Exploring Career-path Streaming through an Intersectional Lens: Race, Gender, and Engineering in the Canadian Context

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Introduction

The conventional discourse around women and engineering often calls attention to their underrepresentation in the profession. But disparity is not just in representation by numbers but also in career path trajectories. The often-obscured implications of career paths on professional outcomes, and in particular the ways in which race and gender can be associated with career path streaming, serve as the rationale for our current study. Our guiding research question is simple: How do race and gender intersectionally influence the career path trajectory, and by extension the sense of professional belonging and identity, of engineering graduates in Canada?

Ample research has documented workplace marginalization, exclusion, discrimination, and misogyny experienced by women in engineering [1], [2], [3]. Robust theoretical work, grounded in empirical findings, has demonstrated the way societal gender norms are entrenched in the way engineering, a profession with men in large majority, has been socially constructed. For example, the works of Wendy Faulkner and Teresa Cardador have, respectively, revealed the way "gender in/authenticity" between person and norms affect who finds identification and belonging in engineering, and offered the "inverted role hierarchy" as a framework to explain why women advancing into management roles often lose occupational status and their sense of engineering identity as they move away from the "technicist"-centric variety of work (i.e., masculine-leaning conception of engineering).

Using data from a 2022 survey with responses from 982 engineering graduates across Canada, and building on our previous qualitative work identifying five distinct engineering career paths with varying "technicist" centricity [4], [5], we explored whether engineering graduates have been streamed into these paths along lines of race and gender.

Gender, race, and engineering graduates in Canada

In Canada, only 15 percent of practising professional engineers are female-identifying [6], and *there is no publicly available data reporting the representation of racialized persons*[1] *as licensed professional engineers*. According to 2021 Canadian Census data, 20 percent of all engineering degree holders in Canada (a much *broader* category than licensed engineers) identified as women, and 53 percent identified as being a visible minority member[2]. With the majority of

[1] We understand the term 'racialized' to mean people who have been negatively and systemically impacted by "racialization", the classifications of people into racial groups by reference to signs of origin - such as skin colour, hair texture and place of birth - and judgments based on these signs about their character, skills, talents and capacity to belong in this country [Canada]" (p. iii) .

[2] In this paper, we make comparisons between our survey respondents who identified as being racialized and those who are reported as "visible minority" in the Canadian census. The Canadian Employment Equity Act defines visible minorities as "persons, other than Aboriginal peoples, who are non-Caucasian in race or non-white in

engineering graduates in Canada identifying as racialized, it is concerning when much of the research on engineering education and practice have been conducted with largely participants who are white men, especially where results are being generalized to represent the experiences of engineers broadly, including those who are not white or men [7]. Even in our current study where we attended to the need to diversify our sample by having organizations such as the National Society of Black Engineers (NSBE) Canada and Women In Science and Engineering (WISE) help with participant recruitment, only 14 percent of our final sample identified as being racialized. The obvious question is: Where are all the racialized engineering graduates?

Perhaps the 53 percent visible minority among engineering graduates is misleading. The challenges faced by international engineering graduates are well documented; many international graduates immigrate to Canada only to experience incredible and sometimes insurmountable barriers to becoming licensed and employed as professional engineers (e.g., credential non-recognition; Canadian work experience required for licensure) [8], [9], [10]. If we were to disaggregate the number of engineering graduates in the Census by location of study, focusing only on Canadian graduates at the moment (as 87 percent of our sample were Canadian degree holders) with the understanding that many of the international graduates would have exited engineering altogether, the percent of graduates identifying as a visible minority member drop to 36 percent. This is still a substantive proportion and much larger than the 14 percent of our sample identifying as racialized. Part of our research interest is to understand whether women and racialized engineering graduates are being streamed into less technically-centric roles and in some cases out of engineering altogether, building on existing research that have presented negative implications as a result of those types of streaming. If racialized graduates in larger proportion are leaving engineering, that could be one explanation for why our attempt at oversampling for racialized women and men through engineering associations still led to an underrepresentation of racialized engineering graduates in our survey.

