



Indigenous Peoples' Access to Post-Secondary Engineering Programs

A Review of Practice Consensus

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Executive Summary

This report is intended to support the development of engineering access programs for Indigenous peoples across Canada. In contrast to traditional processes that were developed to meet the needs of majority culture students, access programs for Indigenous students are specially developed to suit students' entry to post-secondary education.

A review of pre-existing literature was conducted to determine the best practices for access program implementation in Canadian engineering education. However, a robust literature focus on Canadian engineering access programs was not readily available and no best practices could be identified from the limited literature. Instead, a summary of consensus practices, or those activities that have been identified or implemented in numerous programs but have yet to be thoroughly evaluated, are presented.

The seven consensus practices described in this report are activities that many program managers have deemed important to their programs' success. These consensus practices should guide the implementation of programs aimed at Indigenous peoples' access to engineering education. Although some components are essential to program implementation, as they undergird other components and play a critical role in supplying a quality program, others can be adapted to suit the context of the post-secondary institution and its resources. The following are brief descriptions of these seven consensus practices:

1. Throughout the entirety of the process, it is critical to **develop evaluation capacity** within the program. By benchmarking, evaluating implementation and assessing utility, program managers can determine what works well and thereby support other burgeoning programs. Although traditional evaluation practices may suffice, managers should work with community members to employ **decolonized evaluation practices**.
2. It is essential during program development that the faculty of engineering develops a **relationship with the communities** that the access program will serve.
3. Working with members of these communities, the program managers and others involved can begin to **delineate characteristics of their target population**.
4. Knowing the needs of this group will help **deliver appropriate support services**.
5. A non-**standard application system**, which looks at the whole student rather than simply grades, has been successful at many institutions in admitting quality students.
6. Students also benefit from **financial aid** that is delivered based on need rather than merit.
7. **Bridge programs and specialized orientation programs** have been useful in supporting students' transition to post-secondary, as well as assuring that students are academically prepared.

Recommendations and limitations are discussed after the description of consensus practices. The goal of this report is to foster the discussion that will lead to better representation of Indigenous peoples in Canadian engineering.

From Application, to Transition from Home, to Higher Education

Engineers Canada is located on unceded and unsundered Algonquin territory.

Introduction

Faculties of engineering across Canada have been preparing their students and researchers to be innovators and entrepreneurs—to make the next major technological advancement, to develop a start-up that breaks records or to devise a solution to the world's most persistent problems. Investments in state-of-the-art lab space, new technologies and collaborative environments have been made on campuses across the country.

However, a critical driver of innovation is often overlooked in engineering: diversity. Including diverse peoples in engineering education and in engineering workplaces fosters the capacity to solve problems, to be creative, to think critically and to embrace cognitive complexity (D. G. Smith & Schonfeld, 2000). Diversity is a key asset in innovation.

Also prevalent in the Canadian post-secondary landscape are the appeals to indigenize education and to pay heed to the calls to action made by the Truth and Reconciliation Commission (TRC) (The Truth and Reconciliation Commission, 2015; The Truth and Reconciliation Commission of Canada, 2015a). In light of the TRC's report and recommendations, Universities Canada—which represents 97 Canadian universities—stated that eliminating educational disparity will “strengthen Indigenous communities, allow Indigenous peoples to continue to strive for self-realization, enhance the informed citizenship of Canadians and contribute to Canada's long-term economic success and social inclusion (Universities Canada, 2015).”

Furthermore, according to a report by Sharpe and Arsenault (2010), closing the education and labour market outcomes gap by 2026 will lead to a \$36.5 billion increase in Canada's gross domestic product (GDP). Cumulatively, the effect of closing such a gap between 2001 and 2026 would be a benefit of just over \$400 billion, with approximately \$179 billion directly attributed to educational attainment (Sharpe and Arsenault, 2010).

Although the ethical imperative to promote Indigenous peoples' access to post-secondary engineering may be clear, what should also come to light is that diversity is key to achieving advances in engineering and applied science. When we speak about making a Canadian economy that is a worldwide leader in innovation, we must not forget that by investing in Indigenous peoples' access to engineering, we invest in our collective future.

