

The Experiences of Indigenous Engineering Students Enrolled in an Access Program

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Abstract

The Price Faculty of Engineering's Engineering Access Program (ENGAP) at the University of Manitoba is the longest-running engineering-specific access program in Canada, operating since 1985. The program has over 150 graduates and is widely considered to be successful, while similar programs have historically struggled to gain traction and persist. This qualitative research study explores the experiences of Indigenous engineering students enrolled in ENGAP. Four ENGAP graduates and I told our stories in narrative interviews with the goal of learning of and from our experiences. Métissage informed the theoretical, conceptual, and methodological aspects of my research in this way: I 1) blended both Indigenous and Western frameworks, and I 2) included stories of the four participants together with my own experiences being an ENGAP student and as a participant-researcher to create several thematic "braids" in which all our views were woven together. Themes of educators, community, identity, belonging, giving back, support, and challenges arose in the interviews. I analyzed and discussed these findings using frameworks based on relationality and holism, and then comparatively, to the relevant literature. Findings corroborated several ideas from the literature while providing detailed insight into the specific context and nuances of the participants' experiences in the ENGAP program and its community. The most prominent of these were the importance of relationships between participants and staff within the access program, the impact on participants when their peers left the program, and the complex relationships participants navigated between ENGAP and The Price Faculty of Engineering. Recommendations for ENGAP, The Price Faculty of Engineering, and prospective/burgeoning access programs are outlined, with emphasis on addressing non-completing access program students with the remaining access program

students, investigating the relationship and potential cultural-divide between ENGAP and The Price Faculty of Engineering, and calling for further research with ENGAP students who are in, have completed, and do not complete the program.

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Chapter 1: Introduction

Education remains an issue among the Indigenous peoples of Canada centuries into the colonization of Turtle Island (North America). Post-secondary education is no exception. Indigenous students are extremely underrepresented in post-secondary education, especially in STEM (Science, Technology, Engineering, Mathematics) programs. Equity, diversity, and inclusion have become prominent topics in discussions of enrollment in post-secondary education (President's Task Force on Equity, Diversity, and Inclusion, 2020), and the Truth and Reconciliation Commission of Canada's *Calls to Action* (2015) includes calls to eliminate educational gaps between Indigenous and non-Indigenous Canadians (Call 7) and to fund the integration of Indigenous knowledge in post-secondary education (Call 62.2). An increase in the representation of Indigenous engineers would be beneficial to both the profession and Canada at large, as it would create opportunities for people with diverse perspectives to solve problems while addressing skill shortages (Ricci, 2016). In this introductory chapter, I will provide relevant background on the proposed study, detailing the significance and objectives of the proposed research.

Indigenous Students in Canadian Postsecondary

Indigenous people in Canada (being people of First Nations, Inuit, or Métis background) have historically been less likely to enroll in postsecondary education and obtain a degree (Deonandan, Janoudi, & Uzun, 2019). Colonialism and all its systems (e.g., Indian Residential School) have created a legacy of distrust in institutions among Indigenous populations and continue to suppress Indigenous ways of being, knowing, doing, and relating in higher education and society in general. This has led to the underrepresentation of Indigenous peoples in postsecondary education and by extension in many professions.

Indigenous peoples account for 4.9% of Canada's total population (Statistics Canada 2017), but only 0.6% of students in undergraduate engineering programs and 0.7% of undergraduate engineering degrees conferred in 2019 (Engineers Canada, 2020). Proportionally, the University of Manitoba (U of M) has a larger population of Indigenous students, with Indigenous students making up 8.6% of the entire student body at the U of M and accounting for 6.4% of the student body in the Price Faculty of Engineering (PFofE) in Fall 2019 (Office of Institutional Analysis 2020). These figures have grown slowly but steadily in the years preceding 2020 and indicate a higher level of Indigenous representation within the U of M's student body compared to the figure in the 2016 Engineers Canada report. Furthermore, in 2019, approximately 4% of engineering degrees conferred belonged to Indigenous students, which is again, higher than the national census. However, 17% of Manitoba's population is Indigenous, the highest of any of Canada's provinces (Statistics Canada, 2016), demonstrating that relative to the total population, Indigenous students are still underrepresented in post-secondary education at U of M. Additionally, the figures for U of M corroborate the fact that engineering, along with other STEM fields, tends to have a lower level of Indigenous representation than other post-secondary programs—for example, in Fall 2019 the Faculty of Arts student body had 461 students who self-identified as Indigenous, representing 17.9% of that faculty's student body—approximately four times the representation of Indigenous students in engineering at that time (Office of Institutional Analysis, 2020), whereas the Faculty of Science was comprised of 10.6% Indigenous students at that time, a higher representation compared to the PFofE, but still lower than the Faculty of Arts (note: statistics used for this section predate 2020, as enrollment statistics are volatile in the time since the COVID-19 pandemic, which began in Spring, 2020).

Indigenization Efforts in Engineering

At the national level, the calls for Truth and Reconciliation exist to improve relationships between settler and Indigenous populations. As the *Calls to Action* (2015) are intended to provide overarching policy recommendations, some calls to action are relevant to both engineering and postsecondary education. As a result, there are efforts to address the *Calls to Action* at several levels of engineering regulation and education.

Engineers Canada, the national regulatory body for the engineering profession, has published reports on Indigenous peoples' access to postsecondary engineering programs (Ricci, 2016), Indigenous representation in the profession (Engineers Canada, 2021b), and addressing truth and reconciliation (Wolf & Martinussen, 2022). These reports aim to introduce Canadian engineers to Indigenous ways worldviews, acknowledge the impact of engineering projects on Indigenous populations, and emphasize the importance of sustainable development. Engineers Canada also provides a list of resources for Indigenous students and professionals to learn about reconciliation and land acknowledgements (Engineers Canada, 2021a).

Indigenous initiatives in Canadian post-secondary engineering programs come in many forms. Such initiatives include outreach programs to attract Indigenous students to engineering; research related to Indigenous initiatives; strategizing planning for Indigenizing engineering; creating faculty positions for Indigenous scholars; incorporating Indigenous knowledges into engineering curricula; engaging with Indigenous Elders; creating Indigenous engineering student organizations; training and workshops for faculty relating to Indigenous culture and practices; training students with Indigenous knowledge and skills; acknowledging Indigenous cultures; and access programs for supporting Indigenous students (Seniuk Cicek et al. 2020). Many institutions

across the country are implementing one or more of these to varying extents, with most such initiatives being implemented recently.

Provincially, Engineers Geoscientists Manitoba (EGM) is the regulatory body for engineers and geoscientists in Manitoba. End E-5.1, the Indigenous Professionals Initiative, is the motion set forth by EGM to increase the number of Indigenous engineering and geoscience professionals in Manitoba (Everett, 2020). To accomplish this increase in representation, barriers in education, student support, and licensure must be addressed. Additional goals of End E-5.1 are improving the perception of engineering professionals, advocating for funding of Indigenous support programs in engineering, and collaborating with Indigenous communities. It is imperative that an understanding of Indigenous histories and colonization in Canada, consultation and engagement with Indigenous peoples, and Indigenous knowledges is cultivated among EGM members. By providing this information, a step toward reconciliation can be made by engineering practitioners in Manitoba.

The PFofE has undertaken several Indigenization initiatives that are currently underway. These include but are not limited to the creation of a course on decolonizing and Indigenizing engineering, first offered in 2022 as an elective that fulfills the compulsory Indigenous Knowledge (IK) credit recently made mandatory for all engineering students in the Biosystems, Civil and Mechanical Engineering programs (Seniuk-Cicek, Herrmann, & Friesen, 2021; Seniuk Cicek et al., 2022). The PFofE has also appointed an Elder-in-residence, providing the students with access to an individual who can provide them with guidance and knowledge (Seniuk Cicek et al., 2022). A long-running initiative that promotes Indigenous inclusion in the faculty is the operation of the Engineering Access Program (ENGAP), which provides access to the PFofE for

Indigenous students who may not otherwise qualify due to insufficient grades or a lack of requisite courses and aims to support those students holistically through their degree.

The Engineering Access Program at the University of Manitoba

The Engineering Access Program (ENGAP) has operated since 1985 within the U of M's PFofE. ENGAP waives enrollment prerequisites for engineering to bolster the recruitment of Indigenous students to the faculty (Herrmann, 2014). To account for this, ENGAP offers upgrading courses in many fundamental subjects to prepare students for their engineering degree requirements. Additionally, the program offers academic, social, financial, and personal support. Herrmann (2014) lists five primary aspects of the program that are crucial to its success: recruitment; an interview process for vetting prospective students; an orientation leading up to the beginning of the program; upgrading courses to prepare the students for first-year courses; and the numerous supports listed previously. ENGAP enrollment peaked in 2015, having 81 students enrolled in the Fall term (Office of Institutional Analysis, 2016b). At that time there were 98 self-declared Indigenous students enrolled in the PFofE (Office of Institutional Analysis, 2016a). This means that at its peak, ENGAP's students represented most of the Indigenous student population in the PFofE, with 81 of 98 Indigenous students being enrolled in the program. This points to the impact the program has on the Indigenous engineering student population and its importance in including Indigenous students.

Significance of the Study

What distinguishes ENGAP from other support programs for Indigenous students in Canadian Universities is its longevity, its holistic approach to student support, and its position as a program oriented toward the specific degree/profession of engineering. Because ENGAP holds such a unique position among access programs and other support for Indigenous students on

account of its persistence and success in a field with historically poor Indigenous representation, the program has been used as a model informing similar access programs in engineering at other universities (e.g., Queens University and University of Saskatchewan). Despite ENGAP's success, there has been no formal analysis of ENGAP or research designed to listen to and learn from ENGAP student experiences. As well, generally, literature on Indigenous engineers and Indigenous engineering students in Canada is sparse. As such there is ample opportunity to learn from ENGAP and its students, to gain insight into what the program is doing, how it is doing what it is doing, how the program influences Indigenous engineering students, and how students experience ENGAP and the faculty of engineering.

The aim of my research was to listen to the stories of students enrolled in ENGAP to gain an understanding of their experiences. This understanding included ENGAP students' motivations for joining the profession, their experiences through their post-secondary journey, and their thoughts and experiences in and related to ENGAP and the PFofE where ENGAP is housed.

My Positionality

Among Indigenous peoples, the concept of relationality is significant. Where someone comes from and the people one is related to are often included in one's introduction to another as a means of positioning oneself. Shawn Wilson (2008) emphasizes the importance of introducing oneself and discussing your relationships to position yourself as a researcher. Kovach (2021) refers to this as self-location and stresses its importance in acknowledging individual perspectives. Here, I self-locate to contextualize my connection to the research.

My name is Reed Forrest. I am a master's student at the U of M, born, raised, and doing this work in Winnipeg, Manitoba, on Treaty 1 territory, the original lands of Anishinaabeg, Cree,

Ojibwe-Cree, Dakota and Dene peoples, and the National Homeland of the Red River Métis. I am Métis from my father's side but was raised with my mother's Mennonite background as the most prominent culture and value system within our family. As a result, I would consider myself to be someone who has been reconnecting with my Métis heritage since I was a teenager, which is a complicated and ongoing process.

I graduated from Biosystems Engineering in 2020 and was enrolled in ENGAP for the duration of my undergraduate studies. I was a direct entry student into the PFofE, but met ENGAP's program director, Randy Herrmann, prior to enrolling. After hearing about the program from him I was interested in joining ENGAP as an opportunity to engage with that community. In ENGAP I made friends with many students and was able to connect with my Métis background in a way that had not felt like an option for me until I entered the ENGAP community. By being around other students and staff who had similar backgrounds and who were also reconnecting, I felt I was able to embrace my Métis background and learn about myself. Having those connections and that sense of community made my existence as a Métis person feel more realized.

Through my years as an ENGAP student I gained an understanding of that community and built relationships within it. Those relationships naturally inform my view of that community and this project—without my connections to ENGAP I would not be performing this study or writing this thesis. These relationships influence how I heard, understood, and interpreted the stories of the participants in this research, and how I told my own story. Given that I did this work having these connections to these communities and created this work alongside people who I know, I am aware that there is a great deal of responsibility for me to do the work as well as I can.

I was a part of the ENGAP community; this is what drew me toward this research. It is important for me to position myself because of this relationship. It was my hope and my goal that my relationships within ENGAP would help me do work that would be useful for this community, and that I would embrace my relationships within the ENGAP community in a way that would produce meaningful work.

I cannot be separated from the work and need to embrace that my perspective influences this work. I performed this study as a participant-researcher, with my participation coming in two forms: one as an interview participant, by telling my story in response to the questions in the study's narrative interview guide; and by braiding together the narratives of us five participants (my own words included), thus filtering all our experiences and perspectives through my own interpretation. In this way, I make myself explicit in this research.

Scope of the Study

In this study, I explored the experiences of recent graduates of ENGAP. Four ENGAP graduates were interviewed using a narrative interview guide and conversational approach. The interviews aimed to elicit stories relating to the participants' experiences in ENGAP and in the PFofE. These stories became the units of analysis from which I identified, explored and interpreted the lived experiences and the cultural factors influencing those experiences (Moen, 2006).

Purpose

The purpose of my study was twofold:

1. To elevate the voices of ENGAP students in the PFofE at the U of M.
2. To identify and analyze the phenomena and cultural factors within the participants' narratives.

The first purpose was most fundamental to my study, as the research was exploratory in nature. I completed this by co-creating and dispersing a narrative of the experiences of the ENGAP graduates participating in the study with my experiences and perspectives as a participant-researcher. My second purpose was predicated on the fact that this is the first study of a unique group of students with a rich history—there is immense potential for learning and for further research with Indigenous engineering students and ENGAP. Thus, my study aims to hear what lived experiences and aspects of the socio-cultural environment are impactful to students in this community. I interpreted my findings and provided recommendations intended to stimulate improvements to ENGAP and to the PFofE to better support ENGAP students in engineering education.

Chapter Summary

In this chapter I introduced the topic, scope, and significance of my study, and located myself as an ENGAP graduate, a Métis man, and a participant-researcher. There are five chapters to follow. In Chapter 2, I review the literature on Indigenous post-secondary students' experiences, engineering culture, access programs and other institutional support systems for Indigenous students, and topics relevant to my study's methodology. In Chapter 3 I outline my research methodology, which is informed by and honours an Indigenous research paradigm and methodologies. Chapter 4 is a collection of the participants' and my words that I organized into braids to interpret the various themes that were prominent in the narratives. In Chapter 5, I analyze these findings through multiple frameworks to share the meanings of the stories told by the participants. In Chapter 6 I conclude this study and provide recommendations for ENGAP and the PFofE, which may be relevant to others with intentions of establishing similar access programs.

