women are underrepresented and underpaid in some STEM disciplines (Napierala & Colyar, 2022). Informed by our data, we propose recommendations for institutions, but acknowledge that governments, research councils, journals, professional associations as well as industry have a role to play in reducing gender inequity.

Embrace accountability and institutional self-evaluation to ensure policies and practices are effective and relevant.

Institutions should continue efforts to close the gender equity gap by increasing accountability and self-evaluation. These actions should include an expansion of EDI efforts and a commitment to collect and publish equity data by rank and field, as well as gender breakdowns in student enrolment by discipline and credential.[5] Wilfrid Laurier University (WLU) has taken important steps in this direction through their participation in The Dimensions Pilot Program[6], an equity-focused initiative of the federal government. As part of their Dimensions activities, WLU released an Annual Employment Equity Report (2020), which focuses on faculty and staff representation of women, Indigenous peoples, racialized people, persons with a disability and those who identify as sexual minorities. Equity data can be used to inform and update policies introduced years ago that may require revision or enhanced accountability structures (see Agocs, 2014). Institutions should consult models used in other jurisdictions to encourage gender equity. Programs such as the Athena SWAN program, for example, provide a framework to systematically assess and advance gender equality in the postsecondary sector through action planning and awards (Advance HE, n.d.).[7]

Another example of institutional self-evaluation involves starting salaries for new academics. If an analysis shows gender disparities, institutions can commit to equal and non-negotiable entering salaries for new faculty. Some universities have taken a good first step with hiring policies that use a salary floor determined by rank. This approach may not resolve inequities as salary negotiation can be gendered. A transparent, non-negotiation policy for new academics' starting salaries would further ensure that women start their careers in an equitable position. This policy position would also influence the culture and climate for incoming cohorts of academics.

Parental leave is an example of a policy that can unintentionally widen the gap it was intended to close (see Wolfer, 2016). It is also an example of how even good policy is not a panacea for institutional culture and biases; institutions should outline clear and consistent messaging and expectations around the value and intent of parental leave to destigmatize and encourage

[5] Many institutions have expressed a commitment to equity and diversity, but the collection and reporting of equity data is still uneven across institutions in Ontario.
[6] Across Canada, 17 postsecondary institutions are participating in the pilot program, including Toronto Metropolitan University, the University of Ottawa and Wilfred Laurier University.
[7] There is a made-in-Canada Athena SWAN program pilot being implemented in the postsecondary sector through the work of Tri-agency EDI action plan for 2018–2025: https://www.nserc-crsng.gc.ca/InterAgency-Interorganismes/EDI-EDI/Action-Plan_Plan-dAction_eng.asp

appropriate use. The Canada Research Chairs (CRC) program offers an example of a strategic attempt to close equity gaps in academia; the 2019 decision to make targets reflect the diversity of the general population, not just the diversity of the applicant pool, have pushed universities to improve representation among CRCs greatly (Doolittle & Wang, 2021). The CRC program funding rules for institutions were the accountability mechanism that drove action towards change.

Focus on supervisory relationships: Review, update and implement guidelines for faculty and advertise supports for graduate students to ensure safe learning and working communities.

The current and former graduate students we interviewed report feeling extremely vulnerable in the academic workplace. Institutions can take a number of important steps to facilitate healthy faculty/student supervisory relationships, including enhancing available EDI training, reviewing or developing supervisory guidelines, ensuring there are clearly understood complaints processes, providing coaching support for faculty in supervisory roles and conducting exit interviews with graduate students to enable them to share their perspectives without fear of penalty. We heard from some women that they do not trust institutional complaints processes and have turned to whisper networks (especially in the graduate student community) to warn each other off “bad eggs.” Women spoke of a need for more administrator oversight of graduate student/supervisor relationships. Schools of graduate studies should ensure that both supervising faculty and graduate students are aware of the unique nature of the academic supervisory relationship and its inherent power imbalances and that they have access to appropriate support services. An example of this type of intervention is the accessible and fulsome McMaster University’s School of Graduate website, which includes important information for both supervisors and students about the unique academic supervisory relationship and ensuring its success.

Pay attention to the academic pipeline and encourage more women into and through STEM.