This report aims to outline the practices common among existing access programs, or the means by which some post-secondary institutions strive to increase the enrolment of Indigenous peoples. Although documentation from Canadian engineering access programs was initially preferred, thin literature on this topic required investigation beyond this geography and field. Further to this, much of the available literature did not demonstrate a robust evaluation of programming, but, rather, outlined the activities and outputs of programs. Therefore, this document reports *consensus practices*, or those activities and outputs generally agreed upon and frequently deployed in access programming. Seven consensus practices have been defined. This report outlines each and provides a breakdown of the programs' components.

Beyond the pages of this report, Engineers Canada hopes to start a conversation about Indigenous access to post-secondary engineering programs

Engineering Education and Indigenous Peoples

According to the 2016 Engineers Canada enrolment and degrees awarded survey, approximately one per cent of undergraduate engineering students enrolled in accredited engineering programs in Canada identify as Indigenous peoples (First Nations, Métis and Inuit peoples). The 2011 National Household Survey indicates that more than 4.3 per cent of the total Canadian population identify as Indigenous peoples (Statistics Canada, 2015). If the engineering profession is to continue solving society's complex problems, it must reflect the demographics of this society. This gap must be closed.

Engineers Canada maintains that the sustainability of the engineering profession includes the requirement that the membership of the provincial and territorial engineering regulators is representative of Canadian society. In order for the profession to reflect Canadian demographics, more Indigenous students must enter and persist through post-secondary engineering education.

Engineers Canada has expressed that increasing the enrolment of Indigenous students in engineering is a goal. This is particularly true in light of the Truth and Reconciliation Commission's findings and recommendations, namely the need to eliminate education and employment gaps between Indigenous peoples and non-Indigenous peoples; the recommendations to other professional bodies requiring cultural competency and human rights training; and the value of meaningful consultation and ensuring equitable access to jobs, training and education (The Truth and Reconciliation Commission of Canada, 2015a).

Considering this, numerous post-secondary institutions have made calls to indigenize education, including the University of Windsor (Malley, 2015), the University of Saskatchewan (Foster, 2016), the University of Regina, the First Nations University of Canada (Pete, Schneider, & O'Reilly, 2013), the University of the Fraser Valley (n.d.), Mount Royal University (Academica Group Inc., 2015) and Carleton University (Hickman, 2014).

These calls to action indicate that post-secondary administrators recognize their institutions must change to include Indigenous peoples and Indigenous ways of knowing. To accomplish this within engineering, it is important to consider some of the numerous barriers that historically and continually exclude Indigenous peoples from engineering education. Only since the 1970s have First Nations peoples been allowed to pursue post-secondary education without the fear of losing Status and disenfranchisement (Anonson, Desjarlais, Nixon, Whiteman, & Bird, 2008; Doran et al., 2015; Prince Albert Grand Council, 2005). As Goldfinch & Kennedy state, "a long history of institutionally driven dispossession of lands, language, culture and identity have led to varying degrees of mistrust of institutions" (2013, p.5), especially considering the history of residential schools, which ended in the 1990s, and other practices of assimilation (R.A. Malatest & Associates Ltd. & The Council of Ministers of Education Canada (CMEC), 2002).

Unemployment, poverty, insufficient high school education—particularly in remote communities where prerequisite science and math courses may not be offered—and sparse information on career options, are all factors restricting access to post-secondary engineering education for Indigenous learners (Adams et al., 2005; R.A. Malatest & Associates Ltd. & The Council of Ministers of Education Canada (CMEC), 2002; D. Smith, McAlister, Tedford Gold, & Sullivan-Bentz, 2011). Specifically, 29 per cent of Indigenous peoples in Canada have not completed high school. For those with Status, this number grows to 35 per cent (Statistics Canada, 2013).

The benefits of improving representation of Indigenous peoples and Indigenous ways of knowing in engineering are not limited to innovation. It includes the creation of a positive voice for the profession in Indigenous communities, the development of engineering role models and awareness for young people and makes for better project outcomes (Goldfinch & Kennedy, 2013). This is then perpetuated in next generations, as young people know engineers and engineering, and may then be more likely to choose it as a career.

Some efforts have been made to attract and retain Indigenous peoples to post-secondary engineering programs. The University of Manitoba's Engineering Access Program (ENGAP) has been in existence for over 30 years and has graduated over 100 Indigenous students in engineering (Herrmann, 2012). Aboriginal Access to Engineering at Queen's University is a relatively younger program whose scope extends beyond post-secondary engineering and provides culturally relevant materials for teachers and parents of young learners to motivate their interest in math and science (Queen's University Aboriginal Access to Engineering, 2016).