Chapter 2: Literature Review

In the literature review for this research study, I include an exploration of barriers and frictions for Indigenous students in post-secondary education; engineering culture; and post-secondary institutional support for Indigenous students. I chose these topics to draw from research on Indigenous students' success, retention, attrition, and experiences to contextualize why ENGAP exists, what the program does for students, and how Indigenous students have experienced the program. This literature informed my study's conceptual frameworks as well as my analysis and discussion of the findings. Literature from the Canadian context is sparse on some of these topics, and Canadian access programs have seldom been researched, much less in ways that do research *with* those people rather than on them. Thus, I include literature from the United States. In this regard, much of the literature may be applicable only in a broader sense (for example, not all the literature is related to engineering, and some literature involves Indigenous peoples and bureaucracies from the United States, which operate differently than in Canada). In addition to academic publications, government documents and grey literature, I include documents from engineering organizations and post-secondary institutions in this review.

In the first section of this literature review I draw on topics, concepts, and studies in areas relating to Indigenous students' experiences, engineering culture, and academic support for Indigenous students. In the second section of this chapter I review the histories and significance of some of the theories, methodologies, and worldviews that underlie my study. These include narrative research, story as a research method, Indigenous research design, and Indigenous Métissage.

Part 1: Indigenous Students' Experiences in Postsecondary

Indigenous Worldview and Pedagogies

To preface the barriers faced by Indigenous students in postsecondary and practices in engineering education (and post-secondary education more generally), I consider distinctions between Indigenous and Western ways of knowing. I briefly define and contrast western and Indigenous educational context and pedagogies, which are the philosophical underpinnings of teaching and learning, as well as worldviews, which are the fundamental beliefs and values of an individual or group. In doing this, it is also important for me to acknowledge that there are copious Indigenous peoples and communities in Canada and the world, each with their own ways of being, knowing, doing and relating, and who are often generalized, or pan-Indigenized. There can be similarities between peoples, as will be discussed in this section, but it is important to recognize that scholarly literature on Indigenous peoples tends to pan-Indigenize beyond those similarities. For the purpose of providing a general context for my research, I report on this literature here, while also acknowledging and cautioning that these are generalizations, and should be recognized as limited. This includes my use of the term, “Indigenous”, which is a broad term that in Canada, includes First Nations, Métis, and Inuit, and which I recognize, works to pan-Indigenizing peoples.

Generally, Indigenous worldviews are based on spirituality, holism, and relationality. A common symbol among some Indigenous peoples of Turtle Island (North America) is the holistic Medicine Wheel (or Sacred Hoop). The Medicine Wheel represents the four directions, the four seasons (by extension the cyclical nature of time), and life's mental, emotional, physical, and spiritual aspects, which are all connected within the wheel, as they are connected for us as people and for every living thing (Lane et al., 2004).

Relationality is the fundamental belief that all things are interrelated—people, places, things, ideas, and the cosmos (Wilson, 2008). By contrast, Western society is predicated on individualism (Holmes, 2014). Styres (2017) describes the Western approach to thinking as philosophy focused on rationalization, where every idea must be reduced to its fundamental parts and every feeling or phenomenon must be explained. This extends to the concept of self. In an Indigenous ontology, a person is defined by their relationships — self is found in-relationship, contrasting the Cartesian notion that the self is rooted in consciousness (Wilson, 2001a; Styres, 2017).

This difference in worldviews extends to pedagogical approaches. Generally, Indigenous pedagogies draw from the fundamental concepts of relationality and holism, embrace spirituality, and tend to be experiential and process-oriented. Examples of Indigenous pedagogies applied in and include culturally responsive pedagogies (Foster & Jordan, 2014; Skrivanos, 2017) and Land-based pedagogies (Fellner, 2018). A culturally responsive approach to teaching centres the strengths of the students and helps develop those skills (Skrivanos, 2017). Teaching strategies that can be culturally relevant to Indigenous students can include storytelling, talking circles, concept mapping, experiential learning, and cooperative learning (Ledoux, 2006).

According to Battiste (2002), Indigenous knowledges and pedagogies are fundamentally experiential and personal—there is an emphasis on what learners are interested in and *how* they learn, and the differences between learners are acknowledged and respected by the teacher(s). This contrasts the homogeneous view of students in Western pedagogies, where students are typically instructed, assessed, and evaluated in large groups with less concern for students' dispositions or what Battiste (2002) calls “authentic experiences” (p. 18) in the learning environment/process. Generally, in Indigenous education, knowledge is created by doing (Cajete,

2004). Generally, Western pedagogies tend to lack consideration of relationality and encourage a competitive mindset that is consistent with societal expectations (Holmes, 2014).

With these differences in mind, I will now review barriers for Indigenous students, and the relationship between Indigenous students and engineering (both in terms of education and industry).

Barriers and Frictions for Indigenous Students

The literature on Indigenous post-secondary students describes several barriers that could dissuade students from enrolling in engineering, and frictions, which are issues that are ongoing throughout the program. Chichekian & Bragoli-Barzan (2021) identified three categories of barriers: social, cultural, and pedagogical. Their framework lacks the inclusion of resource-driven barriers. This could be considered a fourth category, which I will call logistical barriers. This framework of four primary categories of barriers and frictions describes, in basic terms, the most common factors that could stop or dissuade an Indigenous person from entering university or lead those students' attrition once they are in post-secondary programs. Many of these barriers are related and directly connected to barriers from other categories, indicating the complexity of the issues. These issues apply more generally to post-secondary and are not strictly engineering-related, but bear mentioning.

Logistical Issues. Financial considerations can function as a barrier for students (Mendez, Mendoza, & Malcolm 2011; Mosholder & Goslin 2013; Tachine et al. 2017; Walton et al. 2020). The costs of being a student can be overwhelming on top of the cost of living, compounded by the fact that it can be difficult to maintain a steady income while pursuing a post-secondary degree, especially in a subject like engineering where heavy course loads are commonplace (Kuley et al., 2017). It is only logical, then, that financial stresses pose a barrier

for many students and can be a major determinant of success or failure. In the literature, this barrier came in many forms and was compounded by Indigenous students needing to re-locate to urban centres where postsecondary opportunities exist. Logistical barriers also commonly extend to finding adequate housing and taking care of children (Walton et al. 2020).

Social Issues. Racial discrimination can come in many forms, including substandard expectations from instructors, the use of racist language, and stereotyping (Mosholder & Goslin, 2013). In the literature, it was observed that racial discrimination is most prominent among those students with a clear sense of their culture and identity. Derogatory stereotypes have frequently been cited as a source of friction for Indigenous students on post-secondary campuses (Cech, Smith, & Metz, 2019; Curry & Deboer, 2020; Embleton, 2012; Mosholder & Goslin, 2013; Scott, 2021; Tachine et al., 2017). Experiencing such treatment from peers or faculty can be harmful to a student and negatively impact their sense of belonging and thus their motivation to persist within a postsecondary (e.g., an engineering) program. Exoticized othering comes as another of cultural process of disadvantage (Cech, Smith, & Metz, 2019). This process involves using language and ideas that denote the Indigenous students as ‘others’ while exoticizing what the dominant culture perceives as the ‘expected’ behaviour and traditions of Indigenous students. Delegitimation is another process of disadvantage, in which Indigenous students’ traditional knowledges are treated as irrelevant (and even dead or extinct) (Cech, Smith, & Metz, 2019). This process of delegitimation poses epistemological threats to Indigenous students’ ways of knowing, as historically Indigenous ways of knowing, being, and learning have been suppressed, and the exclusion of those ways in postsecondary education serves to perpetuate that process. Assimilative pressures of cultural hegemony are the final process described, where Indigenous students are expected to assume the behaviours of the dominant culture. This leads to tension

when one must reconcile these disparate ways of thinking and acting, which can be stressful and anxiety-inducing. Jackson (2003) found racism to be a common issue within both curricula and in the worldviews of instructors and the student body. Indigenous students describe feelings of isolation, stemming from a disconnect in both personal relationships and their sense of place (Tachine et al., 2016). Examples of social challenges observed by the educators included the destabilizing effect of coming to the institution from a home community, oftentimes coming as the only student from that community. Challenges of interacting with non-Indigenous students was also noted, as incoming Indigenous students were observed to struggle to open up to unfamiliar people (Chichekian & Bragoli-Barzan, 2021).

Cultural Issues. Transitioning from a home community to a post-secondary institution can be a substantial challenge, as this typically involves a major upheaval in terms of both setting and culture (Nardozi, 2011; Walton, 2020). Smith et al. (2014) found that Indigenous students have community-focused goals that are not aligned with the culture of engineering programs. There is a common sentiment among Indigenous students that their goal in post-secondary education is to gain skills and knowledge to give back to their community (Smith et al. 2014; Tachine et al. 2017; Williams & Shipley, 2018). There is pressure to live up to expectations set by people in their communities. This relates to the motivation to ‘give back’ to their communities (Chichekian & Bragoli-Barzan 2021). While there is generally a desire in Indigenous communities for people to be educated, there are also tensions dissuading community members from enrolling that arise from a distrust of Western institutions due to histories of mistreatment (Nardozi, 2011).

The different value systems between many Indigenous people and that which is perpetuated in engineering education are also typically incongruent. This incongruity can be a

source of tension for students who are situated outside the dominant culture. Jackson et al. (2003) cited a cultural dissonance for Indigenous students rooted in conflicting pressures to be successful in postsecondary while maintaining their culture and identity. There can be a feeling of cultural discontinuity from the process of adjusting to urban and campus environments (Walton et al. 2020). For Indigenous students, an internal cultural conflict can be experienced when their traditional values clash with postsecondary culture, leaving them feeling isolated or out of place (Mosholder & Goslin, 2013). Acculturation, or assimilation to the dominant culture, was found to stem from encounters during which Indigenous students' ethnicity was misunderstood or disregarded (Rodriguez & Mallinckrodt, 2021). Indigenous students may experience anxiety because of interactions with misinformed or hostile people in the postsecondary environment (Rodriguez & Mallinckrodt, 2021). Cultural challenges also include Indigenous students experiencing culture shock when coming into a new community and struggling to relate to their studies as the learning is typically not experiential in a way that the students might be accustomed to. This leads to pedagogical challenges, which are discussed further in the next section. Finally, a deficit of cultural capital is also cited as a barrier, where coming from a community with different etiquette and expectations leads to difficulty navigating the new environment (Mosholder & Goslin, 2013).

Pedagogical Issues. Transition anxiety focuses primarily on adapting to the environment of the postsecondary institution and to the style of learning used in large class sizes (Rodriguez and Mallinckrodt, 2021). Some Indigenous students have been found to be unfamiliar with the approaches to learning and studying that are needed to thrive in a postsecondary environment (Chichekian & Bragoli-Barzan 2021). These skills and study habits ranged from preparing for tests and assignments to lacking certain prerequisite knowledge or courses, to struggling within

the rigid bureaucracy of the postsecondary institution. These challenges stemmed from the kind of education available in students' home communities, and more broadly, a distinct worldview. Indigenous students might be unprepared to transition to post-secondary studies due to the quality/availability of education in their community, potentially lacking offerings of prerequisite courses for a program like engineering. Jackson et al. (2003) found Indigenous students commonly traversed nonlinear paths through postsecondary, studying at multiple institutions and struggling academically at times. This aspect of the students' stories was reflective of a difference in culture, gravitating toward a cyclic progression through postsecondary and approaching studies in a manner less competitive than is typical of western college or university students. One of the primary themes related to colonized education in Canada was colonizing through testing cultures (Mullen, 2019). Poor academic preparation due to the quality of available education and other issues, including financial, self-esteem, and racism, makes it difficult for many Indigenous students to excel in high-pressure testing situations (including standardized testing). By extension, this creates additional barriers for those students when applying for higher education. Additionally, many Indigenous students feel their high school teachers expected them to do poorly in both high school and post-secondary, leading to a feeling of being unsupported by their educators (Restoule, 2013).

Conceptual Models for Retention/Persistence of Indigenous Students in Postsecondary

Related to the concept of access and barriers is that of retention, which has been modelled in attempts to understand what influences student persistence. Tinto's (1975) model of student persistence has long been widely accepted. Tinto's model states that social integration, which happens through interaction with peers and faculty, and academic integration, which relates to grades and intellectual development, but fundamentally relies on having values aligned with the

institution. Tierney (1992), in a critique of Tinto's model, took issue with many of Tinto's assumptions, stating that his model does not adequately consider the different circumstances for minority students, and that focusing on integrating minority students according to Tinto's model could be harmful. Lopez (2018) developed a model for the persistence of Indigenous post-secondary students. This model builds upon the seminal (and more generalized) persistence models of Tinto (1975) and Bean (1980). Lopez's model includes three primary factors influencing academic success and persistence: family support, institutional support, and tribal community support. Rodriguez & Mallinckrodt (2021) used grounded theory to form a model of challenges and coping mechanisms for Indigenous students transitioning to post-secondary. The model addresses concerns of transition anxiety and acculturation and stresses the significance of family and home community support at the beginning of the transition. Becoming a part of communities on campus and embracing their own culture were important steps in completing their transition. The community and cultural factors within the post-secondary setting were crucial to the sense of belonging of the students, which in turn impacted their success.

Issues in STEM, Engineering Culture and Engineering Education

It is imperative to consider the cultural elements specific to the institution to understand the significance of an access program like ENGAP. Engineering tends to have a distinct culture both in post-secondary and in the workplace (Flemming, Johnston, & Thompson, 2018). There is reason to believe these cultural tendencies exacerbate the issues that Indigenous students already have in a post-secondary setting, which could explain the relatively low representation of Indigenous students and professionals in engineering (Cech et al., 2017). Engineering programs (and STEM programs more generally) present their own set of issues for students. These barriers

and challenges will be explored here, first for all students, and then specifically, considering Indigenous students.

