Interpreting immigrant engineers' professional integration as a process of identity development in engineering

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ABSTRACT: Internationally-Educated Engineers (IEEs) are recent immigrants to Canada who hold engineering credentials obtained in their home country and who seek to re-establish their engineering careers in Canada. This work uses Gee's identity theory as a framework to interpret the professional integration elements of IEEs as they pursue qualifications recognition. The work draws on data from a longitudinal, mixed-methods study that examined four cohorts of IEEs participating in a qualifications recognition programme at the University of Manitoba, Canada. The data provided evidence that IEEs' professional integration can be interpreted as the development of Gee's multiple aspects of identity, including institution identity manifest in professional licensure, job roles, and salary, and discourse identity and affinity identity that relate to the attributes expected of individual engineers within the character of the overall engineering profession in Canada. IEEs developed an understanding of the social role of the engineering identity in North America, including the priority of the public welfare and engineering ethics in engineering work.

INTRODUCTION

Much of Canada's labour force growth relies on immigration, and skilled professionals are preferentially recruited for immigration to address labour market needs in many professions, including engineering. This has led to an increase in immigration to Canada overall over the last ten years, and to an increase in the number of immigrants holding foreign engineering credentials and seeking formal recognition (licensing) with the regulatory body for engineering in a given jurisdiction. Hereafter denoted as internationally-educated engineers (IEEs), these newcomers to Canada are individuals who hold engineering qualifications (a university degree, professional experience) from another country, who have recently immigrated to Canada, and who are seeking to re-establish their engineering careers in their newly-adopted country.

Much anecdotal evidence exists relative to the professional integration challenges faced by IEEs upon immigration, and formal studies confirm that IEEs' challenges include achieving formal licensing as a Professional Engineer (PEng, a legal requirement to practice professional engineering in Canada), finding career-related employment at a level commensurate with qualifications and, subsequently, experiencing progressive career development [1-3].

A body of literature speaks to the underutilisation of human capital when highly skilled immigrants are not able to apply their qualifications to their full potential in their newly-adopted country [4][5], and these challenges are often attributed to gatekeeping functions of professional regulatory bodies [6]. Much of the human capital research focuses on the value of formal credentials, and the *transition penalties* incurred by IEEs and other internationally-educated professionals, such as delays in achieving formal recognition and regaining formerly held job titles, job roles and salaries when credentials are not recognised in a timely manner. Other research has extended the dialogue to acknowledge that professional integration requires time for IEEs to achieve cultural fluency, including an understanding of the practices and values of the North American engineering profession, and the language and communication fluency necessary to effectively perform the scope of responsibilities and advance as a professional engineer [7].

This article uses Gee's identity theory as a framework to interpret the professional integration elements of IEEs, positing that IEEs' professional integration can be viewed as the process of developing multiple dimensions of professional engineering identity in a new context (in this case, the Canadian engineering profession). While IEEs hold credentials, experiences and personal assets that constitute a full professional qualification and professional identity in the jurisdiction of their home country, the IEE is faced with the task of adapting or re-developing these qualifications and identity in their newly-adopted country. While the research is situated within the context of foreign immigration to Canada, it is relevant to a global situation of increasing international mobility and migration afforded by the Washington Accord and Bologna Process, and increasing cultural diversity in the engineering profession. Further, the

theoretical frameworks presented in the next sections are widely relevant to educational and professional situations beyond the context of the current work.

LITERATURE REVIEW

Development of Engineering Identity

Professional identity in engineering is acknowledged to be an underexplored area of research, perhaps because it is considered difficult to study and characterise [8-10]. The notion of *identity* is variably characterised as one or more of the following: what is an engineer in practice? How do engineers see themselves or think of themselves? How does an engineer experience their job? How does an engineer understand what they know, do not know, and do not try to know? [8].

Research that explores the nature of professional engineering practice contains glimpses of exploring engineering identity [8-10]. Where the concept of *identity* is included in the literature on professional practice, it is characterised as having both internal (cognitive) components and external (social) components. Identity is said to be personally expressed, earned through practice and bestowed by the community. Once granted, the community acknowledges competence and expects *ways of doing* that are inherent to that identity [8]. Anderson et al claim identity to be the result of both individual choices, as well as one's level of inclusion in the social category of engineer. This characterisation acknowledges both personal agency involved in striving for and achieving identity, as well as the social processes inherent in identity development, where norms and practices of the profession play a dominant role in allowing one to recognise who belongs to the identity and who does not.