However, to close the gap between Indigenous and non-Indigenous students' achievement of engineering degrees, more must be done at the post-secondary level across Canada.

In this Report

This report focuses on seven components of a successful program aimed at increasing the likelihood that Indigenous students will persist through the transition to post-secondary engineering education. Recruitment of Indigenous students to engineering is not considered in this document. Recruitment often starts with elementary-age children and continues with initiatives to recruit secondary school students. The complexity and diversity of this work was considered out of scope for this report. Likewise, this report does not outline what is required for the retention of Indigenous students in post-secondary engineering education, focusing only on the transition from secondary to post-secondary education.

The report is largely review work, summarizing available information. It is intended to promote conversation and to be continually developed. The components describe the early stages of program ideation through to the facets necessary for students' transition to post-secondary engineering and each section concludes with a table. These tables are intended to

guide a robust conversation.

Methods

Data Sources

Multiple data sources were consulted to determine consensus practices. The author interviewed the directors of existing programs, as recommended by Love (2004), Loucks Horsley (1996) and Cousins et al. (2004). After this, a literature review was conducted that included reports of those existing engineering access programs. The literature review relied on peer-reviewed articles accessed through a university library system, government sources and available records of existing programs.

Consensus Practices

1. Evaluation Capacity and Publication

The first consensus practice is to build evaluation capacity and to contribute to the academic literature. By expanding the program's evaluation capacity, program managers are able to show they are meeting funders' requirements, supporting others entering the field of access program delivery, procuring new funding and making program improvements (Preskill & Boyle, 2008). Volkov and King (2007) have developed a "Checklist for Building Organizational Evaluation Capacity" to guide uptake in organizations. Leveraging resources like this, program managers will be able to make informed decisions throughout program implementation and once its established (Preskill & Boyle, 2008).

At this juncture, it would be advisable for the faculty of engineering to delegate or hire a point person whose role is to facilitate this relationship and establish the access program going forward (Labun, 2002). This staffer's position will grow as the access program develops and as the faculty sees fit. Professional development courses and workshops are available that can assist this person and all related staff prepare to work with the community and future students.

Staff new to evaluation can learn through numerous channels, including written materials, online resources, formal training or through capacity building with an evaluator engaging in participatory or emancipatory evaluations (Preskill & Boyle, 2008). Further, the Canadian Evaluation Society (<http://evaluationcanada.ca/>) offers mentor—mentee matching, a national conference, webinars, guidelines of ethical practice and many more resources (Canadian Evaluation Society, 2014).

Programs and staff that are committed to internalizing evaluation procedures, systems and policies will benefit from this practice. To ensure the program's capacity to evaluate is sustainable, Preskill and Boyle (2008) offer advice. Evaluation teams should be established to support education and deploy successful evaluations. Staff positions should include evaluation as a role or responsibility and should embed evaluation in the daily work of staff.

Indigenization / Decolonizing Evaluation

Decolonized evaluation is founded on Indigenous epistemology. The goals, values and ways of knowing of the engaged community should be central to the evaluation (Johnston Goodstar, 2012). Decolonized evaluations are practiced by what the community deems worth knowing, how they come to know it and how and with whom the knowledge is shared (Hopson, Bledsoe, Kirkhart, & Mertens, 2012; Johnston Goodstar, 2012; T. Smith, 1999). Indigenous peoples and communities should have authority over what data and processes are genuine and legitimate (Hopson et al., 2012). The evaluation must benefit the community, and not simply to expand Western knowledge (Kawakami, Aton, Cram, Lai, & Porima, 2008). Individuals from the community who hold esteem should determine quality of evaluation and data. This includes consulting these individuals according to appropriate cultural practices. Outcomes that are highly regarded for cultural or spiritual reasons should be considered as substantial as outcomes identified by Western practitioners or funders (Kawakami et al., 2008).

Johnston Goodstar (2012) recommends using Evaluation Advisory Groups (EAGs) to decolonize evaluation effectively. An EAG will ensure Indigenous epistemologies stay central to the evaluation and that the questions asked in the evaluation are important to the community (Hopson et al., 2012; Johnston Goodstar, 2012).