Cech (2014) argues that there is a culture of disengagement among engineering students, which runs counter to the goal of the engineer to improve conditions for the public. This culture of disengagement stems from three ideological factors: one of these is depoliticization, which is the removal of social and political concerns from prioritization within the value system; another is the dualism between technological and social elements, where siloing these elements results in complete prioritization of technical design while deeming social consideration to be outside the scope of the engineer's responsibilities. Finally, there is the existing meritocratic structure of contemporary society, which is especially prominent in disciplines such as engineering, and which ignores the inequality experienced by many individuals rooted in social systems. The idea that students simply need to work harder to succeed is pervasive in engineering education; this assumption marginalizes students from underrepresented backgrounds and ignores the challenges they face as minorities (Eastman, 2019). It is commonplace for instruction in engineering education to disregard social factors (including social justice and inequity) on the basis that the field is ostensibly a meritocracy and that politicization is inappropriate (Cech, 2013).

Barriers for engineering students can include inflexibility in course scheduling and program length, lack of academic and emotional preparedness, the first-year curriculum, and suboptimal quality of instruction (Kuley et al., 2017). Engineering students have expressed that the engineering curriculum was not designed for how students learn best, and secondary education was not adequate in preparing students for a postsecondary program like engineering (Kuley et al. 2017).

Defining the culture of engineering education is fundamental when investigating the challenges associated with inclusion within those educational spaces. Ekoniak (2013) argues that engineering culture tends to perpetuate dualistic thinking—for example, hard lines are drawn between approaches that might be people-focused, versus those that are technologically focused. In doing so, dichotomies are created. Within these dichotomies, elements such as technology, and perceived objectivity are valued over people and their emotions—things that might be considered subjective and thus unscientific. Ekoniak (2013) supposes that these dualisms amplify binaries within social spheres, resulting in boundaries being drawn between groups, for example, the boundary between masculinity and femininity, which results in an environment that can be challenging for women. Comparable dualisms may exist as drawbacks to other marginalized groups as well.

Engineering faculty are commonly situated in the majority culture, and these educators often lack an understanding of inclusive teaching practices (Eastman, 2019). These elements of engineering education culture ultimately create an environment that can be difficult for some students to feel comfortable and immersed in. These institutional barriers ultimately contribute to the underrepresentation of certain populations in engineering, including those of Indigenous background (Eastman, 2019). Cech et al. (2017) describe an “epistemological dominance” within STEM programs including engineering. In this case, epistemological dominance is when only the Western scientific view of knowledge, or the scientific method, is viewed as legitimate, while alternative ways of knowing are considered illegitimate. This dominance further marginalizes students of Indigenous background by delegitimizing Indigenous epistemologies, using pedagogical approaches that are inconsistent with Indigenous ways of knowing, and perpetuation of epistemological imperialism. Epistemological imperialism stems from the effect of regulatory

bodies on how Indigenous professionals practice within their home communities, forcing those individuals to act in ways that threaten their communities' ways of life. Because of epistemological inconsistency (a difference in values and worldview) with engineering in some Indigenous communities, becoming involved in engineering or the sciences is frowned upon, which contributes to underrepresentation in these areas (Williams & Shipley, 2018).

Kuley et al. (2015), in their review of the literature on student persistence in engineering programs, note the importance of institutional climate for students, especially women and minority students. Engineering culture is a significant factor in shaping this climate. The researchers note the "weed-out culture" that is prevalent in engineering, where the arduous nature of engineering programs is designed specifically to allow persistence for the students who are perceived to be best suited to the role of the engineer. However, this culture can be one contributing factor in creating a homogeneous population of engineers who are not necessarily the ideal candidates but are highly motivated and can ignore environmental factors in their education. Inevitably, this type of culture will perpetuate a narrow view of who is suited to be an engineer and obtain a degree.

These issues can be further compounded for individuals whose worldviews are not already aligned with that of post-secondary institutions and the engineering industry. Indigenous students tend to struggle to find a sense of belonging in engineering programs (Hanson, 2020). Indigenous engineering students are more likely to prioritize communal work goals compared to other demographics (Smith, 2014). This can create feelings of uncertainty and lack of belonging among those students. Rios et al. (2021) performed a qualitative study on the barriers and catalysts that shape Native American students' experiences in engineering. Twenty-nine Native American undergraduate students from three separate universities in Arizona were interviewed.

The findings were that Lopez' (2018) persistence model was mostly relevant to the participants' experiences and feelings, with family support and institutional support being major catalysts for their success. Tribal support, however, was perceived as a barrier, as the participants felt there was a lack of support in terms of employment opportunities provided by their tribal communities. Also, the students expressed serious concern regarding how their work as engineers would impact the environment. Those concerns negatively affected their motivation to work in the industry.

Institutional Support for Indigenous Students

Considering the dissonance between engineering culture and Indigenous knowledges and value systems in post-secondary education and the systemic challenges faced by Indigenous students, the need for personnel and resources capable of bridging those gaps becomes apparent. Institutional supports are among the most influential factors in the persistence of Indigenous students in post-secondary (Rios et al. 2021). Several of the studies included in the section on barriers for Indigenous students cite the importance of structured support for Indigenous students to succeed (Cech et al., 2017; Cech et al., 2019; Jackson et al., 2003; Rios et al., 2021; Rodriguez and Mallinckrodt, 2021; Smith et al., 2014; Tachine et al., 2018; Walton et al., 2020; Williams and Shipley, 2018). While the significance of support programs is often mentioned in such studies, the specifics of what kind of support is being provided and how they are impacting the students' experiences are rarely explored in-depth. The most prominent themes in the literature that can improve Indigenous students' persistence include skill development, family support, appropriate role models, financial aid, and a culturally sensitive environment (Mosholder & Goslin, 2013). There have also been many approaches to supporting marginalized students implemented in post-secondary institutions, drawing from numerous paradigms and operating at

various levels of bureaucracy. These supports can be financial, educational, personal, or cultural in nature. Specific examples of supports for Indigenous students include mentoring (Chelberg and Bosman, 2020; Windchief & Brown, 2017), tutoring (Martin & Seguire, 2013), Indigenous student centres (Tachine et al., 2018) and bridge/transition programs (Lee et al., 2014).

Indigenous student centres are valuable in creating a comfortable environment for Indigenous students and are necessary for balancing out the sense of invalidation that is often caused by the post-secondary institution (Tachine et al., 2017). When looking at programs in engineering education and in post-secondary more broadly, bridge programs and Indigenous student centres appear to be far more common than access programs such as ENGAP.

Bridge programs or transition programs, often completed over the summer prior to initiation of post-secondary studies, can provide incoming students with experiences and skills that will assist in the transition to postsecondary, and can facilitate the creation of a sense of community among students (Lee et al., 2014). Such experiences and relationships could play a role in helping marginalized students gain a foothold in engineering.

Specific types of support may be needed for individual students, depending on the challenges they face in their transition to post-secondary, whether that involves moving from a remote community or reserve, familial concerns, or the fact that they have not attended post-secondary before (Ricci, 2016). A holistic program aimed specifically at Indigenous engineering students, such as an access program, could provide a diverse array of support. Access programs such as ENGAP could be capable of filling that role and might even be considered an extrapolation or synthesis of the roles played by bridge programs and Indigenous student centres.

Studies on Support Programs for Indigenous Students

The objective of the following section is to highlight approaches to supporting Indigenous engineering students in post-secondary. Collecting literature that details concepts and frameworks for supporting students, as well as pieces highlighting existing programs and initiatives and research on the significance or efficacy of such programs and initiatives, is valuable in situating the practices of ENGAP and the PFofE more generally.

Gallop & Bastien (2016) found that in Indigenous-centred education programs, peer support, positive instructor feedback, and clear expectations were valued by students. Embleton's (2012) thesis explored the supports and experiences that helped Indigenous students be successful in postsecondary education. Having clear goals and preparation going into postsecondary was found to be significant. Being able to access special supports and forming meaningful relationships within the postsecondary community were also impactful. Embleton (2012) theorizes that having these supports and experiences fosters a sense of belonging that is crucial for students coming into postsecondary.

Harper's (2007) thesis focused on Indigenous students enrolled in the Special Pre-Medical Studies Program (SPSP) at the University of Manitoba. Student autobiographies were analyzed to determine factors that influenced student perseverance and attrition within the program. Harper (2007) discussed themes including family history, high school academic attainment, program supports, financial issues, long-term goals, and giving back to community. The findings indicated that the impact of the academic, personal, and financial supports provided by the SPSP were emphasized only by some students – the community aspect of that program was more commonly cited as the reason for student enrollment rather than direct support or resources. Furthermore, it was found that mentioning the program in the autobiography was not a

predictor of whether that student completed the program or not. This could suggest that students with more family support and stable home lives did not uniformly require the program supports to be successful.

Martin & Seguire (2013) studied an initiative to create an Indigenous nursing cohort at the University of Manitoba. They found that having a consistent group of peers increased support among those students and having the same group of instructors across courses enabled relationships and trust to form. Supplemental tutoring, offered by those same instructors, also bolstered the students' understanding of crucial material. Continuity of administrative and advisory personnel was also emphasized within that program, allowing the students to become familiar with the staff, which would increase the likelihood of the students seeking support from those staff.

Access Programs

In the 1960s, interest in increasing accessibility to postsecondary for marginalized people burgeoned, resulting in programs such as the University of Toronto's Transitional Year Program launching in 1970 (Braithwaite, 2003). This program, providing support not just to Indigenous students or engineering students but generally to marginalized students, was the first access-type program to begin operating in Canada, with more institutions following suit promptly.

Access programs in Manitoba date back to the 1970s. These programs are founded on principles of "equality of access" and "second chance", which are ideas built on the foundational philosophy that all people should have the opportunity to be educated if they so desire, and that past failures (in education or otherwise) should not disqualify prospective students from getting such an opportunity (Alcorn & Levin, 1998). Alcorn and Levin (1998) mapped the original model for access programs. This model includes factors of recruitment, selection, integrated

student supports, financial support, academic support and remediation, and personal supports. These elements have defined the operation of access programs in Manitoba for decades, and Herrmann's (2014) description of the ENGAP program confirms that this model is indeed the basis for ENGAP.

Access programs operate on the basis that if Indigenous students are afforded the opportunity to get into the area of study they desire and are provided with some support they will be successful, even if they are in a program that they otherwise might not have been able to enroll in due to insufficient grades or missing pre-requisites. Access programs do not alter exit criteria—the degree requirements are no different than for any student—but entrance criteria are changed to improve accessibility (Alcorn and Levin, 1998). Alcorn & Levin define two primary types of access programs: general access programs, and specific access programs. General access programs provide entrance opportunities to the institution, while specific access programs provide entrance opportunities to a specific program. ENGAP falls into the latter category.

Currently, there are several access programs operating at the U of M. These include Health Careers Access Program (HCAP), Professional Health Program (PHP), U of M ACCESS Program (UMAP), Engineering Access Program (ENGAP), Inner-City B.S.W Program, Northern B.S.W Program, and Aboriginal Nursing Cohort Initiative (ANCI) (Office of Institutional Analysis, 2021). HCAP, PHP, ENGAP, and ANCI are access programs operating specifically for Indigenous students. Of these four programs, ENGAP has, over the past several years, consistently conferred the most degrees (Office of Institutional Analysis, 2021). Until recently, ENGAP also enrolled the largest number of students. (This appears to have changed at the onset of the COVID-19 pandemic, for reasons which have yet to be explored.)

Two more engineering-specific access programs are currently operating in the wake of ENGAP's success: Indigenous Futures in Engineering (InEng – formerly Aboriginal Access to Engineering) at Queen's University, operating since 2012 (Smith Engineering, 2022), and the Engineering Access Program at University of Saskatchewan, operating since 2019 (University of Saskatchewan, 2019).

There have been some studies of access-type programs at Canadian universities (Harper, 2007; Orr, 2020), but studies on such programs have thus far been infrequent. As discussed previously, Harper (2007) used autobiographical writing from students enrolled in the University of Manitoba's Special Pre-Medical Program to better understand the factors leading to their success within the program. Harper (2007) found that the primary factors motivating the students to pursue the program were community-driven, while the primary indicators of success were more personal, often involving setting goals and being confident in their abilities. Orr's (2020) thesis focused on the perspectives of educators within access programs at four Canadian universities. The educators provided insight into what strategies they used to support learners within access programs. These strategies included building relationships with the students, creating safe spaces, and the general access program components outlined by Alcorn and Levin (1998) (see above). Orr notes in the study's recommendations that hearing the perspectives of students in access programs will be necessary to expand and confirm the perspectives of the educators involved in the study—a gap this thesis fills.

Decolonizing/Indigenizing Postsecondary Education

Interest in Indigenous worldviews and the desire/need to include them in postsecondary has brought concepts of Indigenization and decolonization into broader discussions of equity, diversity, and inclusion. Access programs naturally play a role in the process of Indigenizing

whatever institution they are founded within. Indigenization is itself relevant to policies relating to specific supports and programs for Indigenous students. The inclusion of Indigenous peoples, knowledges, worldviews, and perspectives within engineering education is a potential way to address the systemic and cultural issues explored in this chapter.

Gaudry and Lorentz (2018) posit that there are three distinct levels of Indigenization—inclusion, reconciliation, and decolonization. When Indigenization is discussed in the postsecondary context, policies and courses of action typically fall into the category of Indigenous inclusion and occasionally into the realm of reconciliation. Naturally, the objective of an Indigenous Access program such as ENGAP would be rooted in inclusion. It is worth considering whether such a program should be moving beyond inclusion into *at least* reconciliation. According to Gaudry and Lorentz (2018), to work toward reconciliation Indigenization, beyond creating space for Indigenous people, Indigenous knowledges must be emphasized, and people in that context (in the case of postsecondary, this includes students, staff, and faculty) must alter their thinking and consider those knowledges. Randy Herrmann, currently the Director of ENGAP, is involved in reconciliation and decolonization efforts, researching and implementing Indigenous knowledges and ways of being, doing and relating into engineering curricula; however, this is not explicitly the role of ENGAP, but rather something Herrmann has initiated on his own.

Wiseman and Herrmann (2019) describe the importance of moving beyond simply providing access for Indigenous students. They suggest that access is not a long-term solution and that the goal for Indigenous participation should include acceptance of their knowledges and worldview within the postsecondary environment. Currently, Eurocentric knowledge is widely accepted in postsecondary institutions, and by extension, Indigenous inclusion and participation

is not as meaningful as it could be. There is optimism that by including Indigenous knowledges and perspectives in educational settings, Indigenous students are more likely to be successful in both academic ways (like test scores) and intrapersonal ways (like self-confidence) (Kanu, 2005).