Intra-occupational segregation in professions

Intra-occupational segregation refers to the stratification and segmentation of workers within a profession into higher and lower status subfields [11], earnings, levels of organizational authority, and other structural characteristics of work that often occur along lines of gender and race. Research has pointed to structural biases (e.g., social/cultural stereotypes) and discrimination as the causes of these segmentations.

Studies examining physician's occupational outcomes have found that despite having reached gender parity in medical school enrolment, women in professional practice remained largely underrepresented in higher status specialization such as surgery and overrepresented in general medicine [12], [13]. Framed another way, specialities considered "people-oriented" like family

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colour." Although we included survey respondents who indicated Indigenous identities as racialized, the Canadian census categorizes Indigenous identities and visible minority identities as separate but not discreet groupings (i.e., respondents could potentially indicate yes to both questions). As such, we did not combine the Canadian Census counts on visible minority and Indigenous identities as a 'racialized person' category to compare with our survey data.

medicine, pediatrics and obstetrics-gynecology were more likely to be pursued by women, whereas "technical-oriented" specialities like surgical specialities are more likely to be pursued by men [14]. Similarly in law, the "numerical feminization" of the legal profession (without broader structural changes) has resulted in new lines of segmentations and exclusion [15]. Characterizing the legal profession in England and Wales, Bolton and Muzio described the way women solicitors were located more so in less prestigious and financially rewarding employment conditions, occupying "…'a (frequently transient) proletarian role' (Sommerlad, 2002: 217) deployed to support the earnings and privileges of a relatively prosperous and autonomous elite of predominately male partners."[15]

Examining gender segregation within software engineering in the US, Campero found that women accounted for a much larger percentage of those hired into quality assurance (QA) positions (considered lower status and lower paid), compared to developer jobs [11]. Overall, women were disproportionately more likely to apply to QA jobs compared to men. Stronger educational credentials diminished women's likelihood to apply to QA jobs, (the author suggesting a positive effect between educational credential and women's self-assessment and sense of belonging); men—regardless of educational background—were less likely to apply to QA jobs compared to women.

Researching engineers across industry sectors, Cardador uncovered a number of unanticipated consequences to promoting women engineers into management [16], which has been a consistent corporate strategy employed as part of their equity, diversity, and inclusion strategy. The study found that engineers in management were often seen as being less technically proficient than others in more technical roles, especially for women whose technical proficiency was already continuously challenged in ways that men's were not. The perceived association between management and lower technical competencies had many negative implications for women engineers in management, such as loss of occupational status and weakened identification with engineering. This, along with a more difficult work/life balance, suggested that promoting women in engineering management (without broader structural changes) can negatively impact their attachment to the profession [16].

Overall, research on intra-occupational segregation into subfield/specialization or roles has been largely explored as a gendered phenomenon (Campero did briefly touch on race and gender intersectionally and findings suggested similar gender patterns across different racial groups [11]). There is some work examining race and intra-occupational segregation (e.g., A Norwegian study examined whether professional advantages experienced by men in women-dominated occupations are extended in the same way to ethnic minority men in nursing—they are not [17]), but the focus is mainly on wage differentials within an occupational group as an income discrimination phenomenon, and not specific to specializations within a given profession [18], [19]. Our study, looking at the intersectional effects of race and gender on career path streaming of engineering graduates, contributes to a currently limited pool of research of examining occupational segregation in ways that consider the influence of race along with gender. It builds on our earlier, exploratory findings about the gendered and racialized streaming of engineering career paths—with white women over-represented in and tapped for socio-technical middle

management work, white men over-represented in and tapped for rapid rise executive track paths, racialized and internationally trained men over-represented in entrepreneurial and technical specialist paths, and the lone racialized woman on a path we referred to as “invisible” [5] .

Leaky pipeline: For women and others

Unlike law and medical schools, a large gender imbalance persists in engineering schools. Only 23 percent of all Canadian undergraduate engineering degrees were awarded to female-identified students in 2020 [20]. The continued underrepresentation of women among engineering graduates, in Canada and abroad, has meant a significant amount of research and advocacy work focused on addressing the “leaky pipeline” or the attrition/retention of women, a group already minoritized in engineering schools and professional practice [21], [22], [23], [24].