On page 337 of their report, Kawakami et al. (2008) provide a table comparing Indigenous and Western frameworks for evaluation practice. The table provides a helpful introduction to some differences in evaluation practice. Later in their report, Kawakami et al. (2008) share a case study of decolonized evaluation that may assist some readers understand what constitutes good practice.

When building evaluation capacity and sharing findings, an access program can measure its implementation against the consensus practices available in Table A.

Table A: Evaluation Capacity and Publication

1. Leverage Valkov and King's (2007) "Checklist for Building Organizational Evaluation Capacity."
2. Evaluation staff and committee members are offered information on evaluation and performance management.

3. Evaluative thinking is incorporated in program development.
4. Findings from evaluations and program implementation are shared through publication and resource materials.
5. Measures taken to decolonize evaluation
6. Staffing
7. Community members who are held in high esteem advise on goals, values and what constitutes data

2. Community Partnership

Early in the development of any program affecting Indigenous peoples, it is imperative to effectively consult with the community the program intends to serve. This initial consultation should eventually evolve to community participation and partnership (Johnston Goodstar, 2012; Nguyen, 2014; R.A. Malatest & Associates Ltd. & The Council of Ministers of Education Canada (CMEC), 2002). It is essential to identify if the access program being considered is indeed desired by the community and to begin to delineate how best to work together. During the process, it is important to agree to what need is being met and what is achievable given resources, expertise and other factors. Limitations, scope and areas where participants have influence should be identified ([Goldfinch & Kennedy, 2013](https://www.engineerscanada.ca/reports/research/review-practice-consensus-indigenous-peoples-access-post-secondary-engineering-programs#references title= "goldfinch,=")).

Curran, Solberg, LeFort, Fleet, and Hollett (2008) evaluated a nursing access program in Labrador. In their findings, they developed a standard of practice for collaboration. The steps they developed have become steps three through 10 in the table at the end of this section and in Appendix I.

Likewise, Nguyen (2014) described three components to effective consultation in an urban landscape, including developmental, empowerment and relationship-building. In this paper, Nguyen (2014) evaluates whether the Urban Aboriginal Strategy in Toronto provides Indigenous partners “the ability to effectively participate in the consultation process (p1).” This example may be helpful when assessing the relationship between access program managers, faculties of engineering and the Indigenous communities in urban landscapes.

Ideally, consultation is an ongoing process, where the community is continually engaged. Ongoing participation beyond initial consultation of the community should be encouraged and planned (Goldfinch & Kennedy, 2013). Community participation, partnership and community control may be greater means to achieving program outcomes (Nguyen, 2014).

Requirements, roles of each stakeholder and limitations should be discussed, defined and agreed upon. Efforts should be made to understand what each stakeholder identifies as most important and their metric for success.

Many authors have written about ethically and effectively engaging with Indigenous communities. Program staff should review what practices are most suited for their situation. Further resources on community partnerships, including training materials and case studies, are available from Indigenous Corporate Training Inc. (2015) and Aboriginal Human Resource Council (n.d.).

Although a discrete component, community partnership underlies all other components suggested in this report and should be integrated where possible and appropriate.

When establishing a community partnership, an access program can measure its implementation against the consensus practices available in Table B. Examples of evidence of achievement and benchmarks are available for some parameters in the Appendix. All components and associated criteria should be considered for sample purposes.

Table B: Community Partnership

1. A point person is hired to facilitate the community - post-secondary relationship and to manage the access program going forward.
2. Professional development opportunities are available to those from the post-secondary institution who are involved with the access program.
3. An appropriate number of stakeholders and partners are involved in the development and implementation of the access program.
4. Perception of willingness to collaborate and compromise from all stakeholders and partners.
5. A sense of shared ownership, contribution and decision making among all stakeholders and partners.
6. Stakeholders and partners have well defined roles and responsibilities.
7. Throughout development and implementation, effective and regular communication exists between stakeholders and partners.
8. There is an effective means to identify and resolve conflict among stakeholders and partners.
9. Realistic, concrete and attainable understanding of goals and objectives, which are valued and agreed upon, is shared among stakeholders and partners.
10. Effective leadership is present. (Curran et al., 2008)