There is a practical side to Indigenizing education. Incorporating Indigenous knowledges in programs can have a positive impact on Indigenous students (Kristoff and Cottrell, 2021). Further to this, being in an institution with other Indigenous students helps foster community and allows students to connect to their culture. However, there is also a caution for those doing decolonizing work: Tuck and Yang (2012) suggest that decolonization includes Indigenous sovereignty over traditional lands and that without that outcome, the process of decolonization is incomplete. Furthermore, any attempts at decolonizing in the more metaphorical sense, of decolonizing individual worldviews, most likely serves settlers more than it does Indigenous peoples.

A Critique of the Literature

As evidenced throughout this review, there have been numerous studies involving Indigenous students in North America, many of which were qualitative attempts to gain a deeper understanding of how students of Indigenous background experience postsecondary education. However, when narrowed to include only studies focusing on STEM or engineering, the literature becomes sparse. This means that I had to look at the literature in a composite way, combining general engineering education research with general research of Indigenous students in post-secondary. With this in mind, there are a few learnings that I suggest we can take from the literature to apply to the thinking about my study.

The importance of community, specifically tribal/reservation community, is frequently cited within the literature. However, this element of Indigenous post-secondary experiences is not necessarily a factor for all Indigenous peoples. For example, the Métis do not have the same tribal and reservation connections as people of the numerous First Nations. This is important to acknowledge in this research, as most recent ENGAP graduates are of Métis background (Rodrigues, Forrest, & Seniuk-Cicek, 2024).

There are distinctions highlighted between the contexts of existing literature and my research. This suggests that there is room to expand the literature on topics of inclusion, persistence, and support for Indigenous students (in engineering and more broadly), factoring in the context of ENGAP.

Part 2: Review of Relevant Concepts and Development of a Conceptual Framework

In this second portion of the literature review, I describe several concepts that comprise my study's methodology and informed my conceptual framework. These include my study's design and corresponding methods and the concept of Métissage, which is central to my research.

Narrative Research Design and Hearing Story as Research Method

The basis of narrative research is the emphasis on the individual stories and experiences of the participants. Interviews are often the primary form of narrative data collection, though observation and analysis of photos and documents can also inform narratives (Creswell & Poth, 2018). The significance of the narrative interview lies in the fact that a narrative can provide a better representation of a person's experiences than simple questionnaires or other statistical analyses (Kirkpatrick & Anderson, 2015). The narrative research process is highly collaborative,

meaning those who are interviewed are actively working along with the researcher as participants, rather than being a more traditional subject of research (Moen, 2006).

Situations and questions for which narrative research are appropriate are like the scenarios where other qualitative designs might be considered, usually involving a need to better understand a phenomenon and/or empower individuals (Butina, 2015). People are natural storytellers and tend to form their experiences into narratives, and thus personal narratives are often an intuitive way for personal information to be presented (Moen, 2006). Moen (2006) discusses how the complexity of issues and subjects can be lost through the research process due to oversimplification or compartmentalization of information, and narratives can avoid such misinterpretation by keeping the information whole. An advantage of the narrative is that it explores many facets, including social, cultural, and institutional factors (Creswell & Poth, 2018). Moen (2006) notes the hermeneutic nature of narrative research – interpretation is ongoing throughout the research process and is present when choosing what stories to include in the findings, and how the researcher interprets those findings, and continues to act hermeneutically as the reader interprets the stories.

There are several aspects of narrative research design that can be considered weaknesses. Only a small sample size of interviewees is feasible, generally (Butina, 2015). In the case of my research this may not be an issue, as the population I will be working with is relatively small. The interview approach usually yields a large volume of data that can be difficult to analyze because of the semi-structured design, and the amount of time and room given to the interview participant to tell their story. Additionally, these data can be challenging to code because of the high level of detail and nuance throughout, according to Pawley (2013). Problems that can arise when using a narrative research design include divergent interpretations between the interviewer,

or if the participants question how their narratives are being interpreted by the researcher (Moen, 2006).

Engineering education is a relatively new and quickly growing area of research, particularly in Canada (Seniuk Cicek et al., 2023), and the use of qualitative research approaches within engineering education is more common than in engineering. There are several studies I used as references when considering the suitability of this research design for my work. Pawley's (2013) study approaches a similar (if broader) research topic to that of this study using a narrative research design. Pawley's (2013) justification for this choice of research design is like that of my own project's research design choice: there are deficits in understanding the representation of marginalized groups in engineering programs, and traditional statistical methods are not capable of representing them, so personal narratives are used to gain a deeper knowledge of those people's perspectives. Jordan et al. (2019), in a study of Navajo engineers, presented a semi-structured interview schedule that included some sections that are narrative in design, in which they asked questions about 'describing experiences' and 'comparing experiences', drawing from their personal experiences as both Navajo individuals and as professional engineers. This study runs parallel to my research topic in how it strives to make connections between individual people's backgrounds (drawing from their Indigenous culture and community) and their later life experiences (professional experience in the case of Jordan et al., (2019), as opposed to educational experience in my own proposed study), all within an engineering context. Kellam et al. (2018) utilized a narrative design for their interviews, which were performed in a study of engineering students' emotional responses to their experiences throughout their engineering programs. This study was effective in beginning to understand

engineering students' experiences, and their feelings and reactions to those experiences, within an engineering-centric learning environment, and as such, is informative for my work.

Running parallel to the Western concept of narrative research are the oral traditions of Indigenous cultures. Oral tradition is of utmost importance in Indigenous cultures (Battiste, 2002)—many Indigenous peoples relied solely on the spoken word to convey their ideas and histories. As such, the concept of the narrative is central to all areas of knowledge in Indigenous ways of knowing and being. By extension, gathering knowledge through storytelling is fundamental to Indigenous epistemologies.

What Caxaj (2015) calls Indigenous storied approaches to research are methods or methodologies embracing oral traditions to carry out research in ways that embody Indigenous ontologies and epistemologies. There are many examples of methods and methodologies involving story utilized in Indigenous research. Storywork is one example that involves finding meaning or creating an understanding of experiences or situations by comparing them to traditional stories using metaphor (Archibald, 2019). Indigenous storytelling relies on passing on knowledge through careful and deliberate use of voice and other forms of expression to convey knowledge through story (Datta, 2017). Conversational method uses conversation to gather knowledge through telling stories and responding in a dialogical way (Kovach, 2010). There is precedent for augmenting narrative inquiry by embracing Indigenous ways of knowing, and enriching the narrative process (Caxaj, 2015). Caxaj argues that narrative approaches are congruent with Indigenous storytelling, as working with story can be similar to narrative research as a way of creating data through working with participants and allowing them to transfer their knowledges and experiences. Wilson (2001b) suggests that storytelling and narrative fit nicely into Indigenous research paradigms because in telling and hearing those personal stories, a

relationship is created between the researcher and the participant. What exactly is an Indigenous research design, or an Indigenous paradigm, must be established to better understand this significance.

Indigenous Research Design

Wilson (2001b) describes the Indigenous paradigm as having four primary aspects: epistemology, ontology, methodology, and axiology. These elements form the basis of the Indigenous research framework. Each of these embodies an element of how one can research in a way that is fundamentally Indigenous. The paradigm defined by Wilson is quite general both in terms of what constitutes its epistemology, ontology, methodology, and axiology, and in its use of the term “Indigenous”. Kovach (2021) writes that Indigenous epistemologies are based on holism and relationality. The Indigenous research ontology and epistemology are rooted in the creation of a “mutual reality” through relationships between the researcher and participants (Wilson, 2008). Further to this, Indigenous axiology is also fundamentally relational. Indigenous research axiology (the philosophy of ethics), and methodology in general, are founded on relational accountability (Wilson, 2008). This means that the researcher must be accountable to everyone related to the study, valuing their contributions and treating them respectfully. In this study, it was imperative that I be accountable to the participants and to ENGAP, as the people involved and as the study site. This meant I needed to listen to each of those people and consider how my actions as a researcher, including my use of their words, would affect them.

Regarding the aims of my research, Tuck’s (2009) concept of the desire-based research framework is relevant. Tuck discusses the reasoning for commonly framing social science research in a deficit or “damage-centred” way, which is to incite change by sharing the harms done to people explicitly. Tuck (2009) suggests there are issues with defaulting to framing

studies in this deficit way, especially when the studies pertain to marginalized groups. This approach perpetuates the notion that these harmful things are what defines the people(s) centred in these studies, which is damaging to the community and further marginalizes this group. As a result, Tuck believes it is imperative to frame such research in terms of desire instead of damage. These desire-based frameworks are “concerned with understanding complexity, contradiction, and the self-determination of lived lives” (Tuck, 2009, p. 416). In this research, I hoped to embrace the complexity and contradictions of a diverse group of graduates who have the common experience of being enrolled in ENGAP. To do this, I turned to a research sensibility called *Métissage*.

Métissage

Logan (2008) argues that one of the fundamental aspects of doing Indigenous research is distinguishing between different peoples, be they First Nations, Inuit, or Métis. For example, Logan (2008) argues that Métis voices have been dominated in the academic sphere as the researchers and subjects are placed into a Western/Indigenous binary, and their complex realities are oversimplified as a result. These challenges historically lead to pan-Indigenization. To address such issues, the concept of *Métissage* can be used as a research tool. This concept is not necessarily Indigenous but has been embraced by Indigenous scholars like Donald (2012), who conceived the concept of Indigenous *Métissage*.

Donald (2012) introduces what he describes as a “decolonizing research sensibility” (p. 533) in the form of Indigenous *Métissage*. Indigenous *Métissage* takes the basic principle of *Métissage*, which is to acknowledge and merge various cultures or identities and uses it to frame the tensions between Indigenous peoples and settler peoples in Canada. Describing the need for such a sensibility, Donald (2012) states:

We need more complex understandings of human relationality that traverse deeply learned divides of the past and present by demonstrating that perceived civilizational frontiers are actually permeable and that perspectives on history, memory, and experience are connected and interreferential. The key challenge is to find a way to hold these understandings in tension without the need to resolve, assimilate, or incorporate. (Donald, 2012, p. 534)

Donald's (2012) *Métissage* is rooted in embracing the complexity that is commonplace in Métis experiences. A primary objective of Indigenous *Métissage* is to challenge the constructs that constitute the attitudes of the general population, and gradually replace them with new ones that are better-informed and embrace the nuances of those constructs. This includes an assumption that there is a dichotomy between Indigenous and settler worldviews, which undercuts the complexities of those identities.

The result of Donald's (2012) praxis would be a deeper understanding of our own contexts, the society we live in, and the people around us. Furthermore, Indigenous *Métissage* seeks to instill ethical relationality, which Donald (2012) describes as an "ecological understanding of human relationality that does not deny difference, but rather seeks to understand more deeply how our different histories and experiences position us in relation to each other" (p. 535).

As an alternative form of *Métissage*, Hasebe-Ludt, Chambers, and Leggo (2009) discuss literary *Métissage* as a way of creating meaning out of writings, combining "threads" into "braids". These threads can consist of anything from stories to poetry or any form of expression, with threads from multiple contributors being woven together into a braid. They describe *Métissage* as a "merging and blurring of genres, texts, and identities" (p. 9), and suggest it has

the power to transcend binaries, including between the colonizer and the colonized. This mixing or crossing of binaries is relevant to the philosophy of this study—I feel it is important to address Indigenous ways of knowing and being, as well as the typical, dominant culture’s approach to qualitative research. This will be reflected in my research methodology, including in its axiological basis and my approaches to the analyses and discussion of the findings. By braiding these threads together, the binaries are circumvented, and the complexity and relationality of the approaches are celebrated.

The value of Métissage comes as a hermeneutic device—a way to explore a phenomenon through interpretation. This is apparent in both Donald (2012) and Hasabe-Ludt, Chambers, and Leggo (2009). Donald (2012), citing Smith (1999) outlines four requirements for a researcher engaging in hermeneutic work, which Donald (2012) applies to Métissage:

1. The researcher must be attentive to nuances of language.
2. The researcher must understand there is interpretability to life.
3. The researcher should interpret based on their own relationship to the work/subject.
4. The researcher must create meaning through interpretation.

These guidelines for interpreting the findings through these understandings are essential to the Métissage process and are guidelines I followed in my research.

Robinson (2016) used Métissage to blend Indigenous and Western paradigms while also using Métissage as conceptual framework for analyzing, organizing, and presenting her findings. This use of Métissage as a research sensibility demonstrates its utility within the study, helping establish the research paradigm by combining Western and Indigenous paradigms and allowing those paradigms to coexist at all stages of the research study. All of these scholars have informed

how I approached using Métissage in this work, which I explain more in my methodology in Chapter 3.

Conceptual Framework

I encapsulated multiple concepts and frameworks to inform the methodology of this study, and how I created and analyzed the data. This is one example of my use of Métissage in this study: using multiple frameworks to interpret the findings acts as a hermeneutic to encourage deeper reflection for myself as the researcher, as well as for this study's audiences. Based on the topics of the literature review, including student experiences, access programs, and engineering education, a relational framework for understanding the context of Indigenous students in ENGAP in this study is shown in Figure 1.

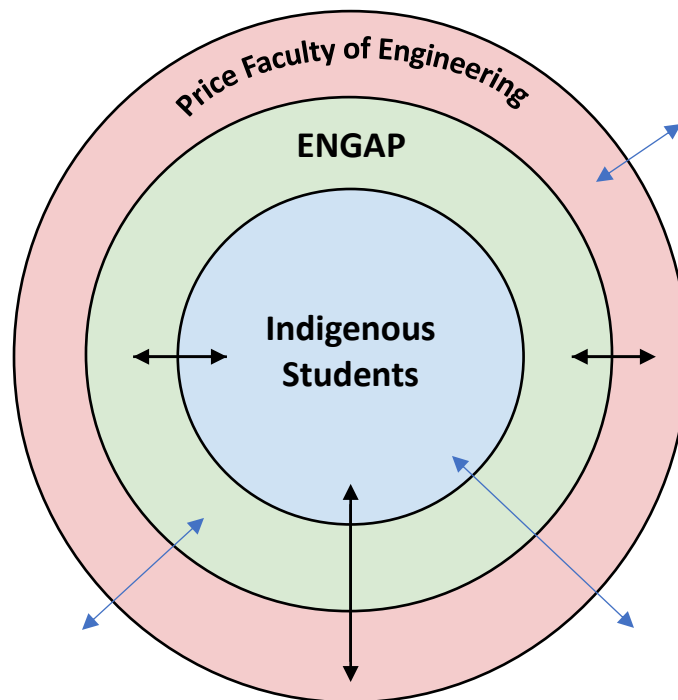


Figure 1. A relational framework of students in the Indigenous Student Access Program (ENGAP) at the University of Manitoba

This conceptual framework is based on the concept of relationality and acknowledges the relationships between the students, ENGAP, and the PFofE, as well as the numerous aspects within all those relationships. The graduate/participants are centered within ENGAP, which in turn are centered within the PFofE. In this study, the environments of ENGAP, the PFofE, and the broader geopolitical regions of Manitoba and Canada are the socio-cultural contexts informing the lived experiences in our participant narratives. There are people, places, and ideas within each of these levels, all of which are related to and affect each other, manifested in each participant's experiences. These are demonstrated by the black arrows pointing to the relationships between each of these groups, and the blue arrows connecting each of those groups to the broader Canadian context.

