2006-59: CONCEPTUAL FRAMEWORK FOR THE INTERNATIONALLY-EDUCATED ENGINEERS QUALIFICATION PILOT PROGRAM, UNIVERSITY OF MANITOBA, CANADA

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Conceptual Framework of the Internationally-Educated Engineers Qualification Pilot Program, University of Manitoba, Canada

Abstract

This paper presents the conceptual framework of the Internationally-Educated Engineers Qualification Pilot Program (IEEQ) at the University of Manitoba, Canada, highlighting the role that engineering schools can play in facilitating the cultural and labor market integration of foreign-trained engineers in North America. IEEQ is a 12-month program combining academic study and a paid work placement, and key structural features are that it leads to foreign credentials recognition, it relies on external partnerships with government and industry, and it shares common features with Minority Engineering Programs. Assessment and evaluation of IEEQ is characterized by a mixed methods approach, gathering both qualitative and quantitative data.

Introduction

This paper presents the conceptual framework of the Internationally-Educated Engineers Qualification Pilot Program (IEEQ) at the University of Manitoba, Canada. IEEQ addresses foreign credentials recognition (FCR) for engineers recently immigrated to Canada. These internationally-educated engineers hold engineering credentials obtained in their home country (engineering degrees, professional work experience), wish to continue their engineering career in Canada, and need to qualify for a Canadian engineering license in order to do so.

The purpose of the paper is to outline the background and regulatory context, motivations and goals, structural features, delivery features, and assessment and evaluation of the IEEQ program. This conceptual framework provides the reader with an understanding of the underlying features and characteristics of the program in order to discern similarities, differences, and potential applicability to other jurisdictions. While regulatory requirements vary between jurisdictions, this paper highlights the role that engineering schools can play in facilitating the cultural, language, and labor market integration of foreign-trained engineers in North America.

Societal Context

Increasingly, the immigration of skilled workers is considered a powerful demographic and economic force to address labor market needs and to facilitate the current and continued strength of the U.S. and Canadian economies[1-3]. In Canada, immigrants made up 70% of labor force growth in the 1990s and are expected to make up 100% of labor force growth by the year 2011[1,4]. In the US, immigrants made up almost 47% of labor force growth in the 1990s and were expected to make up 60-62% of labor market growth of labor market growth between 2000 and 2004[2].

Foreign trained engineers comprise a large proportion of recent immigrants to Canada, and are theoretically well positioned to enter the labor market. In addition to a 'graying' workforce, the engineering profession in Canada has enjoyed higher labor market growth over the last ten years than the general labor market (17% and 9.5% respectively) and rates of unemployment consistently below the national average for the last 15 years[1].

Despite these favorable labor market conditions, the transition to the workforce is difficult even for highly educated immigrants. Skilled workers generally cite lack of Canadian experience and difficulties in having foreign credentials formally recognized as the primary obstacles to full labor market participation[5]. Foreign trained engineers likewise identify the licensing process and the length of time to meet licensing requirements to be primary obstacles. In Canada, only 48% of immigrant professionals have found work in their intended field within two years' of immigration[1,5].

On the other hand, employers indicate that the technical knowledge of foreign-trained engineers is generally at par or better than that of Canadian-educated engineers. The three most important factors that influence level of labor market participation, in the view of employers, are English skills (including general communication, knowledge of North American business practices and technical standards), prior Canadian work experience, and professional licensure[1]. On a broad level, the IEEQ program was designed to address the challenges of immigrants as well as the concerns of employers.

Background and Regulatory Context

Across Canada, holding a professional engineering license (P.Eng. license) is a legal requirement to practice professional engineering, regardless of engineering discipline, and it is generally accepted as a professional credential required for career advancement and mobility. The P.Eng. license is granted by the engineering regulatory bodies in each respective provincial jurisdiction. Acting on behalf of provincial governments, the regulatory bodies are charged with protecting the public by regulating the practice of professional engineering, including to ensure that those who practice engineering are qualified to do so. The P.Eng. license is granted upon demonstration of two major requirements: *academic qualification* (a four-year engineering degree from an accredited Canadian university program, or equivalent), and four years' of supervised engineering practice experience.

Immigrants to Canada holding degrees from countries covered under the Washington Accord are considered to be *academically qualified* on the basis of reciprocal agreements between the respective countries' accreditation bodies. Countries covered under the Washington Accord include the United States, Ireland, Australia, Great Britain, New Zealand, Hong Kong, Japan, and South Africa.