Institutions and government should partner to grow STEM talent by investing time, effort and money in programs and opportunities to encourage girls and young women into the field. Many institutions already participate in programs of this sort; targeted investment from government could expand these efforts and develop long-term partnerships with K-12 school boards to capitalize upon early interest in science and technology. Universities could work with partners to pave a pathway into STEM, developing enrichment programs free of charge, targeting scholarships and providing support for the application process.
A downstream section of the pipeline requires additional focus — and that’s fostering and supporting women in academic and administrative leadership roles within the university. Some women reported having felt welcome in academia until they took on leadership roles. This finding reflects a broken system of support for career development and expansion (Acker, 2014; 2010).

* * *

Our conclusions suggest both hope and cause for concern. Increasing awareness of gender equity has led to a more positive atmosphere for women in academic STEM. Progress has been slow, however, hindered because traditional cultural expectations for men and women are slow to evolve. Women themselves have shouldered much of the burden of change. Talented women continue to leak out of the academic pipeline or abandon their plans for a career in academia

because they face gendered barriers to career progress and have few women role models in their field.

Perhaps most worrying from our findings is the number of women who believe in the primary role of individual action. Human capital theory holds that women's success in academic STEM is a consequence of individual productivity; the women we interviewed report the belief that their success or failure is dependent upon their own self advocacy, resilience, confidence and fortitude. This focus deflects attention from the systems of oppression and misogyny and forces women to find their own way. Fortunately, the women we interviewed also have good ideas about how their institutions can better support them and their colleagues. Institutions can have an important positive impact on the experience of women in academic STEM and contribute to broader social change toward gender equity.

Future research could explore the beginning and the end of the academic STEM pipeline — including a focus on the attitudes and experiences of young women as they make decisions about their postsecondary pathways, and the experiences of STEM women who are interested in or are undertaking senior administrative roles within their universities. Nevertheless, with that said, steps toward equity should not depend on additional research. There is abundant evidence of gender equity gaps in Canada. It is time for institutional leaders to move the needle of progress forward through targeted policies, such as those recommended here, and to ensure that institutional values around gender equity are consistently upheld.

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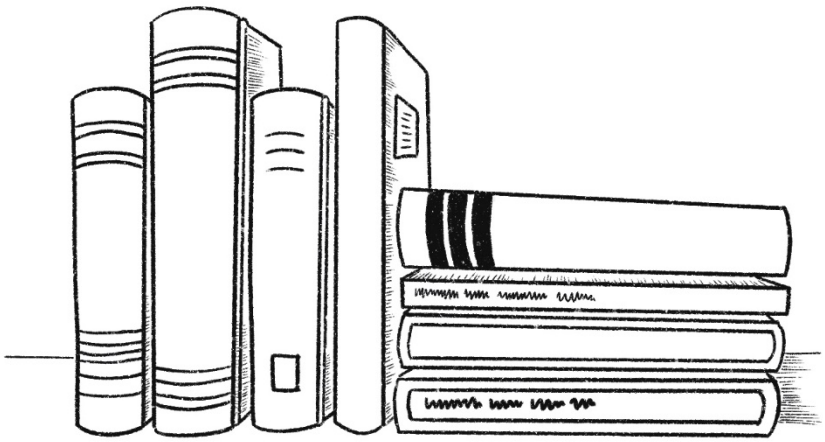


It’s not perfect, but the needle has moved

Appendix A

Sample Recruitment Letter/Email Script for Faculty

Invitation to Participate in HEQCO's Women in Academia Project.

Hello [insert name],

I am emailing you on behalf of the Higher Education Quality Council of Ontario (HEQCO). As an agency of the Ontario government, HEQCO brings evidence-based research to the continuous improvement of our provincial postsecondary education system.

I am part of a team of researchers seeking to better understand the experiences and pathways of women faculty and graduate students in STEM (Science, Technology, Engineering and Math) fields across Ontario. In particular, this project focuses on women's academic pathways and their representation in faculty ranks. Through this project, we will raise awareness of the experiences of women in STEM fields and develop evidence-based recommendations for institutions and policymakers toward the goal of more equitable representation of women in STEM faculties.

We are reaching out because you are a faculty member in [x department at x university]. We obtained your contact information from the [name of university] faculty website. If you identify as a woman, you are eligible for this study, and we invite you to participate.

Your participation is completely voluntary. If you are interested, please take a moment to read the attached information letter for more details. We have consulted with the [x university name] Research Ethics Office and determined that this study does not require formal ethics review. Your participation is voluntary.