Practicing engineers have indicated that up to two-thirds of the knowledge they use in practice is practice-generated [10]. They conceive knowledge not as *knowing what* but rather as *knowing how*. This knowledge is context-specific and is both built and demonstrated through participation in social practice. Furthermore, practicing engineers have identified that nuanced communication tasks and the coordination of others - often in the absence of formal authority - is one of the most important skills within their work. The norms, practices and traditions that define appropriate expressions of *knowing how,* communication and coordination are all culture-specific. The view of professional engineering practice as a social endeavour developed through social practice implies that the IEE's task of developing a professional identity in a newly adopted country has significant cultural dimensions.

A slightly more overt focus on identity development is found in research directed toward undergraduate engineering students, which examines identity development in undergraduate students in the context of specific courses or curricular experiences [11-14]. These studies often use textual analysis to examine student experiences as documented in course portfolios, design journals and similar artefacts - at times combined with observations and interviews - to extract how students see themselves in engineering.

IEEs' Professional Integration

No studies that explored IEEs' professional integration as a process of identity development were identified. Recent studies that explore IEE's professional integration do so descriptively or narratively through a framework of social and cultural capital or through a framework of cultural fluency.

Definitions of social capital centre on the idea that social networks have value and represent opportunity to its members. Social capital is the accumulation of resources based on, firstly, access to, and secondly, inclusion and participation in social groups [15][16] whose resources may include information, support, status and relationships of influence that enhances an individual's access to, and success in, employment and economic mobility [17]. Research exploring social and cultural capital development in IEEs has concluded that access to an engineering workplace - particularly through facilitated internships or co-op experiences - is a significant form of social capital [18], which further facilitated opportunities for IEEs to develop professional relationships and to observe the mechanisms of social influence and mobility in the workplace.

Cultural capital is defined as a set of cultural competencies and *cultural resources that are, first, institutionalized and, second, broadly understood to be prestigious* [19], where an institution (e.g. university, state) confers and guarantees the legitimacy, value and prestige of the cultural artefact. Cultural capital is a mechanism of power and a major factor in social and economic mobility. Cultural capital can exist in various states, encompassing linguistic capital manifested in mastery of language (subtleties of accent, grammar, spelling and style), as well as an understanding of the tacitly understood norms of professional communication such as written letters and email, interacting with colleagues and supervisors, communicating to clients and navigating conflict situations. Cultural capital also exists in an institutionalised state, often understood as credentials that are recognised as signifying some level of cultural competence on the part of the individual who possesses the credential. In the engineering profession, the PEng license conferred by the regulator is institutionalised cultural capital, symbolic of advantage including enhanced employability, mobility and status within the engineering profession. It also serves as an institutionally-validated guarantee of a set of engineering competencies.

Although IEEs may have well-established social and cultural capital in their home countries, they typically lack this capital in their new surroundings, as it depends on access to the professional community and on cultural fluency to understand the network's purpose, resources and tacit expectations of participants. Social and cultural capital are posited to be a critical factor in IEEs' successful professional integration [6][18].

Other studies explore IEEs' professional integration through Laroche's framework of cultural fluency in various cultural dimensions, including power distance and the continua of individualism - collectivism, risk tolerance - risk aversion and high context - low context [20]. These cultural dimensions are played out in constant and innumerable tasks and interactions of professional engineering practice. Concepts of what constitutes a productive meeting or a persuasive email, the correct amount and nature of data needed to move forward on decisions, and appropriate interactions with colleagues at the same and other levels of the organisation are all determined by distinctly (in this context) Canadian expectations of what constitutes appropriate professional behaviour in the engineering profession.

Canada and the United States are generally considered environments of low power distance, high individualism, risk tolerance and low context. The majority of Canada's immigrants come from countries of significantly higher power distance, high collectivism, risk aversion and high context. Because cultural expectations differ on these continua, expectations and behaviours that are highly appropriate in one cultural context may be interpreted as highly inappropriate, unprofessional or incompetent in the North American context. The IEEs' task is to understand where they fit on each cultural dimension, where the predominant North American expectations lie on each dimension, and how to adjust their practices and values to enact this transition [7].

Summary

Prior research has explored engineering identity development in undergraduate engineering students, engineering identity characterisations in practicing engineers, and IEEs' professional integration as processes of social and cultural capital building and developing cultural fluency. However, this work derives novelty by using *identity* as a lens through which to interpret IEEs' integration into the engineering profession in their newly adopted country.