Immigrants from all other countries must submit their academic credentials (copy of original degree, transcripts, and course syllabi) to the provincial engineering regulatory body for assessment. In Canada, most immigrants fall into this category, as the top five source countries for immigration are China, India, Pakistan, Philippines, and Korea[6].

In Manitoba, the regulatory body for engineering is The Association of Professional Engineers & Geoscientists of the Province of Manitoba (APEGM). Upon completing an assessment of academic credentials of an immigrant with foreign engineering credentials, APEGM will assign an exam program by which the immigrant confirms their technical background and/or fills gaps in the technical background identified by APEGM. Exams typically cover material found in the final two years of a bachelor-level engineering program. A typical examination program assigned by APEGM ranges from two to six exams.

Until the IEEQ Pilot Program was conceived, there were no alternative routes for immigrants' foreign credential recognition besides the assigned examination program. Several challenges associated with the APEGM examination program include:

- It is generally a long process. Intended progress is two exams per year, although most immigrants take longer to complete[7], during which time many remain either unemployed or underemployed. Aging credentials subsequently make re-entry into engineering employment more difficult as time goes on.
- It is undertaken alone. While APEGM recommends textbooks by which to study for exams and provides sample questions, no formal efforts are made to introduce the immigrant to other immigrants in similar situations nor to potential Canadian mentors who could help with motivation, self-esteem, and professional integration challenges during this period of qualifying for Canadian engineering practice.
- It is a 'one-shot' opportunity, upon which an immigrant's competency is a given subject area is assessed by one three-hour exam. Issues of exam anxiety, unfamiliar testing formats, unexpected content or vocabulary, or English language difficulties can be significant determinants of exam success, and 'one-shot' exams do not allow the immigrant to self-assess exam preparedness nor to demonstrate progress or mastery over time.

Motivations

The initial motivation to develop the IEEQ program was to address the inherent challenges of APEGM-assigned examination programs. IEEQ program objectives are to provide:

- a time-effective alternative to APEGM examination programs;
- a supportive community for immigrants as they work toward professional recognition, both with other immigrants pursuing similar goals and with Canadian engineers; and,
- an opportunity for progressive transition and integration in the Canadian engineering profession over time, both in demonstration of technical background and in cultural and personal adjustments.

In addition, IEEQ addresses the societal context of immigration trends – the key challenges of immigrant professionals (formal recognition of foreign credentials; Canadian work experience), and key concerns of employers (English skills; Canadian work experience; and licensure) as described earlier.

Structural Features

Key structural features of the IEEQ Pilot Program include foreign credentials recognition, external partnerships, and alignment with structural features of Minority Engineering Programs (MEPs, United States) and Access Programs (Canada).

Although foreign credentials recognition is typically the mandate of provincial governments and professional licensing bodies, and not the mandate of universities, IEEQ is nonetheless delivered by the Faculty of Engineering, University of Manitoba by University staff and faculty members. The pilot phase of the program has added the equivalent of 1.5 full-time positions to the university in the form of a program coordinator and administrative support. Program participants otherwise fit into existing student spaces in the various departments and are served by the existing faculty contingent.

Foreign Credentials Recognition: IEEQ operates directly within the licensing system in Manitoba and this provides the program's critical value. APEGM recognizes successful completion of the IEEQ program as an equivalent to a traditional APEGM-assigned examination program. Successful completion of IEEQ results in a designation of *academic qualification* and Member-in-Training status with APEGM. While a number of other bridge training or gap training programs exist for immigrant engineers[8-13], they operate outside of the Canadian licensing system. Typically delivered by community agencies, they generally focus on general information on professional integration, occupation-specific language training, skills upgrading, job search skills, and job placements or employment facilitation. None of these programs lead to formal recognition from the provincial engineering licensing body and thus play no formal role in achieving a Canadian P.Eng. license.

Partnerships: IEEQ operates as a partnership with the provincial government (Department of Labour & Immigration), who provide administrative funding to deliver the program, and with APEGM, who provide pre-entry eligibility assessments. IEEQ also draws heavily on input from local industry in designing the program format and content, and by industry's participation in the paid work term component of the program (see *Delivery Features* below). Immigrant-serving / settlement agencies in the community act as preparatory entry points for immigrants to become aware of the program and, if necessary, to upgrade English language skills to the minimum benchmarks set for program entry.

Alignment with MEPs / Access Programs: IEEQ shares certain common structural features with MEPs and Access programs in Canada and the U.S. The features which are intentionally considered in the IEEQ program structure include an acknowledgement of the participants' characteristics that set them apart from the general undergraduate population (age, culture, family responsibilities) and the critical role of financial, social, and academic supports in their ability to persevere and succeed[14-18].