Figure 2., a depiction of the Medicine Wheel, represents the holism in my conceptual framework. The four directions contain many meanings, but for the purposes of my study, the dimensions— mental, spiritual, emotional, and physical —inform my interpretive framework.

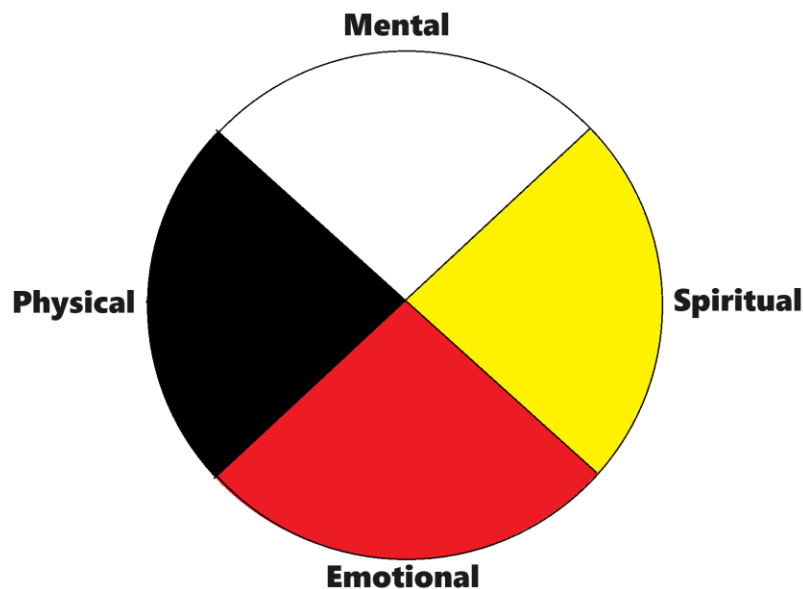


Figure 2. Medicine Wheel as a framework for holism

The access model emphasizes responding to student needs in a holistic way. Drawing from the Medicine Wheel while interpreting the findings will offer me a better understanding of how the participants' experiences impacted each of these facets of our being, as well as how each of us was impacted by entities such as ENGAP and the PFofE.

Figure 3. represents the findings in the literature, which focus on the barriers for Indigenous engineering students, and the ways those students can be supported to increase their likelihood of persistence.

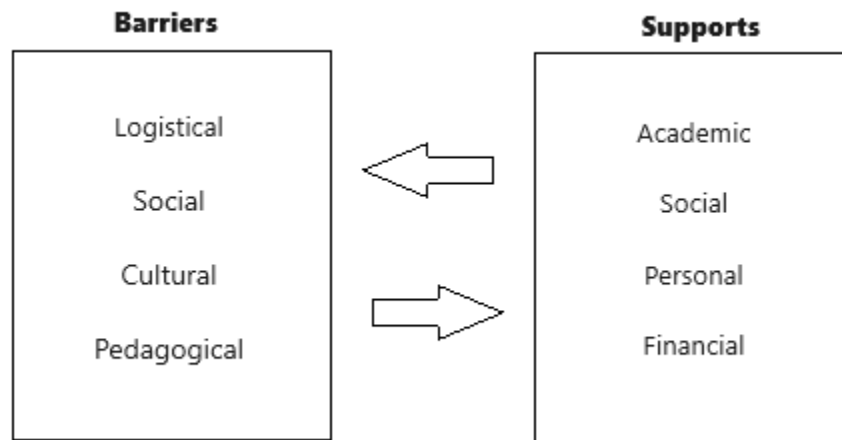


Figure 3. Supports and barriers found in the literature

The factors that comprise the barriers and supports for Indigenous and engineering students found in the literature and presented in Figure 3. are interrelated, with the support systems and barriers for students at odds with each other. In theory, the supports and resources should help students overcome the barriers. This framework is also braided into how I interpret the findings.

In Figure 4. and Figure 5., the braids represent my Métissage process, which follows Hasabe-Ludt, Chambers, & Leggo's (2009) example of literary Métissage: the weaving of the participants' realities, and the weaving of both Indigenous and Western concepts into my study's methodology and analyses. Métissage provides the basis for the dissemination of the findings in

Chapter 4, and the basis for interpreting the findings through multiple frameworks in the discussion in Chapter 5.



Figure 4. Participants' stories braided into one braided narrative.



Figure 5. Braiding rationality, holism, and literature into the interpretation of the narrative.

Donald's (2012) concept of Indigenous Métissage as an approach to interpreting Indigenous-settler relations is also fundamental to my work, as the communities of ENGAP and the PFofE, each containing diverse groups of students, interact with each other in instances of Indigenous-settler relations. The inclusion of multiple frameworks within my conceptual framework also follows the fundamentals of Métissage, providing an opportunity to interpret and analyze the participants' experiences from various perspectives.

I draw on this framework to interpret the cultures and climates that participants experienced and that impacted participants' experiences, and the multitude of factors that emerged in participants' stories to describe the complex relationships students formed and held within their post-secondary ENGAP and PFofE contexts.

Chapter Summary

In this chapter, I reviewed the literature on relevant topics for this study, including barriers for Indigenous students to postsecondary education, engineering culture, and support for Indigenous students, to detail the landscape for Indigenous students in engineering programs. I outlined the concepts of holism, relationality, and Métissage to form the conceptual framework that provides a basis for interpreting the findings in my study.

Chapter 3: Methodology

Qualitative Research

This study followed a qualitative narrative design as my primary objective was to elevate the voices of Indigenous students in engineering at the U of M. As Kovach writes, “relationships, stories, and words mark qualitative inquiry” (2021, p. 24). The significance of relationships and personal stories and experiences are what made a qualitative approach necessary for this research. Qualitative narrative research approaches also align with Indigenous values, which was also important to me in this work. I was determined that the epistemological, ontological, methodological, and axiological underpinnings of the research needed to be approached in a way that embodied Indigenous approaches to research. For this, I looked to Wilson (2008), who outlines Indigenous research epistemology, ontology, and axiology to form Indigenous methodology and research paradigm, to guide my research decisions.

Indigenous Research Paradigm

This study followed an Indigenous research paradigm (Wilson, 2008). The Indigenous research paradigm, in terms of epistemology and ontology, is rooted in the concept of relationality. Relationality is the connectedness of all things. According to Wilson (2001b), the Indigenous paradigm does bear some resemblance to the constructivist paradigm. The congruity between constructivism and the Indigenous paradigm is natural, as constructivism is based on the idea that individuals construct knowledge, while the Indigenous worldview would suggest that everyone’s knowledge is shaped by their own unique relations. Emphasizing relationality is a fitting paradigmatic outlook for my study, as my focus is the relationships participants had with other students, with ENGAP, and with the PFofE at large throughout our studies.

Underlying Philosophies

Indigenous Métissage and the desire-based framework, which I described in the previous chapter, underlie my approach to this research. The significance of Indigenous Métissage is that in the research environment of ENGAP, the students come from a wide range of cultural backgrounds. Manitoba has various First Nations populations, as well as Métis and Inuit, and students come from all over the country bringing cultures that are not typical to the region. As a result, it would be all too easy to view this Indigenous student body in a hegemonic way and generalize their cultures in a way that would be counterproductive to doing good work for the community. Drawing from Métissage was conducive for me to avoid this. Métissage underlies my methodology in two ways: one, in the braiding of stories, with each individual participant represented by one strand that, when braided together, creates meaning (drawing from Hasabe-Ludt, Chambers, and Leggo's (2009) literary Métissage); and two, in the incorporation of differing perspectives when analyzing and discussing those braided stories—namely, discussing the stories through both Western and Indigenous frameworks and comparing and contrasting these perspectives (drawing from Donald's (2012) Indigenous Métissage).

One of my goals in doing this work was to avoid reflexively victimizing the participants simply because they are ostensibly marginalized as Indigenous students (e.g., see Tuck, 2009). The conceptual framework of this study is desire-based in the sense that negative experiences will not be the focus of the research, and more generally, the research will be conducted without preconceived notions of what our participants' experiences are. A more typical approach may be to either focus on the fact that our participants are from a minority group, and analyze our struggles, or focus on the fact that we are graduates and analyze what made us 'successful'. Following Tuck's (2009) concept of the desire-based framework, I approached this work in a

way that would provide a more holistic picture of our participant experiences, and by extension provide details of our experiences of being an ENGAP student. In working this way, I was able to highlight the positive aspects of those experiences in addition to negative ones, and all those experiences were discussed and analyzed to identify what was desired by us participants, and how those desires can be realized for future Indigenous engineering students.

Narrative/Story Research Design

When considering the similarities and differences between narrative inquiry and Indigenous storied inquiry, Kovach (2021) writes that the fundamental difference between the two is the underlying paradigm, with narrative inquiry drawing from a conventional Western research paradigm, and Indigenous forms of inquiry using an Indigenous research paradigm. Because in this study I deliberately draw from both Western and Indigenous paradigms, as well as due to my position as an Indigenous researcher working within a Western institution, this study's form of inquiry falls into both categories.

Narrative inquiry is a research design in which the researcher asks the participant or participants about their lives, eliciting stories as the primary form of information (Creswell & Creswell, 2018). The narrative design is, of the primary qualitative research design, among the most closely aligned with Indigenous approaches, as it recalls oral traditions common among Indigenous peoples of Turtle Island (Kovach, 2021). The purpose of narrative inquiry is to gain a deeper, contextualized understanding of the people, places, and events involved in the research, as “narrative inquiry is not only the study of an experience but also the socio-cultural way of living that affects the phenomenon under investigation” (Adama et al., 2016, p. 2). In this case, the narratives provide an avenue to gain knowledge of experiences and the way of living of Indigenous engineering graduates.

The purpose of Indigenous storied forms to inquiry is to draw from an Indigenous research paradigm, which means to include relationality as a central element in the epistemology, ontology, and axiology of the research. It also should reveal the participants' unique histories and value systems (Caxaj, 2015). Métissage provides an avenue to accomplish this, by creating space for each participant to share their perspective and then be interpreted to learn about their histories and value systems.

My approach to this study's inquiry involves me collaborating with the participants to form a collaborative story, consistent with both narrative research (Creswell & Creswell, 2018) and Métissage (Hasabe-Ludt, Chambers, & Leggo, 2009); through this process my voice as the researcher was not only acknowledged but embraced (Butina, 2015). Given my connection to the research topic and the participants (e.g., I am an ENGAP graduate, and I know the participants in this study from my time in the program), it is important not to distance myself from the research but to use this position to perform useful research. The narratives of the participants were interpreted through my own experiences as an Indigenous student in ENGAP at the U of M—in this sense, my own experiences have become part of the stories, and the organization and presentation of the findings, which will influence how they are interpreted by the reader. Moen's (2006) assertion that hermeneutics are inherent in narrative research and Donald's (2012) emphasis on the importance of hermeneutics in Métissage are congruent. I am primarily concerned with this use of interpretation for the design of my study.

Research Questions

My primary research questions are as follows:

- What are the lived experiences of Indigenous engineering students in ENGAP at the U of M?

- How are these lived experiences influenced by the social and cultural contexts of ENGAP and U of M?

These questions are broad and exploratory by design. The goal of my research is to enable the participants to narrate what is truly important to them/us, what they/we experienced, and what impacted them/us throughout their/our studies.

Intended Audience

The intended audience for this work includes:

- Indigenous people (especially students) seeking representation and empowerment. This includes the participants of the research study.
- The staff at ENGAP, who can review this document as an evaluation of their operations and the impact of these operations on students in their program.
- The staff, faculty, and administrators in PFofE, who will gain a better understanding of the experiences of students in the faculty and of the program operating within this faculty.
- Engineering faculties throughout Canada that are interested in developing programs comparable to ENGAP.

Scope

Despite the focus of this study being ENGAP graduates, the scope of the study goes beyond the confines of our experiences in ENGAP. The scope includes participants' overall experiences in engineering. This means that the scope of the interview questions included anything related to enrolling in and completing an engineering degree.

Research Method

I used narrative interviews as the instrument of data creation in my study. This method provided opportunities for participants to tell our own stories and share our perspectives with

respect to the research topics. I approached the interviews dialogically, in a way that is aligned with Indigenous research methodologies (Kovach, 2010). Kovach (2010) calls this approach to interviewing the “conversational method”: rather than treating the process as an interview in the conventional sense, the narratives were created through a more natural dialogic process. I provided the participants with broad prompts to elicit stories related to their experiences as engineering students. The conversations were guided by the participants’ own interests, experiences, and opinions, my knowledge relating to my experiences as an ENGAP graduate, and my co-interpretations of participants’ experiences.

Recruitment

I used purposive sampling to recruit participants whom I knew. Purposive sampling is valuable when aiming to increase the depth of the data rather than the breadth by choosing participants most likely to share information that is relevant to the study (Campbell et al., 2020). It was important to include individuals whom I knew for two reasons. Firstly, not all ENGAP graduates are equally involved in the program, and some students enrolled in ENGAP interact very little with the ENGAP community. Recruiting specific individuals was a way to avoid recruiting graduates whose connections with the program were less substantial. As well, I deemed it important to recruit graduates whom I had some connection with, as that fits within the Indigenous paradigm to do the work with people whom I already have relationships with.

To avoid making the prospective participants feel pressured to take part in the study due to their connections with me, participants were contacted initially by an ENGAP’s administrative assistant who provided details on the work and instructions to contact me or my advisor, Dr. Seniuk Cicek, if they were interested in taking part. The letters sent to the graduates are in Appendix C.

For the study, it was important for multiple voices to share their experiences. In keeping with the nature of the narrative research design, as well as Métissage, I determined that a sample of three to eight graduates was appropriate for this study. This number of participants would allow multiple voices to contribute while allowing each of those voices to contribute substantially.