INTERPRETIVE FRAMEWORK

Gee's identity types are used as a framework by which to interpret the data in this work [21]. Gee discusses four perspectives on identity: nature-identity (N-identity, a state), institution-identity (I-identity, a position), discourse identity (D-identity, an individual trait), and affinity-identity (A-identity, experiences). An individual holds an identity - and often more than one - in all four domains, such as being a twin (N-identity), a professor (I-identity), an extrovert (D-identity), and a Starbucks Coffee fan (A-identity).

An N-identity is determined by nature. For example, being a Latin-American woman is an N-identity. While the N-identity is determined by nature, its perceived importance, value or advantage (or opposite) arises through societal recognition and ascriptions. Corporately, people agree (or disagree) that a given N-identity, such as being a twin, being a woman, being Chinese or being someone with a disability is important or not. In engineering, being an identifiable newcomer on the basis of ethnic background, language fluency or accent are N-identities. The label of being an internationally-educated engineer is similarly a partial N-identity.

While the N-identity is initially determined by nature and, then, subsequently shaped by socio-cultural forces, Gee proposes that the other three identities are much more directly defined and subsequently validated or legitimised by institutional and social forces and their associated laws, rules and traditions. While the author may claim to be a professor in their own mind, this I-identity is only acknowledged by those around them when an institutional authority has agreed, recognised and conferred this I-identity on the author. Yet, there is a significant opportunity for individual agency in the cultivation and pursuit of specific I-identities. Formal registration as a PEng with the engineering regulatory body is an I-identity that IEEs work to achieve. Similarly, being recognised as a fellow professional engineer as demonstrated by credentials and career position is an I-identity that IEEs strive for. While there are formal pathways for IEEs to pursue these identities, their ultimate recognition is nonetheless negotiated with the regulatory body and with the practice community through the values and criteria that the latter parties reflect in their decisions to grant access.

Like I-identities, D-identities may also be ascribed or achieved, allowing individuals to attempt to fashion themselves in a certain way. Yet where I-identities are validated by the norms, traditions and rules of an institution, D-identities arise through dialogue and discourse with others. Others may identify the author as extroverted, or analytical, or socially liberal.

The extent to which the author welcomes this D-identity or that this D-identity garners favourable reactions from others and facilitates personal goals, it may lead to a somewhat a self-fulfilling prophecy. Cultural values and practices that are derived from IEEs' individual positions on Laroche's cultural dimensions can be disguised as individual traits of D-identity [20]. For example, differences in practices that are derived from differences in power distance expectations can look like D-identities of being a self-starter or a *slacker*. Differences in practices derived from differences in individualism–collectivism orientations can look like D-identities of being a strong team player or a meddler.

Finally, Gee describes an A-identity as derived from participation in, and affiliation with, a set of distinctive shared social practices or experiences with others of the same A-identity. Being a Trekkie, a devoted Starbucks Coffee customer or a goth teen are all A-identities. In an A-identity, the allegiance is primarily to a set of common practices or experiences and secondly to others with the same A-identity. Increasingly, businesses attempt to foster brand loyalty by creating the opportunity for an A-identity with their product or brand. A-identities may be more difficult to identity overtly relative to IEEs and the engineering profession.

Identities are not mutually exclusive, in that people hold multiple identities in each of the four domains and hold identities in all four domains simultaneously. Gee's perspectives on identity and Bourdieu and others' conceptions of social and cultural capital come together in the recognition in the ways that identity and capital are socially negotiated and in the recognition of the powerful role of institutions in affording and legitimising identity and capital to an individual. This is done by recognising certain identities and not others - or by *deciding what counts* in order to be associated with a particular identity. Identities and capital are all directly and indirectly sourced through access to an institutional body, legitimised by an institutional body or rely on socially negotiated interpretations of the identity's value or importance. While individuals have agency to accept, propose, contest and construct their identities, Gee asserts that the critical issue is always *how and by whom a particular identity will be recognised* [21].

SETTING AND METHOD

The present work draws from data from a longitudinal, mixed-methods study exploring the perceptions and experiences of four cohorts of IEEs and employers of IEEs who participated in the Internationally-Educated Engineers Qualification Program at the University of Manitoba, Canada (IEEQ) [7]. In that study, the experiences of four cohorts of IEEs (n = 40) and the experiences of employers of IEEs (n = 10) were explored through multiple focus groups [22] and surveys [23]. This present work draws on the data collected from the IEEs in the study.

The IEEQ Program is a qualifications recognition programme developed specifically for internationally-educated engineers to obtain the recognition required to practice engineering in Canada. IEEQ is comprised of one to two academic years of senior-level engineering courses to confirm technical competency in the respective engineering discipline and an engineering internship to gain Canadian professional experience and to begin to build a professional network. The programme includes explicit curriculum on cultural fluency, communication development and professional networking opportunities. The outcomes of the IEEQ Program include a professional credential (the first licensing stage with the provincial regulatory body) and an academic credential (a post-baccalaureate diploma in engineering).