3. Definition of Target Student Population and Their Needs

As Hayes and Monaghan (1995) report (in Omeri & Ahern, 1999), administrations often only consider Indigenous peoples by the count of individuals in their programs, whereas, in reality, Indigenous peoples hold hundreds of distinct languages, cultures, epistemologies and views (Omeri & Ahern, 1999). Effective consultation, engagement and partnership should consider the program in the context of a system of interrelated factors (Goldfinch & Kennedy, 2013). Support services will be required depending on the needs of students the program desires to attract (Herrmann, 2012). This task is best performed by a committee, particularly those who will be involved in developing and approving support mechanisms, individuals who are familiar with campus supports and those who will interact with the access program and its students.

When defining the students the access program intends to recruit, careful attention should be paid to what transitions those students will make when they attend post-secondary (The Assembly of First Nations, 2012; Wesley-Esquimaux & Bolduc, 2014). Are they moving from a remote reserve to a city? Do they have family where they currently live who provide childcare? Do they have experience in post-secondary? The students may need specific support as they make this transition (Herrmann, 2012; The Assembly of First Nations, 2012; Wesley-Esquimaux & Bolduc, 2014).

In order to systematically evaluate the students' needs, after the target student population has been defined, a needs assessment should take place. The assessment should look to understand what academic, social, cultural, familial and financial needs the prospective students could have.

Programs must consider historical, social, cultural, family and personal factors in order to be effective (R.A. Malatest & Associates Ltd. & The Council of Ministers of Education Canada (CMEC), 2002). Although not an exhaustive list, parameters listed here may assist when starting the process of defining the general characteristics of the student population and areas to consider for the needs assessment. These include: cultural identity, gender, family responsibilities, geography (urban, rural, remote, on-reserve), first language, age and previous educational experience. Wesley-Esquimaux and Bolduc (2014) discuss in detail gendered experiences of post-secondary attainment.

It is critical that program managers consider the intersectionality of these identities as well (Doran et al., 2015). While investigating what students may need, it is recommended that staff involved should work to disrupt their personal or collective assumptions. Often, these are based on our own engrained cultural practices and norms or may rely on stereotypes. 'Getting to know' the students, even hypothetical ones, will help faculty become familiar with their future students' life experiences and be more prepared to recommend appropriate services. This will help program staff and the institution gain awareness of needs that they would not have identified otherwise, or get an understanding of relative importance of needs.

In addition to guiding the implementation of the access program, having completed a needs assessment may assist in procuring funding. It shows that program managers intend on delivering services that are guided by the needs of the students and therefore are more likely to be successful (Work Group for Community Health and Development, 2015). The needs assessment will also help identify existing support services that are meeting the needs of the future students. The assessment should be carried out cyclically as the program develops over years, assuring that the program continues to deliver the support needed and that there are no gaps in services (Office for Victims of Crime, 2010). The program managers can decide how frequently assessments are required.

When defining the future student population and their needs, an access program can measure its implementation against the consensus practices available in Table C. Examples of evidence of achievement and benchmarks are available for some parameters in the Appendix. All components and associated criteria should be considered for sample purposes.

Table C: Definition of Target Student Population and Their Needs

1. Formation of a committee, including members from:
 - a. Indigenous community consulted in A.
 - b. Access program staff
 - c. Individuals familiar with support mechanisms of the post-secondary institution
2. A needs assessment to evaluate what support is most relevant of future student body.
3. Access program staff, and others involved, report a greater understanding of future students' needs and experiences.
4. Enumerate a list of supports student population may need to access, based on needs assessment.
5. Schedule the recurrence of the needs assessment.

4. Non-Standard Application

Institutions have found success in creating an alternative application stream through which Indigenous students may apply (Usher, Miller, Turale, & Goold, 2005). Numerous post-secondary institutions offering engineering, and some engineering programs themselves, have developed alternative admissions processes for Indigenous applicants who choose to use this route of application (Doran et al., 2015; Herrmann, 2012).

Access program staff should form an Application Committee made up of members from engineering programs, access program staff, current application reviewers, community members, current Indigenous engineering students and recent graduates (Labun, 2002). Staff that are not a part of the access program should be encouraged to participate as well. This allows staff that may not have had the opportunity to actively engage with Indigenous students to understand their needs, history and experiences. It is important to note, the alternative application system should be different, but no less rigorous (R.A. Malatest & Associates Ltd. & The Council of Ministers of Education Canada (CMEC), 2002).