Participants

I chose participants based on their connection to me and the research topic. It was not so important that I know them on a personal level, rather that we understand our connection to each other and understand their connection to the study (Weber-Pillwax, 1999, p. 170 as quoted in Kovach, 2010, p. 169).

This study involved the participation of U of M engineering graduates who were enrolled in ENGAP between 2014 and 2022, which aligned with the period during which I was an ENGAP student. Recent and pending graduates were the focus of this study as students who completed the program have more experience in engineering and in ENGAP. I used purposive sampling for this study—it was important that the participants be individuals who were actively involved in the ENGAP community—otherwise, the narratives may not have the necessary depth of experience in relation to ENGAP. Six students were initially contacted to participate. Four ENGAP graduates agreed to participate in the study, in addition to myself as a participant-researcher. This group demonstrated the intersectionality present within the ENGAP community: four participants (including me) are Métis and one is First Nations; four are men and one is a woman; two graduated from civil engineering, one from mechanical, one from electrical, and one from biosystems. All participants graduated between 2016 and 2020. The participants' unique paths are also demonstrated by their career trajectories: one participant works in the construction

industry outside of Manitoba; one participant works for a federal agency; one works within an engineering faculty at a Canadian university; one has continued their studies as a graduate student in a research field outside engineering; and one has continued their studies as a graduate student in a field adjacent to engineering.

The participants were provided with a letter of informed consent (see APPENDIX E), which detailed how their information would be used and protected. This document also described the logistics of the interview, including its estimated length of 60 to 90 minutes and an option to hold a follow-up interview if they felt they wanted to elaborate on or clarify the initial interview.

Along with signing this document, participants were asked to choose whether they would like to remain anonymous in the study. Providing this option was important in doing this work in a good way, as Indigenous participants should be allowed to share their own experiences in a visible way if they chose to do so but should also be able to keep their identity anonymous if it made them more comfortable to participate. A \$25 gift card was also gifted to participants as a small token of reciprocity for their time and energy spent contributing to this work.

Interview Procedure

Narrative interviews were conducted as the primary form of data creation. I created an interview guide to provide a scope for the interview/conversation (see APPENDIX G). I provided this guide to the participants ahead of the interview to avoid any surprises and allow participants to reflect on their experiences before their scheduled interview. I conducted the interviews using a virtual meeting platform or in person, depending on the preference and availability of the participants. Using a virtual platform had the advantage of avoiding contact during the COVID-19 pandemic, and opened up the possibility of including graduates who no

longer live in Manitoba or would otherwise be unable to participate. Meeting in person provided the opportunity to foster a more organic conversation between the participants and me.

I recorded the interviews using Zoom. In the case of the online interviews, I conducted the interview using Zoom software. For the in-person interviews, I used Zoom to record the audio conversation. The recordings were automatically transcribed by the Zoom recording software; I subsequently edited the transcripts to correct for errors in the automated transcription.

I sent the interview transcriptions to each of the corresponding participants for their review, to ensure their words had not been misconstrued or in case they wanted to elaborate on, change, or redact any part of their interview.

I performed a self-interview following the completion of the interviews. For this process, I reflected on my conversations with the four participants and responded to each of my interview questions in writing using a word processor. This process allowed me to reflect on how my own experiences influenced my interpretation of the other participants' stories, and by extension, it allowed for the creation of the Métissage braids.

The interviews averaged approximately 1 hour in length. The participants were candid in their words and were responsive to the prompts and conversation topics. Because the primary topic of conversation was their everyday life several years ago rather than a more specific phenomenon or event, the participants did struggle to recall specific experiences at times. The result was a mix of brief anecdotes, opinions, and expressions of feelings, as opposed to lengthier, overarching stories more typical to a narrative. As a result, the dissemination of their words had to be organized not as a narrative, but as a literary Métissage.

Presenting Findings as a Literary Métissage

The findings were initially organized via an inductive thematic analysis following narrative analysis protocols outlined by Creswell & Poth (2018). General qualitative protocols included steps of identifying codes, reducing codes to themes, relating categories to each other, and relating categories to the conceptual framework. For the narrative analysis, I followed a thematic analysis approach, focusing primarily on what the participants spoke about (as opposed to how the stories were told). I wove those stories into thematic braids to form the Métissage.

I read and organized the interview transcripts. I identified codes to denote important ideas within the stories, and then organized those codes into more general themes. After transcribing each of the interviews, I identified quotes that pertained to the research questions/topic and pooled them together. I aimed to make this process as inclusive as possible, thus a substantial portion of the participants' words were brought to the next stage of organization in the form of narrative strands. These strands were kept intact, in some cases spanning multiple pages. From there, I organized the narrative strands according to the contents of the given strand; I placed strands pertaining to certain people, places, experiences, or feelings together. This process was iterative, with the chosen passages being arranged to make meaning. I then organized these thematically bound strands into seven "braids", each one focusing on one of the prominent themes identified during the inductive coding process. In this way, I wove the stories of five individuals into a Métissage, as described by Hasabe-Ludt, Chambers, & Leggo (2009).

Analysis

Once the findings were braided/constructed, I explored them using the conceptual framework described in Chapter 2, drawing from relationality, holism, and the literature. The relationality and holism frameworks provided opportunities to interpret the findings in a way that

was inductive and created meaning, while the literature provided examples of phenomena relating to Indigenous engineering students, which could be compared to the stories told by the participants.

I reviewed each story again through each framework: first to see how the storyteller related to people, places, ideas, and the cosmos (the four types of relationships laid out by Wilson (2008)) within the contexts presented in Figure 1; second, to explore how the graduates were affected on an individual level considering the four dimensions of being in the Medicine Wheel (mental, emotional, spiritual, and physical); and finally, to compare ideas from the stories to concepts from the literature.

Credibility and Relational Accountability

Definitions of credibility in research typically come from a Western perspective and value rigour above all else. For this study, it was important for me to consider an Indigenous perspective of credibility as well. Wilson (2008) stresses the importance of relational accountability within Indigenous methodologies. That concept is the axiological foundation of the Indigenous paradigm. Relational accountability stresses respectful and reciprocal relationships between the researcher and the community involved in the research. Kirkness and Barnhardt (2001) emphasize the importance of the “4 R’s” in working with Indigenous peoples - respect, relevance, reciprocity, and responsibility. To do research that is respectful and credible from an Indigenous perspective, I worked to enable participants to express their own culture and values. This research will be relevant to the students of ENGAP as it will act as a form of legitimization of Indigenous perspectives in engineering education. I exercised reciprocity with the participants and the ENGAP community by doing work that will be beneficial to future ENGAP students by listening to current and past ENGAP students, increasing visibility for

Indigenous students in the PFofE, and providing ENGAP with information on what has influenced and impacted their students over the past several years. Finally, responsibility was exercised by upholding Indigenous values through the research process, and by using the power I have as a researcher in an appropriate way—in a way that honours and values the community (ENGAP), for the benefit of the community.

Considering credibility in the conventional research sense, Creswell & Creswell (2018) list several procedures to ensure the credibility of the study. Among these is member checking, which I did in this study by asking participants to review their transcripts, providing them space for clarification. Prolonged engagement is another credibility procedure that I addressed by my protracted involvement in ENGAP, as well as the time spent with participants during the interview process. Triangulation, another measure of credibility, is present in the form of the years I spent in passive observation during my time as a student in ENGAP, and from the views of the multiple participants who are heard through this study. Finally, through the use of ‘thick descriptions’, which are highly detailed descriptions of the context and findings, readers should be able to ascertain what elements of the findings are relevant or transferable to their own experiences and contexts (Lincoln & Guba, 1985).

Limitations of the Methodology

Several ENGAP graduates were included as participants in this study when ideally all current and past students should be given the opportunity to participate, so we can hear from and elevate the voice of every individual. Due to the depth of this form of inquiry, I had to limit the number of participants in this study. The benefit of analyzing a small sample is that the participants’ words are less likely to be generalized.

There are limitations to interviews as a data creation/collection method. The context of the interview itself, the relationship between myself as a researcher and the participant, and other unknown factors influence the direction of the interview and what is shared by the participants. Furthermore, the participants were asked to recall a specific period of their lives and reflect on certain details that might have become unclear to them over time. However, I argue that regardless of this context, the participants shared what was important to them and what they were comfortable sharing despite the time that had passed since they graduated. Subjectively speaking, I do feel that my own inexperience as an interviewer did affect the direction of our conversations, and if I were to repeat this process, I would probably feel more comfortable expanding on the points prescribed by the interview guide.

Ethics

This study is approved by the Education/Nursing Research Ethics Board (see APPENDIX A). The study is considered research with First Nations, Inuit, and Métis Peoples of Canada.

I addressed anonymity with each participant. They had the opportunity to remain anonymous and be referred to under a pseudonym or have their identity included in the study. In the case of the former option, any identifiable information was removed. In the latter case, the participants' waiving of anonymity would be documented. All participants chose to remain anonymous in this study. Any information that could potentially identify the participants was either redacted or generalized to maintain participants' anonymity. The transcripts and recordings will remain confidential and are stored securely in keeping with the University of Manitoba Research Ethics Board requirements.

Chapter Summary

In this chapter, I described the study's methodology. I used narrative/storying as the mode of inquiry for my study, combining Western and Indigenous approaches. My interviews followed the conversational method (Kovach, 2010) and were the means by which I gathered participants' stories. Finally, I discussed considerations of credibility, relational accountability, limitations of the methodology, and research ethics.

Chapter 4: Findings — A Métissage

In this chapter, I organized the words of the participants into “braids”. These braids serve to compare the views and experiences of a multitude of voices to perform a literary Métissage, a process which, in addition to disseminating the participants’ words, also helped me to interpret them. Furthermore, Donald’s (2012) Indigenous Métissage underlies my process in that the theme of Indigenous-settler relations is present, whether explicitly or implicitly, within each of the braids.

Because all participants chose to remain anonymous in my study, no further background on the participants will be provided—due to the limited number of participants and ENGAP graduates, additional personal details would make them easily identifiable. The participants, including myself, have been provided with pseudonyms to facilitate referencing specific quotes in subsequent chapters of this thesis. The names given are Alexander, Ernest, Joseph, Maria, and Stan. Pseudonyms were generated and assigned randomly to avoid any identifiable connection between the participants and their pseudonym. Anonymization of my own interview responses was done to remain consistent with the rest of the participants.

The Braids

In reviewing the graduates’ words, I identified seven themes to act as the braids for this Métissage:

1. *Educators*
2. *Community*
3. *Identity*
4. *Belonging*
5. *Giving Back*

6. *Support*

7. *Challenges*

These themes are broad in scope by design, allowing me to provide a diverse array of opinions and experiences relating to the different perspectives. Through these various viewpoints, either through corroboration or contrast, I interpret the findings and create meaning. Many passages pertain to two or more of these themes and were sorted to provide the best opportunities to interpret the experiences. In the discussion chapter that follows, I further interpret these experiences for the reader engaging with the conceptual frameworks I chose for this study.

Braid 1: Educators

The participants held strong opinions on educators and education. In this braid, we listen to them speak about the people who helped and inspired them, and times they felt disheartened. Further to that are participants' thoughts on the engineering curriculum and the approaches to assessment and evaluation in engineering.

Randy Herrmann, ENGAP's director, has taught an upgrading physics course to ENGAP students for several years. This course, and Randy's impact as an educator, are referenced here. Dawit, a tutor whom ENGAP hires to support students in several math and engineering courses, and who has left a strong impression on many ENGAP students in the PFofE, is also discussed here.

Inspiring Educators

Randy Herrmann, who teaches a physics upgrading course that is offered for ENGAP students who lack pre-requisite physics knowledge, was an example of an inspiring educator for the participants. Randy's physics course allows ENGAP students to learn in a smaller class size

with less pressure. Participants noted that Randy had the ‘spirit of math and physics’ – in other words, that he had a passion for teaching these subjects:

The early experiences were largely in the physics class because I enjoyed that Randy had the spirit of math and physics. The spirit of problem-solving—the excitement of it...He wasn't like, “we're just doing this so we can get to the next class.” It kind of helped me imagine what you could potentially do if you could solve something—that was always my big thing, solving puzzles. With Randy...That was just a really good experience overall, the upgrading physics. I think taking the upgrading courses gives you a good connection with the other ENGAP students. I think that that's the case, because I think if you're in the same course—they're new—all the new people are in that course. Not all, but most of them, and I think, being in that course gave me a pretty good connection to a lot of the other new students. And Randy has a way of making people feel comfortable.

- *Stan*

Upgrading courses are also offered in calculus and computer programming. Taking upgrading courses was not desirable at first, but the value they provided participants in this study was evident upon reflection:

I didn't know if I really wanted to do the first semester of the pre-cal or the physics and stuff. But I think it probably helped me because I hadn't been in school for, at that point, 7 years. So, it was probably a good thing, I just don't think I wanted to do it at the time, but it was definitely helpful in the end. -*Alexander*

Having a tutor who was invested in the students and the subject matter was impactful for participants. There was a strong personal connection between Dawit and the participants, and

that relationship acted as a solid foundation that participants could use to improve their knowledge of mathematics:

I feel such a strong connection to Dawit, and I think, Dawit is like...I can't even explain it. He is just...he's a friend. More than anything, more than he has an obligation or anything else, he's your friend. He actually is your friend. Like if you're going somewhere and you invite him, if he wants to come, he'll come. He's your friend. And the thing about the ENGAP staff, too, is they're your friend, but in a way, they also have certain responsibilities that make it so they can't disclose certain things. But Dawit just is your friend. You know what I mean? And it meant so much. I was there for five years, almost 24/7, not completely, but sometimes *literally*, and Dawit was there. A lot of people talked about Dawit, about how much he helped in their math, like "I couldn't have got through this math class without Dawit", and he helped me in math. But more than anything, he was just like a really reliable friend...he was very important. -*Stan*

Ultimately, being rewarded with validation for hard work was motivating, and made success for the participants seem within reach:

...The biggest thing for me was the first time that I got a test back and I did well, because I didn't do very well in high school. So going to university, it was like I knew I had to try, and I did try, but it wasn't clear to me that if I did try, I would be successful, so that meant a lot to me. It meant I could do it. So that impacted me a lot. -*Stan*

Discouraging Moments

On the other hand, when hard work and 'being smart' didn't feel like enough to be successful as a student it caused confusion and distress for participants. Alexander realized the

difficulty of first-year engineering courses as a defining experience of starting an engineering degree:

...Realizing that it's a struggle for everybody; I think thermodynamics was one where, for the first time in my life, I had not been able to complete something. It was the final exam and I got through 80% of it maybe. And talking to people after, nobody finished it—that was weird to me. Because why? Why would that be? I'm supposed to be smart!