IEEs in this study were representative of IEEs in the IEEQ Program and the general IEE population in the province of Manitoba. They are typically 30-50 years old and have immigrated to Canada one to three years prior to enrolling in the IEEQ Program. All hold an undergraduate degree in engineering from their home country, spanning civil, electrical, computer, mechanical and manufacturing engineering disciplines. Most had significant professional experience in their home country prior to immigration. Approximately 75% are male. A total of 20 source countries were represented in the study and the top source countries of IEEs in this study are (in descending order) India, Argentina, Pakistan, China and Colombia.

Upon human ethics approval of the research protocol, four IEE cohorts participated in two focus groups each: at the completion of their IEEQ Program participation and at two-to-four years after their IEEQ Program participation. The focus groups were designed to collect qualitative data on IEEs' perceptions of the availability of, and their involvement in, the major components of the programme (academics, internship, cultural training, mentoring and networking), their perceptions and experiences of career development post-IEEQ, and their perceptions and experiences of engineering knowledge and skill gaps that IEEs need to bridge. Each of the four IEE cohorts also completed survey questionnaires at one and at two years after the IEEQ Program participation.

The questionnaires were designed to collect quantitative data on licensing and employment measures after completion of the IEEQ Program, as well as qualitative data on participants' perceptions and experiences on the availability of, and their involvement in, the internship experiences component of the programme and their subsequent career development post-IEEQ. Quantitative data analysis was limited to descriptive statistics (means, measures of range) due to the number of respondents. Qualitative data from focus groups and questionnaires formed the bulk of the data set and were analysed according to qualitative norms [24].

FINDINGS AND DISCUSSION

The findings presented here are situated directly and extensively in the data from participants, with representative quotations of participants providing evidence from within the rich data set. While participants were never asked about *identity* directly, the data were interpreted through Gee's framework to illuminate aspects of identity with which IEEs are contending and which they are developing through their experience of immigration and professional integration into the Canadian engineering profession.

Broad Perspectives

IEEs noted similarities in their experiences and conceptions of professional engineering to the Canadian environment, focussed on engineering's technical core. An Asian civil engineer noted, *Technically, there are not too many differences between the industrial environments I came from. The difference is here we can afford the latest technology, which is extremely motivating to keep my engineering abilities technologically updated*, while others echoed, *the engineering is not different* and *the technical work is comparable to my home country*. This realisation was often expressed with an undertone of relief, as in one comment that *the most enlightening conclusion was the lesson that engineering and logic transcend borders*.

Despite the similarities, IEEs noted differences in the nature of professional engineering practice that transcended the technical requirements and knowledge. An Asian engineer commented, *the logic doesn't change, just the perspective changes*, while a Central American engineer agreed that *you not only have to have technical skills, you have to think broader. Engineering in Canada is a big responsibility* […] *In our country, we were strictly technical people*.

The difference that IEEs noted between their past experiences and conceptions of engineering and the practice of professional engineering in Canada ranged from structural features of the profession to conceptions of the role of an engineer. Participants noted differences in *what makes an engineer - the university degree vs. the licensing process. The* [regulatory body's role] *is hard to understand because for many of us, there is no similar context from the home country*. A South American engineer noted, *in Canada, the regulatory standards are much higher - for example, the right to call yourself an engineer*, alluding to the reality that in many parts of the world, the university degree alone confers right-to-title and right-to-practice. Participants noted differences in the day-to-day practice of the profession. A South American manufacturing engineer remarked that *understanding what goes on in an engineering department, it was a shock that took me 1-1/2 to 2 years to feel comfortable* and an electrical engineer commented, *in my home country, there would be a larger stratification between the trades and the professions. In Canada, the trades are very important, and the engineers are a little more important but not much!*

Participants repeatedly and unanimously noted the priority of the public interest and the public welfare, safety, social responsibilities and professional ethics in the Canadian engineering profession, relative to their past experiences of being an engineer in their home countries: *In Canada, there is a social responsibility in the profession that is not present in my home country*, and *it is different than I knew it before: responsibility to clients, environment, and society - in a positive way*. An Asian electrical engineer reflected, *the idea, conception I had before of what being an engineer means, the values, I felt I really learned in the* [IEEQ] *programme*. These concrete observations in the data can be interpreted within the framework of multiple dimensions of identity and identity development, and this is explored in more detail in the following sections for each of Gee's dimensions individually.