In Canada, engineering graduates have to become *licensed* not only to practice engineering but also to be *legally* allowed to be called “engineer” [25]. Licensure is often used as a proxy to indicate retention of recent graduates on an engineering career path, and according to recent data (2022), the conversion rate from student to licensure at 4 years after graduation was relatively comparable between women (42 %) and men (45%), but again, there is no data disaggregated by race [6].

But using licensure to account for who is officially an “engineer” further complicates an already politically charged discussion of who is included or excluded from the profession. There are many engineering graduates who employ their engineering training and technical expertise in their day-to-day work who do not become licensed engineers because their jobs do not formally require them to do so (e.g., engineering consultants, computer and software engineers, sustainability managers), even though they work in engineering intensive firms or subfields. When using licensure to measure, these engineering degree holders do not officially count as “engineers.”

It is a valid assumption that being able to identify as an “engineer” is part and parcel to having a sense of belonging to the engineering profession, but there is limited research on the impact of ‘not-being-counted’ on the professional identity and belonging of engineering graduates. There is also limited information on who among engineering graduates (in sociodemographic terms) are working in engineering intensive fields but excluded from the legal definition of “engineer.” These are complexities particular to the “leaky pipeline” in the Canadian context, and again, there is limited data related to race.

Forces entrenching intra-occupational segregation

The gendered sociotechnical dualism and its implications in engineering have been explored deeply in the work of Wendy Faulkner [2], [26]. Through ethnographic studies, Faulkner theorized that a technicist-centric understanding of ‘real’ engineering prevails, despite

engineering practice being heterogeneous in nature—incorporating both technical and social dimensions, because 'technical'/'hands-on' work aligns with stereotypical ideas of masculinity, and 'social'/relational work with similar ideas of femininity. These ideas, which impose judgment of gender "in/authenticity" onto women in engineering, has meant that women engineers who move away from technicist-centric roles (e.g., into management) are seen to be confirming gender expectations and dissociating from 'real' engineering in ways that men who move into less technicist-centric roles are not. This perceived dissociation by others (and sometimes by women themselves) from 'real engineering' has a specifically gendered impact on women's sense of engineering identity and sense of belonging in the profession [2].

The gender essentialism that underpins the technical/social divide within professions is what contributes to the *horizontal* segregation within occupations [11], [12]. Although vertical gender segregation typically refers to the overrepresentation of men at the top of the occupational or organizational hierarchy in terms of pay and status, Bolton and Muzio emphasized the interplay between horizontal segregation and vertical stratification, where occupational subfields led by women (i.e., horizontal segregation) also typically offer lower financial rewards and fewer advancement opportunities [15]. As such, "numerical feminization" appears to ease the broader access to the profession while deepening internal controls within the profession that gate-keeps the upper echelon.

The complexity of these gendered stratifications is further demonstrated in Theresa Cardador's theory of the "inverted-role hierarchy" [16], a paradox where women engineers advancing up the organizational hierarchy into managerial roles simultaneously experience lowered professional status (with implications on identity and belonging), as they move down the occupational "value hierarchy" that privileges 'technicist'-presenting engineering work (masculine signifier) over 'heterogeneous'-presenting work [2]; as women are promoted up, they become at-risk of being "promoted out" of engineering [16]. Consistent with the critique that advancing equity is more than simply increasing the number of women (and other underrepresented groups) in the profession, Faulker called for engineering as a profession to embrace the heterogeneity of its practice and accept heterogenous engineering identities, decisive moves that are needed to attract and retain the talent it needs to truly diversify the profession [2].

Research questions

Building on the work that has interrogated intra-occupational segregation within engineering along gender lines including our earlier qualitative research, and with an awareness of the need to incorporate an intersectional lens to our inquiry and to consider the impact of licensure on inclusion and identity, we sought to understand:

1) Who, by race and gender, among engineering graduates are counted as "engineers"?
2) How are engineering graduates, by race and gender, differently distributed across engineering career paths?
3) How do engineering graduates' sense of belonging and professional identity differ by career path, race and gender, and licensure status?