The Application Committee will devise the appropriate application criteria and a process to identify desirable qualities that are indicative of a student's success in an engineering program (Curran et al., 2008). Labun (2002) suggested that criteria should include: the ability to follow through to achieve stated goals, existing support and academic ability. A student's success at work, in their community or family life should be considered as evidence rather than strictly transcripts and resume.

The Red River College model, as described by Labun (2002), suggests each applicant is reviewed by a five-person team. Each individual independently reviews the application and decides if the applicant meets the admission requirements. If a majority agrees, the applicant is interviewed. The interview is intended to see the student holistically, including their interest in the area of study. The committee then decides whether or not to accept the applicant. If an applicant is rejected, they are given advice on how to prepare or areas of improvement should they choose to reapply. Members of the Application Committee who are currently engineering students, and upon successful acceptance would become the applicant's peers, should be excluded from the selection committee. This allows applicants to speak freely and ensures peers do not have information that might be highly personal.

When establishing a non-standard application process, an access program can measure its implementation against the consensus practices available in Table D. Examples of evidence of achievement and benchmarks are available for some parameters in the Appendix. All components and associated criteria should be considered for sample purposes.

Table D: Non-standard application

1. Access program application committee is formed, including members from:
 - a. Indigenous community consulted
 - b. Staff from existing application centre
 - c. Current students who identify as Indigenous. Note: these students should be excluded from the selection process, as confidential information may be shared by the applicant that a future peer should not have access to.
 - d. Engineering faculty members. Note: Although helpful to have faculty who have been trained or informed of issues facing Indigenous learners, this also may be an opportunity to familiarize faculty members who have not interacted with Indigenous communities.
2. Committee devises application criteria. Criteria should be measurable and indicative of success.
3. Committee devises application process for students.
4. Committee devises application review process.
5. Individuals are identified to review applications. This should exclude current students.

5. Financial Aid

Financial assistance to cover costs of tuition, textbooks, living expenses, transportation, childcare and other expenses should be considered important to Indigenous students' access to post-secondary engineering education. Cost has been identified as the greatest obstacle to completing post-secondary education among urban Indigenous peoples (Enviroics Institute, 2010). Financial support is often key to recruitment and retention (D. Smith et al., 2011). Although merit- and need-based assistance affects post-secondary enrolment, need-based aid had a "more substantial direct effect" on post-secondary enrolment (Ness & Tucker, 2008). Recently, McMaster University diverted some merit-based financial aid to need-based to improve accessibility (McMaster University, 2016). Although there are many benefits to this action, it would certainly assist Indigenous students studying at the university.

Another option to provide student funding is through programs like the Indigenous Peoples – Industry Partnership Program at the University of Saskatchewan. Indigenous engineering students are provided financial assistance through industry-sponsored funds. In return, the students commit to working three summers with the company who sponsored them (Dunn, 2015).

There is a great deal of misinformation regarding Indigenous peoples' access to financial aid when studying at the post-secondary level (Doran et al., 2015; R.A. Malatest & Associates Ltd. & The Council of Ministers of Education Canada (CMEC), 2002). Métis, non-status and Bill C-31 Indigenous peoples have historically not been eligible to access any financial support (R.A. Malatest & Associates Ltd. & The Council of Ministers of Education Canada (CMEC), 2002). However, a recent Supreme Court ruling ("Daniels v. the Queen," 2016) will likely alter the eligibility of these groups allowing Métis and non-status individuals access to post-secondary funding (Madden, Frame, Davis, & Strachan, 2016). Prior to this decision, funding was allocated to First Nations Bands from the sale of land or mineral rights, for example, by First Nations peoples. The money is distributed by an Aboriginal Trust Fund established by the federal government. Eligible people ('Status Indians' with Band membership) may apply to their Bands for post-secondary funding. However, the financial aid that Status First Nations students may receive is rarely enough to cover the ever growing expense of post-secondary attendance and cost of living (Doran et al., 2015).

When establishing a bridge program or alternative orientation, an access program can measure its implementation against the consensus practices available in Table E. Examples of evidence of achievement and benchmarks are available for some parameters in the Appendix. All components and associated criteria should be considered for sample purposes.