- *Alexander*

Stan felt that the dynamic between instructors and students was often strained, with the student's wellbeing not prioritized.

I think the thing with professors not having a particular education background is that some professors may not understand the impact that they have when they say things. They have a research background for the most part, usually very little teaching background—in rare cases they have that background, but mostly they don't—and psychologically you are a professor, you can fail someone, you can turn someone's life completely around. You can make their family disappointed in them if you give them a bad grade, you can make them not have the degree which is a huge financial impact. So everything that you say, the students will remember *way more* than you'll remember what the student says. - *Stan*

Curriculum and Values

Some of the assessment and evaluation methods employed in engineering education were not inspiring for participants. Questions of how students are tested and what the objectives of the degree are for future professionals were expressed by participants:

We have a linear algebra course; I think it's 100% required. We need it. Do we need proofs on the final exams? Do we need to fail someone because they can't prove some theorem on the final exam? That's just a simple example. *-Stan*

I don't think it's—at least to alumni—I don't think it's a big secret that school really doesn't teach you a lot in terms of what actually happens in the real world. There's a lot there that you kind of have to learn on the job, and I think the overall engineering curriculum...I will admit I'm a bit of a critic of some of the courses that are taught that I don't think are very relevant and very helpful in the real world. Of course, this is going to kind of depend on what specific engineering field you're in. And of course, it's so vast, it's kind of hard to cover all your bases in, in, you know, four years. But I don't really believe that the engineering curriculum really set me up as much as I would have hoped, to be honest. I think there are definitely some shortcomings there. *-Joseph*

One participant extended his feelings on the curriculum and knowledge transfer to the general worldview and value system of the engineering faculty:

I think when you talk about Indigenization, you're talking about changing the value system at the top right now. Our value system at the top is, “they've taken this many electromagnetic classes, this many thermodynamics classes,” the value system has to change at the top to slowly work its way down, right? That's what I think. *-Stan*

Braid 2: Community

In this braid, the participants describe the role of the ENGAP community in their postsecondary experience. Here, ENGAP is described as a safe space and a central hub for the participants to interact with the program's students. The relationships present in this smaller community were valued by the participants. Contrasting this are thoughts on the PFofE more broadly, where participants referenced the culture and interactions within that context.

The ENGAP Community

The participants found ENGAP to be a safe space. Alexander noted that the presence of this community made a big difference for him compared to his previous stint in university:

ENGAP was awesome. Going to university for the year right after high school versus going back when I was a little bit more experienced—the year I was there after high school I didn't know anybody, I didn't have anywhere to go, I just kind of would show up to classes if I wanted to, you know, do my work. But the ENGAP program, everybody being together, having a place to go, having people to talk to. They're in the same kind of place as you. It was a night-and-day difference compared to what I was in with the U1 program. The community was the big thing. *-Alexander*

ENGAP's lounge acted as a touchstone for the participants throughout their studies, especially in the early years when finding a comfortable space can be challenging for students. It was a comfortable, safe space for the participants to dwell. There was ample opportunity to make connections and thrive.

ENGAP was a huge part of my day-to-day experience in university—especially for the first few years—and was a major factor in how I approached school. The ENGAP lounge

was often the place where I would start and end my day. I'd go in there, hang up my coat, maybe get a cup of coffee, chat with whoever was around, and then head to class. I'd eat my lunch in there and sometimes study as well. I used the computer lab quite a bit to work on assignments. More often than not I was doing these things with the other students. *-Ernest*

I did feel really comfortable there. I was fortunate enough to get along with everyone in ENGAP, so I felt like ENGAP was a really safe space. But then I also got along with a lot of other people as well. A lot of other people who weren't in the program. So, I felt like I really enjoyed being a student. I felt like I made lots of friends and connections, and was able to make friends, and memorable relationships outside of ENGAP as well. *-Maria*

The around-the-clock availability of the lounge, as well as the presence of the people there, helped participants with their studies:

ENGAP was very helpful in the way that I completed my degree, how I interacted with other students and how I did things. You know, I was in the lounge quite a bit. I was there every day, a lot of the time, even late into the night doing work. So, it was always in my mind a safe place to do something and interact with people. *-Joseph*

Being in ENGAP provided participants opportunities to connect with people from diverse backgrounds, as the ENGAP body of students come from diverse walks of life.

I've always felt that I'm good at forming friendships and connections with people. I felt like I had an easy time making friends in ENGAP, and my first couple of years in ENGAP I would say, I just stuck with the people I would normally make friends with

based on, I don't know, looks or personality-wise, I guess. But then, later on in ENGAP, I did form a lot of relationships with people that I wouldn't really see myself being friends with, and I think that just came more with hanging out in the lounge and stuff like that, and just getting to know people a bit better. But yeah, people that don't have the same hobbies as you, and stuff like that. A lot of people from the Northern communities that I would say I never really talked to in my first couple of years, and I ended up getting really close with near the end of my degree. So that was really nice. -*Maria*

Participants felt a sense of pride in the community in ENGAP. They also understood each other's differences:

As a program, I think being in ENGAP did emphasize the pride in being an Indigenous person. Early on, first of all, I grew up in Winnipeg, which is not—it's everywhere in Canada's Indigenous community, really. But Winnipeg is largely, I would say, settler-populated—so it's not like an Indigenous community per se in Winnipeg. So, in ENGAP there were just so many Indigenous people from all over the place. We have people from Nunavut, from Manitoba up North, and I really got to understand their experiences, and people's experiences which were similar to mine, or different than mine. Even if you're from any community, in ENGAP specifically, you have like, just to kind of list that you have. People who are from Treaty one, from Treaty two, from Nunavut—you get to see people from all over and stuff. So Indigenous people from near and far. -*Stan*

The Price Faculty of Engineering

For participants, the broader community of the PFofE sometimes evoked contrary feelings to those they had for ENGAP. This started with the space, which was less inviting and communal than the safe haven of the ENGAP lounge:

I guess one thing that was surprising to me a little bit—it's not maybe the most important point, but at [my previous university], the way the building is structured actually makes a big difference because everyone from all different disciplines knew each other. But in engineering, I think it's partially the physical building and the separation of the buildings. The people—you didn't really know anyone here other than people in engineering so that one was one thing that surprised me based on my experience at [my previous university]. Partially because [my previous university] is smaller. So that was one thing that kind of surprised me. And there is an engineering culture which I didn't know anything about, which, slowly, as time went on, would kind of surprise me. Because I didn't know anything about it. -*Stan*

The culture of the engineering student body was at times hard for participants to understand and didn't always align with participants' values. Certain behaviours and traditions were found to be tiresome:

I've got to say, as I develop as a person, my attitude to people that I don't understand changes, and I'm more accepting of people, but when I see—and I'm going to be honest—when I see people walking around in hockey jerseys that are like “engineering” and all this frat house stuff, I don't like it. I don't like it, and like I said, as I get older, I start to see that, you know, I would say now, with the culture I don't particularly like the culture,

but that doesn't mean that I won't like the people that are participating, that are wearing the jersey. So, I think me developing as a person over the years—maybe years ago I would see the person in the jersey and not like that person. But as I grow as a person, I feel like I don't like the culture per se, but the person I probably would like, actually.

-Stan

Divided Communities

A division between these two communities—ENGAP and the PFofE—was felt at times. At times they did not overlap or feel connected. Maria, in particular, tried to navigate this disconnect by mediating between different groups, to no avail:

I would say overall my experience is pretty positive, but it's probably because I don't look very Indigenous. So, people just didn't really comment on it. I would say it's overall positive, but anything I do remember from school about people commenting on me being Indigenous is somewhat negative. Like people saying we're so lucky to have ENGAP—which is true—but I think I feel like it's more like jealousy, almost like we don't deserve it, or something like that. Also just feeling like I had friends in ENGAP, and I had friends outside of ENGAP, and I felt like they could not connect or relate to each other. So, I was sort of like the middle person in between those two groups. I felt that a lot in university, actually. Like I was friends with people in ENGAP that were in all the same classes as I was. But then I was also close with other people that were in my same class, and it's very separated, never really any willingness on either side to communicate with each other. And that being vocalized to me too, right? So that was tough because I felt very close to both groups and didn't really understand why they couldn't get along. And I felt like it was just because maybe the students that I was hanging with in ENGAP were a bit

different than what people are used to. So yeah, I didn't really like that. Definitely not. And then yeah, I do have a couple of negative experiences where I went to bring some friends up to the lounge—the ENGAP lounge—to study, because there was nowhere else to study and there was barely anyone in ENGAP. And then afterwards they would say to me like, “oh I was super uncomfortable there, I'm never going back there,” and it's like, well, how do you think those students feel when they're anywhere *but* ENGAP? So that was kind of like an eye-opener to me. Yeah, they didn't want to put themselves in our shoes for like an hour basically. So that was my experience with my...sort of ‘friends’. And then I wouldn't really say that it was like anything directed at me, when you say like me personally, as an Indigenous student. But you see people being comfortable around you making comments and stuff like that, and then it's like, well, I'm Indigenous, too. But never really being able to tell them to stop saying that kind of stuff. I would think from this generation it wouldn't happen as much. But it did. But then obviously I see that in my everyday life too, even like family members on the other side of my family, like they're like very comfortable vocalizing what they think about Indigenous people. And now I would say that my family is getting a bit more vocal about not allowing that kind of behaviour. But yeah, I guess you see it everywhere. But I was kind of shocked to see it in our generation. -*Maria*

Braid 3: Identity

The theme of identity was prevalent among the participants throughout the interviews. This included both Indigenous identity and professional/engineering identity. Here we see the

various interpretations of these personal identities—complexities regarding Indigeneity, professional identity, and how they have evolved through their experiences.

Indigenous Identity

Being in the ENGAP community provided the participants opportunities to connect with and reflect on their Indigenous identities in ways that were a struggle to navigate on their own. Having other students with similar backgrounds and struggles, as well as Elders and staff members to talk to, helped some participants grapple with their Indigenous identity.

Prior to being in ENGAP I don't know if I was not as aware of my culture and community that I had, but once I was within the ENGAP program I think it brought out me getting more from my community and being pointed to be more involved, because through ENGAP we had the Elder-in-residence stuff, and got to talk to a lot more of the Indigenous community around the University as a whole, it was really cool to see where you come together. And it was like all because of ENGAP kind of being like the center point of it all. *-Alexander*

You know I've got to say, I didn't see at the time, but one of the most important aspects of being here was connecting with and understanding who I am as an Indigenous person. We have elders here. We have other people. There are so many ways in which Indigenous people were disconnected from who they are. There are Métis communities which were all of a sudden, due to population changes, white communities. So basically, disconnection is a major factor. And the elders here were just incredible in helping—helping you understand who you are. For me—my dad is Métis. My mom is Ukrainian. I

have the experience of saying, “who am I? Am I an Indigenous person?” I am an Indigenous person, but the elders are extremely helpful in identity, and helping you find who you are. I also think that Randy and Tannis, being Indigenous people, have greatly impacted my experience, and I think that's part of the thing about Indigenous people being in positions—is that they can help you with your journey and understanding who you are. Because they're on the same journey. So that was one of the most important things which I will take with me for my whole life. No matter where I go or what I do. Yeah, Randy has supported me so much. I can't even explain all the ways—I probably can't even remember all the ways he supported me because he's supporting me in so many different ways. -*Stan*

The complexities of Indigenous identity and concerns over how people perceived and treated ENGAP students were present for participants. Stan felt there was a responsibility to support each other in ENGAP, because those outside the program might not always have a good attitude toward ENGAP students:

...As an Indigenous person, I think really, one thing about Indigenous people is we have a connection, like a sense of community to each other, and that was reflected in ENGAP, because I think everybody felt like, if you were an ENGAP, student we would want to support you. It is really like the community...it's like you have a responsibility. Like if you meet someone and you find out they're an ENGAP student—I feel like I want to help that person. That is really important. Say you're a program director. That's what you want out of your students. You want them to meet each other and immediately want to help each other, because it matters that there's a sense of community, you know the help that you give them is different than the help that some other random person gives them,

because if you help them, you're in increasing the sense of community. And then to say, I know I talked about how I feel I have a privilege...it's kind of hinting on this 'white privilege' kind of thing. But we all have different privileges, different types of privileges. I feel I have a certain privilege, but at the same time there are certain ways that people look at me that *I don't know*. I don't know. Sometimes maybe I'll have a bad experience. *I don't know* why I'll have a bad experience. I don't know if they have attitudes that they're projecting onto me. I don't know, so, you know, it could be. -Stan

Professional Identity

In addition to Indigeneity, the professional identity of being an engineer was also addressed by participants. Some expressed ambivalence toward the profession and their place in it, but pride is evident among the participants—both in terms of the achievement of obtaining their degrees, and in what they've accomplished professionally:

Well, that depends on the day...but no, no, it's good, like I said, sometimes it's kind of frustrating, and sometimes you feel in over in your head...there's a lot of components that I don't know about, that I still have to learn, and it's a lifelong process, right? And I think that'll just get better over time. But I do like being an engineer. I definitely think I made the right choice. You know I've seen projects from start to finish now, and it's always a rewarding experience seeing what's happened over that course of time. And that just reinforces my decision to be an engineer. -Joseph

I think really the best thing about engineering, with all the things which are good and bad, the best thing is how hard you have to work to get that degree. Anyone who has an

engineering degree has worked their ass off. There is no one who can do this degree easily because it's not just mental. It's physical. You have to physically be in the lab. You can't just be really smart. You actually have to be in there and move things around. It's very hard, and you have teachers who present in different ways. They want us to work, and we have to do it. To have an engineering degree is a thing to be very proud of. It takes so much work to get it so hard to get it, that I think that's the real thing, like all of us—every graduate is a hard worker, and what we do in life, for the most part, you can trust us to work hard. I am very proud of it. I think a lot of time I try to not necessarily tell people how proud I am of it, because it's like, you know. It's like bragging kind of, right? I mean, it's always the thing where you're like—are we just going to go up and tell people how proud you are of having achieved what you've done? But yeah, I am very proud of it. -*Stan*

The participants all felt that the engineering profession is valued and important, but some feel that a discipline with more personal stakes and a more communal sensibility would be more appropriate for them. Maria expressed this, explaining why she moved from an engineering position to a less technical position adjacent to engineering:

I feel like it's a really good profession. I feel like it's really cool and it's a valued profession. People think it's a good job and stuff. I like that there are so many different things you can do with engineering. Like now, after I graduated, I feel pretty good about being an engineer, I guess. I also felt like I could have done other things as well though, just because I didn't love the technical part. I basically found through my degree that I like people—I liked helping people, so I could have ended up in different professions. I feel proud to be an engineer. I feel like it's a super hard degree to get through. But yeah, I

don't know. I think it's cool. I think it's really cool, and I'm just more interested in helping people find what they want to do more, based on how I felt when I was in engineering.