Informed by our earlier research [4], [5], we expected that women and racialized engineering graduates would be more represented in career paths that are less "technicist"-centric than others. We expected career paths that are more expressly heterogeneous to be associated with a lesser sense of engineering identity and sense of belonging to engineering overall.

Methods

Cross-Canada survey on engineering career paths and EDI

In partnership with Engineers Canada, Troost ILead conducted a survey with engineering graduates across Canada in late 2022. As part of our recruitment strategy, we invited all provincial and territorial regulators of professional engineers to an informational session about our planned survey on engineering career paths. In particular, we reached out to each regulator's representative on the '30 x 30' campaign, which has a goal to increase the percentage of women among all newly licensed engineers to 30 per cent by the year 2030 [27]. As a result, eight of the regulatory bodies and one provincial engineering advocacy organization agreed to support our participant recruitment efforts (e.g., Linking to our survey invitation through their online newsletter or social media channels). We also recruited with support from the Faculty of Applied Science and Engineering's alumni office at the University of Toronto, Engineering Deans Canada, Women in Science and Engineering (WISE), and National Society of Black Engineers (NSBE) Canada, as well as through our institute's own social media. The survey remained open for approximately one month. The only two participant inclusion criteria were: 1) respondent must be an engineering degree graduate, and 2) respondent must have completed an undergraduate engineering degree prior to 2013, as we were interested in graduates with at least 10 years of work experience with which to explore their career path trajectory. Given research that has suggested 40 to 50 percent of technical women in STEM leave their careers after only 5 to 7 years [28], the 10 years post graduation requirement for our survey, we believed, would allow us to capture the career experiences of those who have exited engineering.

We conducted our data analysis using SPSS and primarily through chi-squared tests of association to determine whether patterns and relationships between the categorical variables we found in our sample (e.g., race x gender identity and career path) could be generalized to the larger population of engineering graduates in Canada. Where a chi-squared test result (i.e., the omnibus test result) determined a statistically significant association between two variables, we then examined the adjusted standardized residuals for the individual subcategories/cells (e.g., licensed racialized women engineering graduates) to determine if the number of observed cases belonging to that subcategory is disproportionately smaller or larger than expected (adjusted residual < -1.96 or $> +1.96$, respectively) [29].

Participant Characteristics

Our final sample included responses from 982 engineering graduates, consisting of 66 percent white men, 21 percent white women, 9 percent racialized men, and 5 percent racialized women.[3]

[3] Percentages do not add up to 100 because of rounding.

Only 12 percent of our sample consisted of international engineering graduates, and an overwhelming 88 percent were licensed as Professional Engineers. A quick comparison with 2021 Canadian Census data suggested our sample was substantively underrepresented by racialized engineering graduates and overrepresented by those who graduated from a Canadian university. As such, we offer another comparison with a narrower subset of the larger Census population that includes only engineering degree holders trained in Canada. As presented in Table 1., even after removing international graduates for the comparison, our sample remained largely underrepresented by racialized men. In our sample we also saw an overrepresentation of white women as well, which may be attributed to our recruitment efforts through those affiliated with the '30 x 30'campaign, which has a focus on gender but not necessarily in an explicitly intersectional way.

Although there is no official data publicly available for comparison, given that we know many engineering graduates do not become licensed, and even at four years post graduation only around 45 percent of graduates become licensed [6], our sample consisting of 88 percent licensed Professional Engineers was a large overrepresentation of this group; this suggests our sample was likely missing those who have exited engineering completely. These characteristics of our sample are all considerations to keep in mind as readers reflect on our findings below.

Table 1.
Sample Comparison with 2021 Canadian Census Data

	Engineering Graduates		
	Survey Sample	**2021 Census[4]**	**2021 Census (Canadian degree holders only)**
Race and Gender	*N* = 982	*N*=788,085	*N*=413,775
White men	66%	39%	55%
White women	21%	8%	9%
Racialized men	9%	41%	28%
Racialized women	5%	12%	7%
Location of Study			
Canada	87%	53%	100%
Outside of Canada	13%	47%	--
Licensed Professional Engineers	88%	--	--
Median Age Category	46-65 years	45-54 years	35-44 years

Note. 1. Percentages may not add up to 100 because of rounding.
2. The age categories used on the survey were: 29 and under; 30 to 45; 46 to 65; and 66+. The age categories reported by the 2021 Canadian Census of engineering graduates 25 years and over were: 25 to 34; 35 to 44; 45 to 54; 55 to 64; and 65 and over.