Table E: Financial Aid

1. Determine minimum percentage of students' costs to be covered.

2. Are financial planning and emergency supports available?
3. Students are aware of available financial support.
4. Students are comfortable accessing support services.
5. Available student support is promoted. (Curran et al., 2008)

6. Establishment of Support Services

EnviroNics Institute (2010) found a relationship between urban Indigenous students who reported feeling supported throughout post-secondary and their level of educational achievement. Post-secondary institutions will have to allocate both physical and human resources to support students' adjustment to campus (Smith et al. 2011). The completed needs assessment, recommended previously when defining the target student population, will guide access program staff to find or develop the appropriate support for incoming students. These supports may already exist within the faculty of engineering, the post-secondary institution or the community and should be identified. However, some may be unique and will require innovative solutions and partnerships. The importance of these services will continue over the students' time at post-secondary, but will likely be most acute during their transition to post-secondary. Support services are key to Indigenous students' persistence through the engineering program, to student morale and to performance (R.A. Malatest & Associates Ltd. & The Council of Ministers of Education Canada (CMEC), 2002).

Students may need support in different facets of their lives, but example areas include: daycare, locating housing, accessing transportation, academic counselling, personal counselling, professional development, career planning or tutoring (EnviroNics Institute, 2010; Herrmann, 2012; R.A. Malatest & Associates Ltd. & The Council of Ministers of Education Canada (CMEC), 2002). For urban Indigenous students, family support has been shown as central to their success at post-secondary (EnviroNics Institute, 2010).

Labun (2002) suggests support personnel, including faculty, counselors and support staff, meet regularly to discuss each student, with greater frequency early in the students' time at post-secondary. More frequent meetings occur with students who require extra assistance, as deemed by personnel or the individual. Behaviours that solicit more frequent meetings include missing class, falling below a certain grade limit or behaviour indicative of a student not managing the transition well.

Through a responsive evaluation of a nursing access program, Curran et al. (2008) established a set of standards by which the program can determine if student support services are being delivered effectively. The five criteria for student support uptake that the authors prescribed are numbered 4a to 4e in the table at the end of this section and in Appendix I.

While the establishment of support services is critical, caution must be taken to not treat the transition to post-secondary as a means to students 'fitting in.' Rather, support services should support Indigenous students' ability to work in multiple contexts, ensuring their cultural and social capital is treated as valuable. Students who study abroad are celebrated by majority culture as having gained important cross-cultural aptitudes that should accelerate their careers. Care must be taken to not treat Indigenous students, who acquire the same cross-cultural skills, with deficit language or attitudes.

When establishing support services, an access program can measure its implementation against the consensus practices available in Table F. Examples of evidence of achievement and benchmarks are available for some parameters in the Appendix. All components and associated criteria should be considered for sample purposes.

Table F: Establishment of support services

1. Pair needs identified in assessment of student population with supports (existing or those that can be established).
2. Identify if these supports are significantly culturally appropriate, revise accordingly.
3. Establish a communication plan to inform students of support services.
4. Measure if students are sufficiently aware of support services. (Curran et al., 2008)
 - a. Student services and supports were identified and effort was made to offer appropriate level of services and programming to address needs.
 - b. Students are aware of available support services.
 - c. Students are comfortable accessing support services.
 - d. Students are satisfied with support.
 - e. Available student support is promoted.

7. Bridge Programs/Alternative Orientation

Bridge programs allow students to take a step to upgrade skills, begin first-year courses or acclimate to post-secondary culture before entering an engineering program. They range in scope from years-long to multi-week orientation programs. Bridge programs can be implemented within a student's home community, at an associated college, at the post-secondary institution where the student has been admitted or a combination of these (Herrmann, 2012; Labun, 2002; R.A. Malatest & Associates Ltd. & The Council of Ministers of Education Canada (CMEC), 2002). Community-based delivery allows for social, cultural and financial strain to be minimized (R.A. Malatest & Associates Ltd. & The Council of Ministers of Education Canada (CMEC), 2002), whereas programs at associated colleges or the post-secondary institution allows for acclimation to post-secondary culture (Labun, 2002).