If you agree to participate, I will work with you to schedule an interview date and time between now and the end of [month]. During the interview you will be asked a few short questions about your experience as a woman working in academic STEM (i.e., What influenced your decision to enter and stay in the STEM field as an academic? What have your academic career experiences been like as a woman in STEM? etc.). We will not take more than an hour of your time.

Thank you very much for your consideration. To express your interest in participating or if you have any questions about the study, please email me at akaufman@heqco.ca or our VP of research, Julia Colyar at **jcolyar@heqco.ca**. Please do not hesitate to contact us at any time.

Sincerely,

Sample Letter of Information and Consent / Women in Academia

Purpose of the Study

We aim to gain insights into the experiences of women graduate students and faculty in STEM fields (science, technology, engineering and math) across Ontario universities. Information gathered from this study will be used to raise awareness of the experiences of women in STEM fields and to provide evidence-based recommendations for institutions and policymakers. We will be publishing a report that will highlight women's experiences in these fields.

Eligibility

Participants must satisfy all the following criteria:

- Professor of assistant rank or higher, working in STEM field at an Ontario-based university, and
- Professor of assistant rank or higher who identifies as woman.

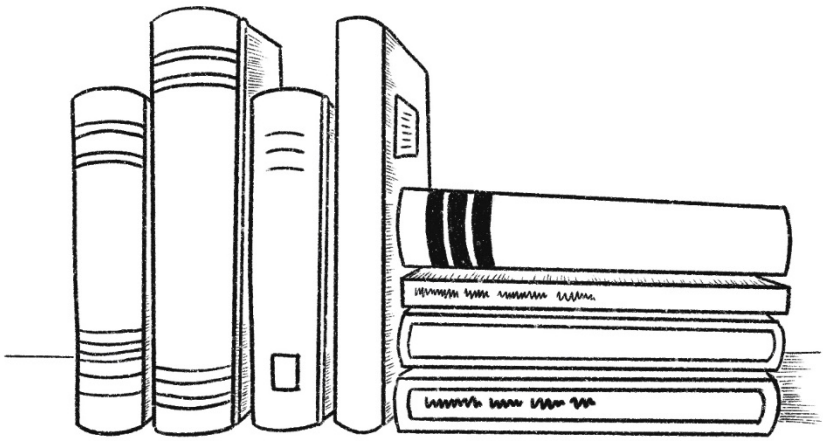
Procedures Involved in the Research

You will be asked a few questions about your professional experience in the STEM field. In particular, what influenced your decision to enter and stay in the STEM field? What have your career experiences been like as a woman in STEM? Are there any challenges? If so, what, and how do you overcome some of these?

The interview will last no more than 60 minutes. They will not be audio recorded; instead, HEQCO staff will take detailed notes during the interviews.

Potential Harms, Risks or Discomforts

Discussing your experiences as a woman professor in STEM may cause you to feel stressed or upset. If any part of your participation in this research makes you feel upset our uncomfortable, please do not feel like you have to answer the question and/or let the researcher know. You are always free to stop the interview at any time. We describe below the steps we are taking to protect your privacy.



It’s not perfect, but the needle has moved

Appendix B

Women in Academia Interview Questions

These questions are designed to help us learn more about your experiences as a woman professor in a STEM field. Interviews will be conducted online with HEQCO researchers and will be open-ended. The exact wording of questions may change slightly, and we may use additional questions to be sure we fully understand your response. For example, to clarify we may ask "*So, you are saying that …?*", to get more information: "*Please tell me more?",* or to learn what you think or feel about something: "*Why do you think that is…?".*

Below are the general questions we may ask:

1. Can you tell us a little bit about yourself and your current role?
2. Why did you originally decide to enter a STEM field? For example, was there anything specific that influenced your decision?
    - Have you left a STEM field? If so, why? (If you have left a STEM field, could you elaborate on why?)
3. How would you describe your experiences as a woman in STEM?
4. What has helped you succeed?
5. What has hindered or slowed your success?
6. What are the most difficult aspects of your job?
    - Do these relate to/are they influenced by your gender?
    - If so, what strategies do you use to overcome them?
7. Have your experiences changed over time?
8. Has the COVID-19 pandemic impacted your role? If yes, please describe how.
9. What recommendations/advice would you give to institutions, faculty and graduate students in terms of supporting women in STEM fields?
10. Is there anything else you would like to tell us that is important to understanding the experiences of women in STEM?
11. Do you know of any other women in STEM that we could connect with?

END