Overall, the data held repeated references to a process of learning and change that IEEs had undergone in their professional integration during and after their IEEQ participation. Participants remarked, *what I found so striking were so many different perspectives on the same issue, all within our class* and *I really learned how big the differences are;* [IEEQ] *opened our eyes and our mind*. A South American engineer stated *I have learned a lot, had people that I could follow*, and there was near-unanimous agreement that *our thinking has been changed*.

Further, IEEs recognised that changes they achieved in their perspectives and practices of a professional engineer were not only subject to self-evaluation but subject to external evaluation as well. A South American engineer remarked, *In Canada, you have to prove yourself. It's not a given* and an Asian engineer concurred that *the marketplace, expectations of engineering, they become the rules of the game*. Another IEE commented, *IEEQ was a place to learn about Canadian engineering as reflected in the university. It gave us a safe place to try things and see how they turn out*. These reflections resonate with Gee's assertion that the multiple aspects of identity are all, to some degree, legitimised or validated by external interaction and the ultimate decisions of other individuals, groups and organisations. These data suggest that the IEEs in this study were highly aware of this reality.

Contending with I-Identity Development

A primary objective of the IEEQ Program is to facilitate formal recognition of foreign credentials, resulting in licensing with the engineering regulatory body and a post-baccalaureate diploma from the University. These objectives relate to facilitating I-identities in IEEs: a professional recognition validated by an institution. Besides professional licensing, the aspects of I-identity may include general recognition as a professional engineer from within the profession itself, evidenced by markers, such as job title, position, responsibilities and salary. The quantitative data collected through post-programme surveys identified outcomes in employment measures of IEEs in the study.

The data revealed outcomes indicative of formal engineering recognition in the form of professional employment and registration with the jurisdiction's regulatory body for engineering, the Association of Professional Engineers & Geoscientists of Manitoba (APEGM). In the Canadian regulatory framework, Engineer-in-Training (EIT) is the first licensing stage, obtained upon completion of an accredited undergraduate engineering degree. Upon four years'

professional experience and completion of a national ethics and law examination, the full Professional Engineer (PEng) licensure stage is achieved.

Table 1: Employment and licensing outcomes of IEE respondents.

	9 mths post-IEEQ	24 mths post-IEEQ
Licensing status of respondents		
Registered as Engineer-in-Training (EIT)	100%	48%
Registered as Professional Engineer (PEng)	0%	52%
Self-reported activities of respondents[1]		
Engineering employment	76%	76%
Engineering-related employment	10%	20%
Graduate studies in engineering	5%	15%
Unemployed	10%	0%
Other[2]	5%	0%
% who answered *yes* to the question: Are you currently doing your preferred activity?	85%	90%
Self-reported salary outcomes of employed respondents		
Average salary, $/year	46,787	55,175
Range, $/year	33,150-64,000	34,000-72,500
Standard deviation, $/year	9,200	12,700
Self-assessed employment classification of employed respondents[3]		
Duties: mean score/response range[4]/available range[5]	2.4/1-5/1-8	3.0/1.5-5/1-8
Recommendations, decisions and commitments: mean score/response range/available range	3.3/2-7/1-8	3.6/1.5-5/1-8
Supervision received: mean score/response range/available range	3.5/2-6/1-8	3.7/2-5.5/1-8
Leadership authority and supervision exercised: mean score/response range/available range	2.4/1-4/1-9	3.2/1-5/1-9

1. Percentages add to greater than 100%, since some participants are attending university while also holding employment.
2. Other employment; college/university studies in a non-engineering field; care-giving duties, etc.
3. APEGM Professional Engineering Employment Classification Rating Guide, available http://apegm.mb.ca/SalarySurvey_Index.html
4. Range of scores noted in respondents' data.
5. Range available for this parameter in the APEGM Professional Engineering Employment Classification Rating Guide.

When compared to salaries of APEGM members as reported in the annual APEGM salary surveys, the salaries of IEE respondents in this study at 9 months post-IEEQ were noted to be comparable to EIT members of APEGM of the same university graduation year as the year of IEEQ completion. The salaries of IEE respondents in this study at 24 months post-IEEQ were noted to have made considerable gains relative to EIT members of APEGM of the same university graduation year as the year of IEEQ completion. While this implies IEEs' rapid career progression potential, in neither case did the IEEs' salaries reflect the salaries of APEGM members with the same number of years' total experience, when IEEs' graduation year from their original engineering degree and IEEs' professional experience prior to immigration to Canada were considered.