[4] The universe for the Census 2021 data comparison consists of all individuals in a private household, 25 years and older, whose highest degree is at the Bachelor level or higher in Engineering; Population estimates are provided using 25% sample data.

Findings

(1) Who gets counted as an "Engineer"?

Our first analysis revealed a significant association between licensure and race x gender of the engineering graduates, χ^2 (3, N=901) = 98.01, p<.001. There was a significantly smaller proportion of racialized engineering graduates who could be legally counted as "Engineers" compared to white engineering graduates. Only 67 percent of racialized women and 70 percent of racialized men in our study were licensed Professional Engineers, while 88 percent of the overall sample was licensed.

Table 2.
Licensed Engineers among Engineering Graduates, by Race and Gender

	Engineering Graduates by Race and Gender				
Licensed as Professional Engineers	Total Sample	Racialized women	Racialized men	White women	White men
% Licensed	88%	**67%**	**70%**	86%	93%
Adjusted residual		-4.5	-5.3	--	--
% Not Licensed	12%	**33%**	**30%**	14%	7%
Adjusted residual		4.5	5.3	--	--

Note. Percentages in bold represent statistically significant results (p<.05)

Since our sample was largely of Canadian degree holders, the underrepresentation of racialized engineering graduates among those licensed cannot be explained away by assumptions of international education credentials.

(2) Engineering Career Path Streaming by Race and Gender

Based on our previous research, which revealed five distinct engineer career paths through career history interviews with 29 engineering graduates [redacted], we presented the five career paths on the survey and asked respondents to identify the one that most reflected their own career trajectory.

As presented on the survey, the career paths were:

a. Technical Specialist (successive technical roles to senior tech specialist)
b. Executive Track (successive managerial roles up the organizational hierarchy)
c. Boundary Spanner (successive lateral managerial roles moving between units)
d. Entrepreneur / Independent consultant (leapt out on my own after university OR after working for another organization)
e. Non-Traditional path (engineering to another discipline – e.g., public policy, education, financial services)

Overall, Technical Specialist was the path chosen by the largest group of respondents (43 percent), reflecting a continued dominance of the "technicist"-centric story of an engineering career. When we disaggregated the five paths by intersectional social identities (race x gender),

what we found was that race x gender was significantly associated with career path, χ^2 (12, N=879) = 48.53, p<.001. For simplicity, we reported in Table 3 only results for race x gender groups where the difference between observed and expected values reached statistical significance to p<.05 (i.e., where adjusted residuals < -1.96 or > +1.96).

Table 3.
Five Engineering Career Paths by Race and Gender

		Engineering Graduates by Race and Gender			
Career Paths	Total Sample	Racialized women	Racialized men	White women	White men
Technical Specialist	43%	--	--	--	--
Executive Track	25%	--	--	--	--
Boundary Spanner	12%	--	--	--	--
Entrepreneur/ Independent Consultant	10%	--	--	5%	12%
Non-Traditional Path	11%	30%	--	17%	6%

Note. All results reported are statistically significant to p<.05

We saw no significant difference in the way race x gender groups were proportionally represented among the Technical Specialists, Boundary Spanners, and (perhaps most hearteningly) those on the Executive Track. For the Entrepreneur path, we saw a disproportionately higher percentage among white men, and a disproportionately lower percentage among white women represented on this path.

For the Non-Traditional path, the one most clearly depicting a move away from engineering, we saw a significant overrepresentation of women, especially racialized women (30 percent of this group on the Non-Traditional path compared to 11 percent of the overall sample). A significantly smaller proportion of white men (6 percent) was represented on this path.

This finding, of a disproportionately high percentage among women engineering graduates on the career path considered furthest away from one with a core engineering focus (i.e., the "technicist"-centric path), was consistent with the extant literature, including our earlier qualitative study [5], except we saw here that race, not just gender, contributed to this pattern. This higher percentage among women on the Non-Traditional path was contributed more so by *racialized* women than white women.