Delivery Features

Academic Work: IEEQ is a 12-month program of academic coursework (eight months) and a paid engineering work term (four months), in that order. The goal of the academic coursework is to provide an opportunity for the immigrant to confirm and demonstrate their technical competency in their respective engineering discipline. Academic courses are chosen to address

the topic areas of the APEGM-assigned examination program, and are chosen at the fourth and third-year undergraduate levels.

Two core courses are mandatory in the program: Engineering Economics, and Practicing Professional Engineering in Manitoba (PPEM). PPEM is a course developed in consultation with Manitoba industry and delivered exclusively for the IEEQ participants. It focuses on general cultural integration, engineering professional culture in North America, the organization and regulation of the profession in Canada, employability and employment maintenance, engineering law, and professional ethics.

The total number of courses that a given participant takes in the IEEQ program depends on the number of technical exams assigned by APEGM, and generally ranges from four to seven.

Work Term: Upon completion of the academic coursework, participants are hired by local industry for paid, four-month engineering employment terms. The goal of the employment term is for the immigrant to gain Canadian engineering experience and to begin networking with other practicing engineers in the field.

The employment is monitored by IEEQ staff. The employer commits to providing a minimum of 16 weeks of engineering work, supervised by a licensed P.Eng., and to pay a salary or wage within the recommended range of $16 - $24 per hour depending on qualifications. Ideally, the participant is able to translate the four-month employment term into a longer-term or permanent employment opportunity with the employer or through connections developed while with the employer.

Supports: Like MEPs and Access programs, IEEQ has integrated a number of support structures into the immigrants' experience, including social supports in the form of regular advisor sessions with program staff, informal social events, a dedicated weekly group meeting time, family events, and industry tours; financial support for tuition, books, and living expenses coordinated with industry and government; and, academic support in form of customized orientation programming, individual academic counseling, referral to appropriate campus services, facilitation of IEEQ study groups, and connecting current and former IEEQ participants of the same engineering discipline.

Fees: Participants pay tuition fees to the University of Manitoba on a per-credit basis as any other undergraduate student. Typical costs range from $2400 - $3200 in tuition fees, $600 - $1000 in textbook costs, and up to $400 in incidental fees. The largest financial consideration for most participants is lost income while studying full-time for eight months. Financial assistance in the form of tuition support and living support has been available through the provincial government, student loans, and bursaries offered by industry.

Credential: Currently, successful completion of the IEEQ Pilot Program does not lead to a certificate, diploma, or degree from the University, although future plans include seeking formal approval for a Post-Baccalaureate Diploma in Engineering. Successful completion leads to a letter from the Dean of Engineering, confirming the participant has successfully completed all

program requirements. APEGM accepts this letter as a confirmation of *academic qualification* required for licensing as an Engineer-in-Training (Member-in-Training) in Manitoba.

Post-IEEQ: Following the IEEQ Pilot Program and designation as an Engineer-in-Training with APEGM, applicants must demonstrate a minimum of four years' professional engineering practice experience in order to qualify for the full P.Eng. license in Canada. Up to three years' experience can be obtained outside of Canada, leaving a minimum of one year of Canadian experience required. Experience obtained in the home country prior to immigration to Canada and experience obtained during the IEEQ work term are considered eligible experience toward the P.Eng. license. In an ideal case, participants can qualify for the full P.Eng. license within eight months of completing the IEEQ program.

Participant Profiles

A fairly consistent profile of participants has emerged over the three years of the program to date. Program funding has limited capacity to seven, 14, and nine participants in each of three years, respectively. Participants generally range in age from late 20s to mid-40s. Most have spouses and children, and most have immigrated to Canada within the two years prior to beginning the IEEQ program. In Year Two and Year Three, two participants in each respective cohort were female. Regions of origin include Central and South America (11 participants from five countries to date), Southeast Asia (11 participants from six countries to date), Central and Eastern Europe (six participants from six countries to date), and Africa (two participants from two countries to date). Participants came with backgrounds in mechanical, industrial, metallurgical, electrical, electronics, computer, civil, and agricultural engineering. In addition to a completed bachelor-level engineering degree from their home country, a number of participants also had additional training including Master degrees in engineering, graduate studies in engineering not leading to a degree, or additional certificates in management, financial accounting, etc.

Assessment & Evaluation

Assessment and evaluation of the IEEQ program follows general trends for educational program evaluation[18-21] and is characterized by triangulation through multiple methods. The complete assessment and evaluation framework is outlined in a separate paper to the Emerging Trends in Engineering Education session of the ASEE 2006 Annual Conference.

