WIP : Landscape of faculty involved in engineering education research in Canada

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Mattucci was raised in the traditional territories of the of the Mississaugas of the Credit First Nations, Anishinaabek and Haudenosaunee Peoples (Southwestern Ontario, Canada). He has strong core values around continuous personal improvement, and love for learning. His post-secondary education includes three technical engineering degrees (two mechanical, one biomedical). Mattucci's post-doctoral work shifted to focus on collaborative change management and communities of practice in engineering education at the national level in Canada, before beginning a faculty appointment in 2022 with a teaching focus. Mattucci's favourite courses to teach are engineering design, mechanics (solids), dynamics, and anything related to leadership and professional / transferable skills. His favourite things to do are backcountry camping, and going on adventures with his family.

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Introduction

Engineering education is a relatively new field of study and research in Canada. In recent years, several centers or institutes focused on engineering practice and engineering education have been created, several universities began offering graduate programs in engineering education, and there has been a steadily growing number of faculty (and prospective faculty, such as graduate students and postdoctoral scholars) with interests in engineering education research (EER) [1].

As an emerging field, it is important to understand the context and social realities in which graduate students and faculty involved in EER operate. Sheridan *et al.* described the context of engineering education graduate students in Canada, revealing a largely female demographic (in contrast to traditional engineering programs) and the need for improved funding, peer communities, and interdisciplinary support [2]. Using collaborative inquiry and autoethnography, Strong *et al.* described the context of early-career engineering education faculty in the US as they transitioned into their roles, especially in terms of their experiences with asserting their legitimacy, understanding their expectations, and establishing support networks [3]. A similar autoethnography conducted by Hladik *et al.* had similar findings for pre-tenure EER faculty in Canada [4]. Aslam and Alarcón examined the composition of engineering education faculty in US institutions that offer engineering education programs, identifying their tenure status as well as terminal degree and corresponding disciplinary focus [5].

Inspired by these studies, we sought to understand the broader context of faculty involved in EER in Canada and in particular, to assess the support they receive and the challenges they encounter. This work-in-progress paper reports the results of our first step, which focused on obtaining the landscape of EER faculty.

Methodology

We searched faculty involved in EER in Canada to obtain information about their institution, appointment status (i.e., title or position), terminal degree, and corresponding disciplinary field. Figure 1 illustrates our search process for gathering the information while Table 1 describes our inclusion and exclusion criteria for selecting institutions to examine and faculty to profile.

For the universities included in our study, we analyzed information about faculty available online, e.g., in the Faculty, Directory, People, Personnel, etc. sections of Faculty, School, Department, Institute, or Center webpages. We used the following two criteria to define involvement in EER: (1) research interests stating explicitly EER or keywords from the EER taxonomy [6] and/or (2) publications in engineering education journals and conferences. We did not examine the individual, research group, or lab webpages of faculty as not each faculty member maintains a separate webpage from that of the university. If no information on research interests was available from the university webpage, we simply marked these faculty as having ‘no information’. We also tracked for gender based on name and photo. When in doubt, we used online databases of names; this process is similar to the methodology used by a gender gap tracker for analyzing gender bias in the media [7]. We performed our search and content analysis from July 1 – 24, 2024.