Consistent with these patterns, when we examined for differences in licensure across the five career paths, we again found a significant difference, χ^2 (4, N=936) = 67.44, p<.001, where the path with the greatest proportion of racialized women (i.e., the Non-Traditional Path) had also the smallest proportion of licensed engineers.

Table 4.
Licensure Across Five Career Paths

		Five Engineering Career Paths				
	Total Sample	Technical Specialist	Executive Track	Boundary Spanner	Entrepreneur	Non-Traditional
% Licensed as Professional Engineers	88%	93%	--	--	--	63%

Note. All results reported are statistically significant to p<.05

(3) ***Differences in engineering identity and belonging across career paths, race x gender, and licensure status***

For our last series of analysis, we explored the relationships between perceived sense of engineering identity and belonging, career paths, and licensure.

On the survey, we had asked respondents to rate (i) the centrality of engineering to their professional identity, and (ii) their sense of belonging in engineering. For professional identity, the rating scale ranged from 1 (irrelevant to my professional identity) to 10 (central to my professional identity). For belonging, the scale ranged from 1 (I do not feel like I belong) to 10 (I feel a very strong sense of belonging). For simplicity, we did not operationalize identity or belonging using existing multi-item scales (e.g., [30], [31]), as these concepts were not the primary focus of the research. As such, we allowed the respondents to reflect on identity and belonging from their own perspective with their own understanding of those terms.

For the overall sample, the median score on both those scales were 8 out of 10, demonstrating a strong sense of identity and belonging and perhaps reflecting the nature of our sample (i.e., large majority licensed engineers and those who remained affiliated with engineering in some way in as far as our recruitment strategy allowed us to connect with them).

We created a dichotomous variable with each of the scales using a median split, to determine whether career path was related to the two dichotomous variables, respectively. From the chi-squared analysis, we found that the relationship between identity and career path was statistically significant, χ^2 (4, N=900) = 54.76, p<.001, as was the relationship between belonging and career path, χ^2 (4, N=899) = 32.98, p<.001. In Table 5, we presented only the results for the particular career path where the difference between observed and expected values reached statistical significance.

Table 5.
Identity and Belonging Across Five Engineering Career Paths

		Engineering Graduates by Race and Gender			
	Total Sample	Racialized women	Racialized men	White women	White men
Stronger sense of belonging in engineering (rated 8+)	59%	35%	--	--	62%

Note. All results reported are statistically significant to p<.05

Again, consistent with our earlier qualitative findings and other research literature, we see that the Technical Specialist path had the greatest proportion of graduates with the strongest sense of belonging in engineering and had a more engineering-centric professional identity. Unsurprisingly, the Non-Traditional path had the smallest proportion of engineering graduates with the same strong sense of belonging or engineering-centric professional identity.

When we examined race x gender's respective relationships with professional identity and belonging, we found no significant relationship between race x gender and professional identity, but a significant relationship between race x gender and professional belonging, χ^2 (3, N=866) = 13.38, p<.01. Racialized women in disproportionately smaller numbers, and white men in disproportionately larger numbers, felt that strong sense of belonging in engineering.

Table 6.
Sense of Belonging in Engineering Across Race x Gender

		Five Engineering Career Paths				
	Total Sample	Technical Specialist	Executive Track	Boundary Spanner	Entrepreneur	Non-Traditional
More Engineering-Centric Professional Identity (rated 8+)	75%	84%	--	60%	--	52%
Stronger sense of belonging in engineering (rated 8+)	59%	66%	--	--	--	34%

Note. All results reported are statistically significant to $p<.05$

Considering licensure also as a form of segmentation among engineering graduates, we examined the relationships between licensure and professional identities and belonging, respectively. Again, as expected, chi-squared analysis found both relationships to be statistically significant, χ^2 (1, N=925) = 21.05, $p<.001$, and χ^2 (1, N=924) = 28.60, $p<.001$. More Licensed Professional Engineers had a stronger sense of belonging to the profession and a more engineering-centric professional identity, compared with non-licensed engineering graduates.