Similarly, the nature of IEEs' employment as reflected in the self-reported employment classification is generally comparable to that of EITs or early-career engineers, despite IEEs having varying years of engineering experience in their home countries prior to immigration to Canada, including at times senior supervisory roles. However, these data cannot be used to evaluate whether these outcomes indicate the full capability of IEEs' professional contributions at a given point in time, whether IEEs are being underutilised in the profession and whether there are any other limiting factors that influence these outcomes. Nonetheless, the data suggest that IEEs' I-identity in the Canadian engineering profession is being developed relative to timely licensing outcomes and progressive professional employment achievements. As one IEE remarked, *IEEQ offers a reasonable pathway to the PEng license*.

The qualitative narrative further suggests the development of an I-identity in the Canadian engineering profession. A Central European electrical engineer described his post-IEEQ employment, saying that his initial role was primarily design and transitioned to progressively complex work, as well as more project management and leadership on some projects. While IEEs identified design as their primary engineering role to date, other employment descriptors that arose frequently in the data included contract administration and simple project management. Consistent with the quantitative

data, IEEs recognised the early-career nature of their roles and they nonetheless expressed satisfaction at their current employment, commenting that *I am happy with the point where I am* and *I have gained a lot*. They considered their roles to be *very much an engineering role* and *100% engineering*.

Particularly in the focus group data gathered 24 months or longer past IEEQ completion, this satisfaction appeared to be rooted in a thoughtful reflection of their experiences of integration. When asked whether their career expectations were being met, one Central European electrical engineer laughed as he commented that *my expectations were met, but I don't remember what my expectation was. I am satisfied, I learned to be satisfied with my situation*. From this retrospective position, another Central European electrical engineer commented, *I am much better off today than I was in my home country*, echoed by others IEEs, including an Asian civil engineer who agreed that *overall, we achieved much more in this short period of time than we personally thought possible*.

IEEs unanimously considered three to five years after immigration as the minimum realistic timeframe within which to experience developments and progress in licensing and career developments, while one commented *when I moved, a friend talked about 10 years* [to regain professional status]. *I didn't think it would be that way, but it was. It did take long* […] *but I would say that I am satisfied with the position I am in, and the life I have*. IEEs acknowledged the different emotions that needed to be confronted along the way, including disappointment and confusion: *I had to do things here* [employment-related] *that I didn't do in my home country* and *there is a huge effect on morale when you cannot get back into a profession, cannot regain your status right away*, while at the same time repeatedly acknowledging that through the process, *our thinking has been changed*, *doors were opened*, and *I learned the importance of engineering in society, the values, what it means to be an engineer* [20].

Contending with D-Identity and A-Identity Development

The changes and learning to which IEEs referred can be interpreted as the development of D-identity and A-identity in the Canadian engineering profession. While Gee's characterisation of D-identity refers to an individual trait (e.g. being outgoing, being analytical, being lazy), in this context, it is conceptualised as a *professional personality*, or the set of characteristics and traits that are expected of an individual who is presenting themselves as a professional engineer. IEEs' responses contained numerous references to culture, learning the engineering culture and the Canadian culture, and navigating cultural differences.

Here, D-identity was interpreted to include the development of cultural fluency or *ways of being* a Canadian professional engineer. While different cultural practices are often superficially and improperly interpreted as personality traits, cultural fluency nonetheless does lead an individual to adapt their individual practices and actions in order to adapt to the mainstream society. In this way, D-identity elements are developed that are subsequently affirmed and encouraged or alternately rejected and discouraged via discourse with others.

A South American computer engineer reflected on his interpretation of the expectations of an engineer in Canada:

> *A few things in Canada got my attention, helped me understand the engineering role. One, I applied for a mortgage and was approved for $400,000. When I asked* why did you give me so much money, *he said,* because you are an engineer. The rate of repayment is over 99%. *Two, signatures on my passport applications for my family had to be someone you can trust, someone you can believe. Engineers were on that list.*

When asked to reflect on their current understanding of the role of a professional engineer in Canada, others echoed themes of reliability, responsibility and trust. Their responses also highlighted ways in which they noted differences in the expectations of an individual engineer in Canada compared to an engineer in their home countries. One such difference was noted in the role of safety in engineering work: *you don't compromise safety here*. A Central American civil engineer commented, *In Canada, the engineer takes more responsibility. At home, we do try our best, but there are no big consequences if otherwise. For example, I can't imagine an engineer in my home country going to court because a bridge collapsed*. Others confirmed, *In Canada, I learned that the public safety is the highest priority* and *In Canada, when engineering for safety or for economy, economy is secondary*.