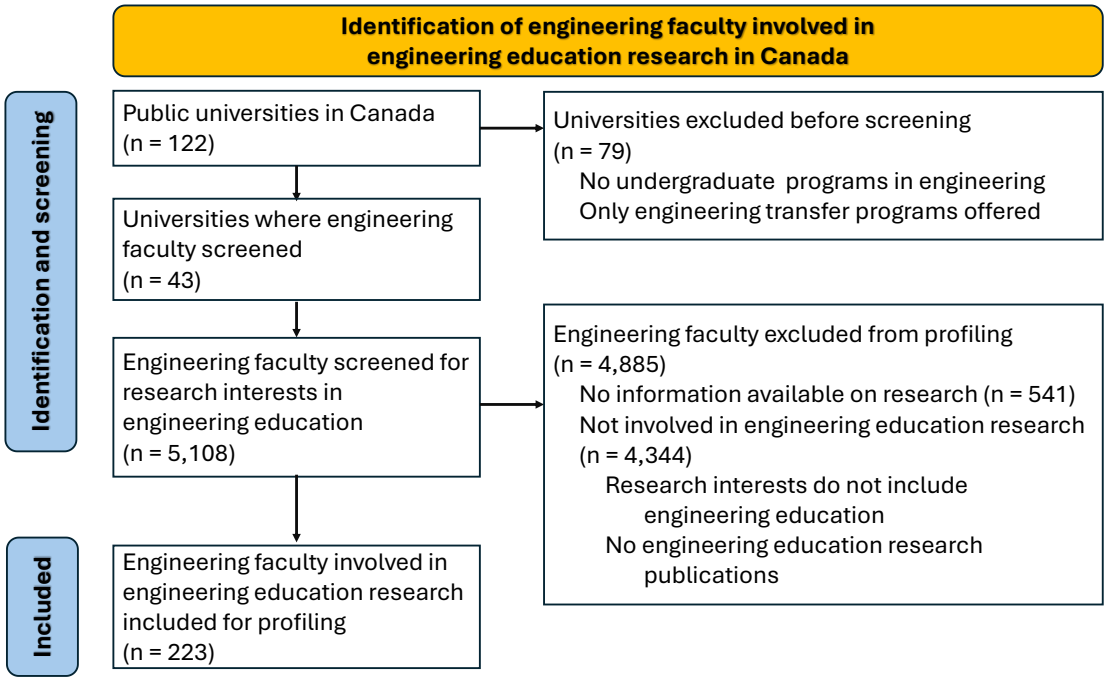

Figure 1. Search process for identifying faculty involved in EER in Canada.

Table 1. Inclusion and exclusion criteria for university and engineering faculty.

	Inclusion	**Exclusion**
University or institution	Offer undergraduate (and possibly graduate) degrees in one or more engineering disciplines	Technical colleges No undergraduate (or graduate) programs in engineering Only transfer programs into engineering programs at other universities
Faculty position	Professor (Assistant / Associate / Full) Professor of Practice Professor of Teaching Lecturer / Senior Lecturer / Faculty Lecturer / Senior Faculty Lecturer Instructor / Senior Instructor	Retired professor Professor emeritus Honorary professor Visiting Professor Cross-appointed members with a primary appointment outside of engineering Course / sessional instructors (i.e., without a continuing appointment) Postdoctoral scholars Research assistants and research associates Part-time or limited term appointments
Involvement in engineering education research	Research interests state explicitly engineering education research or keywords from the engineering education research taxonomy Publications in engineering education journals or conferences	Only focused on teaching with no reference to scholarship of teaching and learning or research

Results and discussion

There are 122 public universities in Canada, of which 43 were included for screening faculty; of the 5,108 faculty that were screened, 223 had research interests in EER and were retained for

profiling. Appendix A lists the 43 universities that were included for screening and the corresponding number of faculty involved in EER. Our results are summarized in Tables 2-4.

Table 2. Faculty involved in EER by province.

Province (number of institutions)	# of faculty (n = 223)	Percentage
Alberta (2)	19	8.5%
British Columbia (3)	35	15.7%
Manitoba (1)	9	4.0%
New Brunswick (2)	3	1.3%
Newfoundland (1)	1	0.4%
Nova Scotia (1)	2	0.9%
Ontario (12)	120	53.8%
Prince Edward Island (1)	5	2.2%
Quebec (4)	21	9.4%
Saskatchewan (2)	8	3.6%

Table 3. Breakdown of faculty involved in EER by title/position and gender.

Rank/position	# of faculty (n = 223)		
	Male	Female	Total
Assistant/Associate/Full Professor	67	37	104
Professor of Teaching	52	42	94
Lecturer/Instructor	16	8	24
Other/Unspecified	0	1	1

The top 5 institutions having the greatest number of faculty involved in EER are the University of Toronto, University of British Columbia, University of Waterloo, York University, and University of Calgary; three of these institutions are from Ontario. Collectively, they account for more than half (113/223 or 50.7%) of faculty involved in EER in Canada. Quebec and the maritime provinces (New Brunswick, Newfoundland, Nova Scotia, and Prince Edward Island) have the lowest number of faculty regionally: 32. Of the 12 universities in Quebec, only 4 have faculty involved in EER, including the two English-speaking institutions, Concordia University and McGill University. The number of Assistant/Associate/Full Professors (104) is approximately equal to the number of Professors of Teaching (94). Interestingly, nearly all of the Professors of Teaching (90) are from the top 5 institutions listed earlier. This may suggest a practice in some institutions where Professors of Teaching are expected to be engaged in education-based research. For other universities, it is not clear whether such a title or position exists, or if EER is considered 'traditional' engineering research. Nevertheless, the results highlight the possibility for differences in institutional (and provincial) priorities and culture. An interesting line of future inquiry could investigate institutional professorial streams, ranks, and terms for tenure and promotion and correlation with EER involvement. Further, these institutions may incentivize education research more broadly, and there may be higher proportions of faculty engaged in Disciplinary-Based Education Research (DBER) beyond just engineering. In terms of gender, 40% of faculty involved in EER are female—nearly double the national average of female engineering faculty members which, in 2020, was less than 20% [8].