Table 7.
Licensure, Engineering Identity, and Belonging

	Licensed Professional Engineer	
	Yes	No
More Engineering-Centric Professional Identity (rated 8+)	77%	56%
Stronger sense of belonging in engineering (rated 8+)	61%	34%

Note. All results reported are statistically significant to $p<.05$

Discussion

By considering race along with gender as part of our analysis, we found evidence of occupational streaming not only by gender, but also by race and intersectionally, by gender x race. Consistent with existing research including our earlier work[5], which explored intraoccupational segregation within engineering—where women are streamed away from "technicist"-centric work, we found a disproportionately higher percentage of women engineering graduates who identified with the Non-Traditional career path. *But more importantly, by disaggregating the data intersectionally, we revealed that racialized women was the group with the highest proportion represented on the Non-Traditional path, even more so than white women, exposing the intersectional dimensions of who may be streamed into this non-"technicist"-centric path*.

Other evidence of segmentation by race included a disproportionately smaller percentage among racialized engineering graduates who indicated they were licensed Professional Engineers. Because of how engineers are legally recognized in Canada, graduates who are not licensed become invisibilized by the profession itself. If racialized graduates in greater proportion are consistently invisibilized by the way the profession is socially constructed, then this warrants further investigation as to what structural forces may be producing these patterns.

Furthermore, our findings reaffirmed some of the research which has suggested that engineers who move away from the "technicist"-centric path have their sense of engineering identity and professional belonging placed at greater risk [2], [16], [26]. In our study, more graduates on the Non-Traditional path (the path adopted more so among racialized women and white women) had less engineering-centric professional identities and a weaker sense of belonging to engineering, compared to other paths. Similarly, engineering graduates who do not become licensed (which was more of the case among racialized engineering graduates), also in greater proportion expressed less engineering-centric professional identities and a weaker sense of belonging to engineering.

Overall, career path stories that are farthest away from the technicist-centric, archetypal, licensed engineering path appeared to be associated with negative implications on engineering identity and professional belonging, and those paths were seemingly more so associated with racialized and women engineering graduates. As such, in the way that the profession is currently configured and regulated, racialized and women engineering graduates in larger proportions are being streamed out of 'engineering proper.'

As Faulkner clearly stated, until engineering as a profession is able to expand its narrow definition of who is an engineer and what engineering practices look like (perhaps beginning from a cultural change from as early as engineering schools), the profession will continue to perpetuate the exclusionary forces acting upon racialized and women engineering graduates [2]. There is no easy prescription to addressing the patterns of career path streaming and possible implications for professional identity and belonging that were evident from this study. However, our findings can help inform equity initiatives across industries and engineering associations going forward. Beyond increasing membership among minoritized groups into the engineering profession, there are occupational and career path stratifications *within* the profession along race and gender lines that need to be addressed. Initiatives that facilitate more equitable entry to any career paths for all engineering graduates, along with dedicated efforts to tracking career path differences over time, are two important areas of focus for advancing more substantive equity, diversity, and inclusion within the profession.

Limitations

Much like our other studies, we faced in this study the same consistent challenge to reach a broader pool of engineering graduates (e.g., those who are not licensed, international graduates). Although we had ample support from a number of sources with our participant recruitment, the large majority of our sample were licensed as P.Eng. (88%). As always, we tried to include voices of all engineering graduates, including those who have exited engineering completely—by choice or otherwise, in our research. Any future research must continue to try to attend to this gap in the existing literature.

Another limitation was that we had to consider gender as a binary construct. Despite attempts to measure it as a spectrum with the survey instrument, there were far too few responses indicating identities outside of cis-gender woman or cis-gender man to have them accounted as unique

identities in the quantitative data analysis. The professional experiences of underrepresented groups may be better explored through qualitative research. Similarly, although we encountered many interesting patterns that we reported in this paper, often a limitation of quantitative research is that we do not get to interrogate the 'how' or the 'why' of the phenomenon under investigation. For example: How did so many racialized women come to pursue the Non-Traditional Engineering career path? Such pertinent questions need to be further pursued with more in-depth qualitative study.

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