A variety of other differences in expectations and the individual's approach to their engineering work were also noted. These included communication skills, with a near-unanimous affirmation of one IEE's comment that *there is a greater emphasis in Canada on developing good communication skills than in the home country*. IEEs noted differences in the individual initiative in career planning, with a South American mechanical engineer saying,

> *I come from a place where you don't plan your career. To me, that is a very North American approach. The culture, the reality of economic instability in my home country, questionable justice, and high tolerance for corruption just doesn't allow you to plan long-term.*

Risk orientation was identified, with an Asian engineer stating, *we come from countries with less regulation and control, so we tend to be able to take more risks in the home country than a professional engineer can in Canada*, while another commented:

> *The decision-making processes are different. In my home country, you are often burdened with lack of resources, so you improvise. Here you cannot improvise, and you have to learn that very quickly. It is a matter of going with your gut, vs. taking a systematic analytical approach.*

Finally, professional image was identified as a personal quality in which expectations differed from the home country: *when working on the shop floor with non-engineers, they apply different standards, high standards to you, and you notice right away, standards on how you communicate and how you make decisions*. All of these data pointed to an emerging understanding of the personal characteristics expected of a professional engineer in Canada, as summarised in the very representative comment from one individual that *I really learned the meaning of being an engineer, the role in society, responsibilities, and ethical obligations.*

These data support an interpretation of D-identity development, but can also be interpreted as aspects of A-identity development or the shared practices that characterise being an engineer within the profession. In this case, *affinity practices* were interpreted to include shared patterns and habits of actions, as well as thought or perspective in the engineering profession. This interpretation also deviated from Gee in that affinity to the group is considered as significant to the identity as affinity to the practices alone. In many cases, a delineation between A-identity and D-identity was difficult to establish in interpreting the data. Together, they can be viewed as the development of a personal identity as an engineer (D-identity) aligned with the profession's identity in society (A-identity).

A South American manufacturing engineer shared his reflections of differences and adaptation:

> *The* [IEEQ Program internship experience] *has been extremely educational in terms of fitting into the Canadian social environment at the workplace: from coming five to ten minutes early, to saying just* morning *instead of* good morning, *or simply being a member of the employees'* social club.
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> *Regarding the technical experience itself, I would say that what I believe is the Canadian way of life: discipline and respect are the most exerted actions, therefore a procedure, a* frame, *legislation - rules and punishments - have to be made first, then everybody knows what to respond to. My background is from a country where things change at an incredible pace, where we are ready for immediate changes, while here, I started to understand the importance and benefits of having a procedure: methodologically repeating steps that proved to be successful.*
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> *Advantages? Because everything is documented, there are easier ways to investigate past design documents or past research, and it creates a common language within the company that everyone understands. The procedure is* safe. *Disadvantages? The process is not elastic; things that are different become difficult to be categorised and put into the process, changes are really slow*.
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> *To understand how I see the influence of this idea in the engineering profession itself,* the procedure *becomes the whole frame in which an engineer in Canada does his or her engineering work: the way he or she approaches a solution, the way the design is initiated, the way the drawings are done, and the way the ideas are exchanged. There is not too much creativity or out-of-the-box thoughts, but things are made* in the language *and it is absolutely useful for the company's goal and society's safety*.
>
> *If I have to balance my work experience, I would say that I learned many things that are not in any book yet they impact my performance and position within the company.*

These reflections can be interpreted as the IEE's emerging development of D-identity and A-identity as an individual engineer within the shared practices and perspectives that characterised both a Canadian engineer and the Canadian engineering profession, respectively. Other IEEs' responses highlighted the priority given to ethical conduct, public interest and welfare, and safety in engineering work, both as an individual commitment and as a characteristic of the profession. One IEE observed, *...in my home country, my personal reputation is at stake, but in Canada, this reputation extends to the organisation and to the public*.

Contending with N-Identity Development

The data also contained numerous references by IEEs to their language and communication competencies as an engineer. IEEs unanimously agreed that the greatest barrier to feeling confident as an engineer in Canada is the language barrier - being fluent in conversational and technical vocabulary, grammar and syntax, and being comfortable in the Canadian expectations in leading conversations, small-group discussions, achieving the correct tone in email and letters, and other communication competencies. One IEE commented, *back home, the role of the engineer did not include the extent and variety of communication expected here of professional engineers*, which received near-unanimous affirmation from other IEEs in the focus group interview. A Central American engineer commented that *it took a good two years* [in the workplace] *for me to feel comfortable communicating*, while another IEE commented:

It took some time before my colleagues took what I said as being valid. Especially at the beginning when it is difficult to express yourself, make your points with good language, strength, and then others think, ah, whatever... *It is not necessary prejudice, but ignorance of the unknown*.