In terms of terminal degree, the majority of faculty (179) have PhDs, while 26 have a master's degree, and 1 had only an undergraduate degree; 17 were unspecified or unknown. Table 4 shows the breakdown for the disciplinary focus of the terminal degree and perhaps

unsurprisingly, 'engineering and computer science' was the most frequent. Only 3 faculty indicated having a terminal degree in engineering education, though 96 are unknown. Anecdotally, the 'traditional' pathway in Canada appears to be one where faculty transition to EER following research programs in their technical domain.

Table 4. Disciplinary focus of terminal degrees for faculty involved in EER.

Disciplinary focus	# of faculty (n = 223)
Engineering (e.g., traditional engineering disciplines or discipline not specified) and computer science	91
Physical, natural, and health sciences	11
Humanities and social science	3
Engineering Education	3
Education	9
Other: architecture (5), technical communications (1), neuroscience (2), management science (1), and development studies (1)	10
Unspecified	96

Limitations

There are some limitations with our landscape. First, our content analysis may not have captured all faculty involved in EER as there were many for whom no information was available and there may be faculty that are engaged in EER even if this is not listed explicitly as part of their research. Second, there may not be a common nomenclature with regards to the use of 'Professor' vs. 'Professor of Teaching'. Finally, online databases for gender identification have their own limitations and more importantly, make use of a binary gender selection. These latter two limitations may result in faculty being incorrectly profiled.

Future Work

Our landscape scan has led us to more specific social realities and questions for further investigation, including (but not limited to) the following:

1. Are the regional differences for the number of faculty involved in EER due to institutional and/or provincial priorities and culture? Do institutions that have more faculty involved in EER offer a different type of support structure to help them be successful?
2. What challenges do faculty face, what support have they received, and what kind of support do they require?

Moreover, we are aware of colleagues who are engaged in EER who were not screened as the information available from their webpages did not meet the selection criteria. It will be interesting to understand the reasons (if any) why this subpopulation could not be selected. Our next step is to conduct a national survey where we will also seek to clarify the lack of a common nomenclature with respect to title or position. However, it is possible that the response rate to the national survey may be limited. An alternative is to contact explicitly the faculty identified in our landscape though we may then miss important information from those that were not identified / profiled. We hope that our process will be useful for helping others conduct similar studies in countries where engineering education is emerging as a field of study and research in order to identify more specific questions and topics of exploration that will allow us to better understand the social reality of EER faculty.

References

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Appendix A: List of public universities in Canada offering undergraduate degrees in engineering

Province	Institution	# faculty involved in EER
Alberta	University of Calgary	2
	University of Alberta	17
British Columbia	Simon Fraser University	2
	Thomson Rivers University	0
	University of British Columbia	29
	University of Victoria	4
	University of Northern British Columbia	0
Manitoba	University of Manitoba	9
New Brunswick	University of Moncton	1
	University of New Brunswick	2
Newfoundland	Memorial University of Newfoundland	1
Nova Scotia	Dalhousie University	2
Ontario	Brock University	0
	Carleton University	1
	Lakehead University	0
	Laurentian University	0
	McMaster University	8
	Ontario Tech University	2
	Queen's University	7
	Royal Military College	0
	Toronto Metropolitan University	9
	University of Guelph	3
	University of Ottawa	11
	University of Toronto	30
	University of Waterloo	19
	University of Western Ontario	7
	University of Windsor	5
	York University	18
Prince Edward Island	University of Prince Edward Island	5
Quebec	Concordia University	2
	École de Technologie Supérieure	0
	McGill University	2
	École Polytechnique de Montréal	14
	Université du Québec en Abitibi-Témiscamingue	0
	Université du Québec en Outaouais	0
	Université du Québec à Chicoutimi	0
	Université du Québec à Montréal	0
	Université du Québec à Rimouski	0
	Université du Québec à Trois-Rivières	0
	Université Laval	0
	Université de Sherbrooke	3
Saskatchewan	University of Regina	2
	University of Saskatchewan	6