Key challenges in assessment and evaluation of IEEQ include:

- The lack of precedents in Canada for programs that address engineering foreign credentials recognition through multiple partnerships *operating directly within the licensing system.* To date, IEEQ is the only university-based program in Canada that leads directly to a formal credential with the provincial engineering regulatory (licensing) body, and therefore there are no direct assessment & evaluation precedents available.
- While MEPs and Access programs have elements in common with IEEQ, the evaluation goals of typical MEPs and Access programs center around recruitment and retention outcomes, and these are not the primary challenges of the IEEQ program. IEEQ is currently

oversubscribed, and is fundamentally a FCR program for mid-career professionals. This difference naturally leads to different evaluation measures as well.
- As a program that operates informally within the University structure (i.e. not a certificate, degree, or diploma program), accreditation requirements for engineering programs (Canadian Engineering Accreditation Board; ABET) provide some reference points but neither define, limit, nor encompass the entire scope of goals and outcomes of the IEEQ program.

The evaluation goals are to compare program objectives (articulated in the previous section *Motivations*) to program outcomes, and to inform ongoing program development by identifying perceived strengths of and suggested improvements to the program.

Assessment and evaluation uses triangulation of data through multiple methods to address each respective evaluation goal. Multiple methods provide multiple and varied perspectives, which in turn enhance the validity and credibility of the findings. For each evaluation goal and program objective, a minimum of three of the following instruments and measures are used to gather data.

- Quantitative or 'hard' measures include program completion rates (academic performance, work term placement), statistical comparison of program completion times between IEEQ program and traditional examination program, and rates of ongoing engineering employment post-IEEQ.
- Qualitative or 'soft' measures include content analyses of participants' course evaluations and work term reports, performance evaluations by employers, focus groups with participants, and follow-up questionnaires with participants nine and 24 months post-IEEQ.
- Mixed-method measures include participants' use of social supports and on-line discussion boards (hard measures of participation rates; soft measures of engagement).

Key findings to date include the following:

- The IEEQ program is a viable and time-effective alternative to the traditional examination programs assigned to foreign-trained engineers, by which immigrants can confirm or demonstrate (and in some cases upgrade) technical knowledge, gain Canadian work experience, and qualify for a professional credential legally required for engineering practice.
- The critical role of adequate English language skills to achieve program requirements was clearly demonstrated. This led to more intentional collaboration with community organizations that can act as preparatory streams for IEEQ or other university studies;
- Consistent with the literature on more typical MEPs and Access programs, support structures – including social, financial, and academic – are critical for perseverance and success. Participants need and welcome a significant amount of information and transitional support to adapt to an unfamiliar educational system, a second language, and to address misinformation and misconceptions. The primary changes that occurred between the first and second year of the program related to enhancing these supports.
- While small cohort numbers to date preclude a valid statistical finding, the role of the IEEQ program in ongoing engineering careers of participants, measured by ongoing engineering employment and career progression, appears to be significant.
- Participants have confirmed the IEEQ program as a viable vehicle for re-entry into the engineering profession in a new country. It is considered by participants to incorporate the

necessary time to comfortably demonstrate existing and assimilate new technical knowledge, English engineering vocabulary, North American codes and standards that govern in the respective engineering discipline, and new cultural understandings and practices of North American life generally and the engineering profession specifically. Participants have identified the IEEQ program as a safe and supportive environment in which to practice new vocabulary, design practices, and cultural approaches with fewer social, financial, and professional 'costs' than in an industry environment if they fall short. In addition, participants have used the IEEQ program to accommodate varied goals, including foreign credentials recognition, employment, upgrading technical knowledge and skills, and preparation for ongoing studies.

Conclusion

A FCR program like IEEQ achieves maximum value through its formal partnerships between the University of Manitoba, APEGM, the provincial government, and engineering industry, and through its informal partnerships with community agencies that serve as preparatory points. To date, the formal partnership between the university and the engineering regulatory body for formal credentials recognition is the first of its kind in Canada.

Echoing findings in the literature and mainstream thinking in Canada, local experience is that an immigrant's ability to succeed in the engineering workplace in Canada is generally not related to their technical knowledge and abilities. Rather, inadequate English language skills, lack of cultural knowledge, and lack of community support are significant barriers to full labor force participation including job entry and job maintenance. The IEEQ Pilot Program, a relatively new, small, and evolving initiative, is one step toward addressing these challenges, with tangible local results.

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