Bridge programs may function simply as an academic upgrade program. Assuring students are prepared for calculus, physics or chemistry can introduce post-secondary class style, alleviate the need for those courses in admissions policies and help students step into their other classes feeling prepared (Herrmann, 2012; Labun, 2002). Other course topics include professionalism, student responsibilities, career planning or language training (Labun, 2002). Bridge programs may also help mature students return to the routine of school. These skills may alternatively be introduced during an orientation program rather than a full-scale bridge program (personal communication with ENGAP director, 2015)

At some institutions, successful completion of the bridge program may be required for entry to the rest of their engineering program, as it was at Red River College for their nursing students (Labun, 2002). Others allow students to study in their community and, during the summers, attend classes on the post-secondary institution's campus (R.A. Malatest & Associates Ltd. & The Council of Ministers of Education Canada (CMEC), 2002).

Programs that involve more advanced community engagement leverage resources within the community to deliver post-secondary services. Programs like Brandon University's Northern Teacher Education Program (BUNTEP) allowed both students and community members to be involved in the development and implementation of the program. Further, students were assisted in finding employment related to their field of study (R.A. Malatest & Associates Ltd. & The Council of Ministers of Education Canada (CMEC), 2002).

Orientation Programs

In some instances, specialized orientations, rather than complete bridge programs, may be more suitable. Alternative or additional programming to the post-secondary institution's first-year orientation may provide Indigenous students an important introduction to post-secondary. The orientation familiarizes students with important support services, assists in transitioning to post-secondary and introduces them to their future colleagues. ENGAP at the University of Manitoba introduces students to the University's electronic systems, including registration and email, as well as its library system. Students participate in a short course to assess and refresh key academic skills. Academic, personal, social and financial supports that are available to the students are introduced. Students are also familiarized with the city of Winnipeg, the rules of the University and student roles (personal communication with ENGAP director, 2015).

When establishing a bridge program or alternative orientation, an access program can measure its implementation against the consensus practices available in Table G. Examples of evidence of achievement and benchmarks are available for some parameters in the Appendix. All components and associated criteria should be considered for sample purposes.

Table G: Bridge Program / Alternative Orientation

1. Based on needs assessment, establish what professional and academic skills students require refreshers.
2. Determine feasibility and appropriate scale for delivery (community based, on campus, alternative orientation, etc.)
3. Determine consequences of bridge program / orientation completion (compulsory for entry, course credit, information only)
4. Measure students' confidence, anxiety and feelings of preparedness for "first week".
5. Ensure introduction of supports available to students.

Recommendations for Next Steps

The consensus practices described above are meant to be somewhat prescriptive in early stages. As stated in the components "Evaluation Capacity and Publication," "Community Partnership" and "Definition of Target Population," it is critical that solutions fit the peoples the programs intend to serve. It is necessary to engage with the Indigenous communities the programs hope to serve, it is important to reflect on the context the future students are likely coming from and to hire a full-time staff person dedicated to maintaining those relationships and supporting future students.

Limitations

Canadian engineering-specific literature was rarely available for this report. Therefore, resources from other disciplines and regions were used to advise on the implementation of engineering access programs. Attempts were made to avoid pan-Indigenous recommendations. It is stressed that program managers and faculties of engineering must consider their local context and the specific cultural and historical identity of the community with which they collaborate.

Although evaluation is promoted throughout this report, only minimal success was made to include decolonized evaluative approaches. It is recommended that future work incorporate and recommend decolonized evaluation procedures. Resources like the paper by Kawakami et al. (2008) give a good background and introduction to decolonizing evaluation.

Funding for access programs is not discussed in this document. Other initiatives, like the ones referenced earlier, have looked within their post-secondary institution for funds, across faculties or institutions for collaboration, to government, to industry and to private donors. It is believed that increasing evaluation capacity, which is recommended in this report, would support acquiring and sustaining funding.

Conclusion

With the implementation of Indigenous access programs, the engineering profession will be more representative of Canadian demographics. Increasing diversity in engineering will foster Canadian innovation and organizational capacity to think critically and solve complex problems.

It is recommended that faculties of engineering and applied science leverage the advice found in the seven consensus practices in this report. Throughout implementation, access program staff should institute performance measures and evaluation. Efforts should be made to decolonize evaluation processes, when appropriate. While evaluation can assist in procuring funding, it will also help others who intend on promoting access at their institutions and will improve the program for students.

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