A South American engineer agreed that *my frustration is still the language issues. For example, when I write a business letter, I can't guarantee that it doesn't have a mistake, and I hate that*.

While most participants agreed that the engineering profession in Canada carried a *social role* (responsibility and priority of the public interest and welfare, codified in the regulatory framework and the engineering code of ethics), one Asian civil engineer offered insights into the role of language in his process of professional integration: *Since the profession in my home country does not have a social role, it makes the role of an engineer difficult to describe in our home countries*. Upon probing, he expanded the thought, saying *the engineering is not different, just the perception. Language influences the thinking process, the decision process, the structure of the language, what you can say, the methods to express yourself, the perspectives you express*. This participant's views resonate with Deutscher's perspectives on the influence of language on thought. Deutscher posits that features of individual languages *oblige* the speaker to express certain things and oblige the listener to pay attention to certain things, and furthermore, this requirement to habitually pay attention to certain aspects of the world can eventually settle into habits of the mind such as attention, perception, memory and association that differ between speakers of different languages [25].

The condition of being multilingual and having a discernible accent can be interpreted as aspects of N-identity. However, the data regarding language's influence on how others perceive you - both in individual communication proficiencies and fluency with the professional communication norms and practices - can be interpreted as extending to the development of D-identity and A-identity as well. The data regarding language's influence on how one is able to understand and explain the role of a professional engineer may be more profoundly related to D-identity and A-identity development; however, the data in this area were too sparse to explore this latter concept more fully.

LIMITATIONS AND CONCLUSION

Most of the data gathered in this study were qualitative data in written surveys and focus group interviews, and the usual limitations for qualitative studies apply. The data and the findings are contextualised to the specific setting and to the group of participants that voluntarily agreed to participate in this study. The findings are reliable to the context of the study, but their transferability to other contexts must be evaluated by each individual reader. The limitations on the quantitative data collected through surveys are related to the sample size, which limited the analysis to descriptive statistics only and precluded any exploration of causal or correlational relationships.

The data are also subject to the limitations of any survey data, including self-selection biases in respondents. Like the qualitative data, the quantitative data should be understood to relate to the context of this study and generalisability to all IEEs is not intended. The study did not ask participants about identity directly and did not introduce Gee's framework to the participants. While this lends credibility to the findings by allowing the interpretation to emerge organically, the findings would be strengthened by further work that explores the identity framework in IEEs' professional integration more explicitly.

This study highlights that IEEs are aware that while the technical aspects of professional engineering practice are highly transferrable between their home countries and Canada, that there are nonetheless significant differences in the identity of an engineer that need to be resolved upon arrival. The data provide evidence that IEEs are aware that they are undergoing a transitional process and re-orienting both their perspectives and their practices toward the expectations of a professional engineer in Canada, and that they are holding themselves to the evaluation of external groups - whether that be within formal processes of licensing or within the personal interactions in the workplace.

This process can be interpreted as the development of Gee's identity parameters. For an IEE, this identity development process includes the formal recognition of foreign credentials and labour market access (I-identity). The process includes developing the understanding of, and affiliation with, the role of a professional engineer in Canada and the role of the engineering profession in Canadian society, with particular developments in the understanding of Canadian cultural expectations and of the responsibility to uphold the public interest and public welfare, and ethical conduct within the Canadian concept of ethics (D- and A-identities). However, the interpretation differs from Gee's construct of A-identity, in that both the shared practices and experiences and the affiliation to the others in the group are considered important in the development of an A-identity in professional engineering.

The integration process of IEEs into the North American engineering profession is a multi-faceted, complex and lengthy process. There are essentially multiple aspects of recognition to contend with in order to become an engineer, and immigration policies and qualifications recognition initiatives often focus almost exclusively on the I-identity components of formal recognition of foreign credentials with a regulatory body, neglecting to acknowledge and address that full professional integration is far more complex. Full professional integration requires on-going initiatives to assist IEEs in understanding the identity development facing them, and this reinforces a role for university-based continuing education programmes and qualifications recognition programme in engineering to offer pathways that assist in

developing these multiple identities. To the extent that engineering identity is externally validated, full professional integration requires authentic opportunities through education and practice for IEEs to develop the multiple identities inherent in being a professional engineer in North America.

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