-Maria

Participants' struggle with the engineering identity goes beyond figuring out whether an engineering career is the most suitable choice, though. Stan had serious reservations over the values and attitudes in engineering education, exemplified by concern over the significance of the Iron Ring ceremony and Kipling's "The Ritual Calling of the Engineer":

...Before the iron ring ceremony, I found out about Kipling. I thought, "this is just wrong", and at the time I was taking this course...it was all about colonization and stuff too. So, it's like the same thing—I had to write essays on things, and then at the same time Kipling was in the iron ring, and I just thought I just...I feel like I let myself down to be honest, because my ethics told me not to go to the iron ring ceremony. That's what my ethics told me. That's what my heart told me, but I did it anyway, I went there. I mean, it's not anybody's fault. It's still my own fault for going, but at the same time the pressure that I felt was that you could potentially negatively affect your career by not going, and you can tell people that it's not a professional thing, but it is, it really is, and you say "oh, well, it doesn't have any professional meaning". Well, if you say that to me, I'm going to say I disagree with you, because if you don't have the iron ring, you will be treated differently in your 30-plus year career. You will have to explain it multiple times. If you're an Indigenous person, if you are a person from poverty who always feels like they did something wrong, who doesn't feel like they should have this degree in the first place, are you going to go and make the decision not to have something which you're supposed to have? That's the thing. People like me. Probably everyone. Maybe it's every

single person—feels like they did something wrong, and I didn't want to feel like I did something wrong, so I went to the iron ring ceremony. My heart told me not to. I still went. I let myself down. That's really what it was. -*Stan*

Evolving Identities

The participants' identities evolved through their experiences in engineering. The participants explained how both their personal and professional identities changed throughout their studies, and how they gained better understandings of themselves and what they prioritized doing.

Stan explained how he did not see himself as an engineer, partially because he switched to a different area of study after graduating, but also because he struggles with some of the cultural aspects of engineering:

Well, the interesting thing is that I'm not really an engineer. I didn't take a lot of pride in a lot of the aspects of the culture that other people did. Like I said earlier, a lot of the culture I didn't really relate to. I still don't understand it, so you know, like, for example, I don't wear my iron ring, and there's a whole thing behind that. But basically, I'm proud of engineering because of how hard it was to get it. I'm not necessarily having this sort of particular pride in being an engineer, to be honest. Like if someone has a physics degree versus an engineering degree, they're both very hard. Some people might feel particularly pride for engineering, but for me not really. I think they're both really hard, so I don't have that kind of pride in it. -*Stan*

Ernest described a similar evolution, having reckoned with what it means to be an engineer and realizing his calling was to focus on social issues more than technical engineering:

I think there was a change in how I felt about being an engineer too. I never had strong feelings about what kind of engineering I wanted to do, but for a number of reasons I eventually started to gravitate toward more social-minded things. Part of that might be that I want to contribute to positive change, and part of it might be that I don't actually want to be an engineer that badly. I decided to go do my master's in engineering education because it presented the opportunity to think about engineering critically. So in that sense, I would say my view of the profession or my studies took a turn toward a critical worldview that was not so present at the beginning. *-Ernest*

Stans's evolution came from the realization that other people—forming relationships with them, and helping them—was his priority:

Well, my attitude changed after I graduated high school...My mom told me, "You can go to university, but if it doesn't work, we don't have the money to support you to do it twice. If this doesn't work for you it's not going to work." At that time, I made some big changes in my life. That was it—my attitude was 100% into working very hard at that time. So my work ethic was strong right from when I was at [a different postsecondary institution in Manitoba]. My attitude, I guess, over the years—I think my biggest thing is that slowly, every year you could say I care more about other people, because initially I wanted math, and I wanted to do good in math in the courses, but every year, every new person that I met, I'd want more to care about other people, basically. *-Stan*

Braid 4: Belonging

The importance of belonging was evident through the conversations with participants. In this braid, Joseph and Stan expressed the importance of belonging and the process of finding belonging in terms of community, culture, and the engineering profession. Though Stan is quoted most often in this braid, these feelings of being an imposter and the importance of finding a sense of belonging are representative of all the participants.

Belonging in Engineering

Joseph discussed a lack of confidence in his ability to handle his engineering studies through the first two years of his program. Part of this was due to a high level of turnover among his peers, but as his community crystallized, he began to feel that he belonged in engineering:

You know, the first couple of years, I at times didn't really feel like I belonged there. Like, it was almost like I'm kind of an imposter. I had a bit of a rough second year...I was not doing so well in some of my courses, and there were times that I was thinking maybe I should be transferring. Maybe I shouldn't be continuing with this. But once I persevered over that, I definitely felt a lot more confident about where I was going. Especially considering pretty well everybody that left had left already at that point, mostly at least, and the people that you were going to classes with were the same people. And you were probably going to make it through the end with them, and I felt more confident in that way, just knowing that I only had a couple of years left, and I had kind of an idea of what it meant to be an engineering student and what I had to do. So, it was kind of an evolutionary thing, where in first or second year it was like, "oh, I don't know. I don't know if I can do this" kind of struggling a bit. A lot of people are leaving, and I'm not really having a consistent group of people that I'm doing my courses with, and that kind

of evolved into, you know, I'm getting close to the end. I'm working with the same people, and we're all in a kind of “get through this together” sort of mindset... You know, we all kind of have a collective understanding about the fact that we were the seniors at that point, and we kind of had our own community. *-Joseph*

The struggle to belong can go deeper than not doing well in courses or being unsure about the profession. Stan recalled an unshakable feeling that his behaviours and ideas were always wrong or inappropriate in the university environment.

The thing about negative experiences is that, in my mind, every time I have a negative experience, I can't get over the fact that maybe it's me. Maybe that I did something, so in all of my experiences which are negative, I can't separate that I may have done something. Like I had one experience where it was actually another ENGAP student said: “Oh, you know you can take your midterm back to this, professor and he might give you some marks back.” So, I did the same thing, but I did it much later, like a couple of weeks later, which I think in the professor's eyes is maybe not doing it when you should be doing it. Because he's forgotten about the midterm. So, I had a bad experience because I asked him, and then he just wasn't very nice to me. But at the same time, you know, I don't know like maybe he saw me come in late, maybe because I came 2 weeks late or 3 weeks late to ask, so I had a lot of experiences like that. I mean you can take that as sort of an anecdote. But I've had many experiences like that where I don't know if people are treating me a bad way, or if it's because of my behaviour, because I understand teachers get frustrated with students—if I came in late or missed class or whatever, I do understand that. So, I think to be fully...there could potentially be some experience which maybe I could be helpful that I could think of it at some point. But I can't think of

it right now. It's kind of related to this sort of 'imposter syndrome' type of thing. I think other people feel like this too, but always feel like *I* did something. Like, it's just me. And lately, I've been having this experience with some people. I went to [a Canadian engineering conference] and I have been talking about some aspects of the iron ring ceremony, where I had a negative experience...and I thought, in my mind, that I'm just being difficult because it's just kind of how I am. I'm a little bit...I just have a little bit of rebelliousness in me. So, I just thought well, because Richard Kipling was a well-known racist person—people call him imperialist, but I prefer to use racist—I think it gets to the point a little better. Anyway, I thought “well, maybe I’m just being difficult, maybe I’m just causing an issue when there's no issue. Maybe I'm just...I don't know. Am I just trying to get attention?” What is going on in my head that I have an issue with this? It's me. And then lately, in the last few years, when I was at an education conference, I met people who had the same feeling, and I realized it's not just me. And I was really important—it's not just *me*. That's just unbelievable to me, because I've always had that feeling, and I think many people have it where it's just like, I'm just being difficult. I'm just, you know, being rebellious or something. I don't know what the truth is, or whatever, but then other people say they have the exact same experience. It's like “it's not just me.” I really wasn't alone, ENGAP supported me with what they could, but I was alone in my own head. I feel like there's potentially a lot of things, experiences, where like this situation with the professor, there's a lot of stuff I could talk for a long time about. Every situation in my head that sticks with me, and if you maybe looked at them all and looked at other people's, you'd say, like, “okay, there is actually a pattern of this potentially happening”. And maybe this is what the research is sort of about in a certain degree, just

some sense or another. That's one thing I think people should know, that I want people to know, is that if you have a bad experience, if you come late and the professor doesn't treat you nicely or whatever, that it's not just *you*. It's not in your head. You're not just being bad. Because I feel a lot of us have this sense like, "I'm always doing something wrong". You know that's how I always feel. So, if you feel like that, I think you should know that other people have that same feeling. I walk around every day trying not to do something wrong. And I'm very, very careful because that's how I am. And I want other people to know that. So, I sometimes try to let other people know that. -*Stan*

Finding Belonging

Participants found acceptance among ENGAP students. Stan points out how connections with ENGAP students fostered a sense of belonging:

It made me feel proud to have some connection with them. Because a lot of the people were just really good people who I really felt proud to be connected to, and other people's acceptance of me personally was important to me. And when they have mostly accepted me as a peer and a friend it meant a lot to me. -*Stan*

Stan gave a word of advice to current and future students on forming relationships to find a sense of belonging in the university setting:

I think if you share the one thing, I would say to ENGAP students, if I could say to ENGAP students, and in a formal honest way, is to share with each other your honest experience as an Indigenous person and to say that sometimes I feel I don't belong because other people might feel that way. And then, when you share that you know, other

people will feel like “actually, I do belong”, because it seems like everyone here has a feeling that they don't belong, whether that be in sort of Indigenous-led events or that being there in university because a lot of people don't feel like they're supposed to be there. I wasn't meant to be here, so that's what I would say to ENGAP students—to share with each other more and let yourself be vulnerable when you can. When you feel safe is important. But if you feel safe and you feel like you have a connection with someone then sharing who you are, honestly, it helps other people, I think. -*Stan*

Braid 5: Giving Back

Each participant expressed a desire to give back. This drive to help was found in their actions both during university, and in their career paths since graduating.

Giving Back in ENGAP

For Maria and Stan, the desire to give back focused on giving back to their own community—in this case, ENGAP. Maria found herself in a mentoring role with newer ENGAP students toward the end of her studies:

There were twins in the program, I'm sure you remember them. So I got really close with them. We would try to bring them to a quiet study space, or something like that. Try to help them with some of their classes. They were really great people, but I feel like I never would have talked to them if I wasn't in ENGAP, if that makes sense. That was probably the most positive experience. Towards the end of my degree sort of forming those relationships with not just people in my years, but the people in their first and second year and just sort of taking on that mentorship kind of. -*Maria*

Stan felt a responsibility to help in ENGAP, due to his connections to the community and his understanding and recognition of the hardships that some of the students faced:

...That actually goes back to me feeling a responsibility, to my community at the time, which was ENGAP, I feel still feel like it's my community, but especially when I was in the program. When I knew with my education, and how I was doing in the program that when a teacher wasn't able to teach, I always felt like...and this might be kind of conceited in some way, but like I felt like if I'm having a hard time with this, other people are having a hard time with this and other people are closer on the cusp of not passing this course. It's just a fact of the matter that I was doing well, and I did work in almost all the courses. So, if I was going to be downgraded by the level of teaching, other people would be, and it would affect them more. So, when I saw teachers who didn't teach well—which were many—I felt like “this is wrong”. Because you're increasing the filter—teachers are filters. If you teach poorly, some students like me, who have an education in the city, understand how to go and work around you being a bad teacher, and we'll go and get an ‘A’, or whatever other people don't. What you do will affect the students who are struggling more. It will affect them more. I know I always have this thing too, which I've been lately thinking about, which is, we always say, “struggling students” or “students who are whatever...”, and in a lot of ways what we do is we focus on the negatives of these students, but these students have strengths. A lot of the students who didn't have the same education that I had have a stronger sense of community, and they have many things that we can learn from. We could perhaps recreate our entire curriculum based on what they know, but in a lot of ways, in terms of the way the program treats them in what will make you successful in the program, they are a struggling student, even though they

could teach us quite a lot. They could revamp our entire curriculum in a better way. So, I personally think that the teaching needs to be better. It needs to be better. It's a filter.

Yeah...I'm passionate about that. -*Stan*

Giving Back as an Engineer

Alexander more generally wanted to leverage his position as an engineer to give back to Indigenous communities more broadly. Alexander explained how getting a new job gave him the opportunity to work with Indigenous communities:

So, there are two reasons. The first one was: Yeah, working with Indigenous communities because I was funded for university through my band so I've always thought that I should give back my knowledge and help out any way I can and it kind of seemed like I wasn't doing that at my prior job. I was just kind of there to make people with some money and stuff. So, it was like a mental...wanting to do something more important, I guess. My second one was like a work/life balance because at my prior job it was a lot of work and not a whole lot of life. -*Alexander*

Josephs's desire to give back was broader still—he expressed that regardless of who he was helping, the important thing was to do work to improve society.

I wouldn't say it necessarily drew me to that job. You know, the way I see it is, Indigenous communities or non-Indigenous communities, there's going to be issues that need to be solved, problems that need to be solved. People are always going to have things that could be improved, and that doesn't matter if it's a reserve or a municipality, and I've worked in both, and there are a lot of similarities there in terms of the actual work. Now, how it's managed, and how the actual paperwork side administration side

goes, there are definitely some differences. But yeah, I wouldn't say working in Indigenous communities attracted me to my job, it is just a component that is quite strong where I work, and just a lot of the work that we do in where I work is Indigenous-focused. *-Joseph*

Wanting to Do More

Despite some ambivalence regarding the profession, the urge to help people was uniform among the participants. Maria described her view on the limitations of the profession in terms of her drive to help others, how those values guided her career path toward an engineering-adjacent position in a post-secondary institution:

I kind of just feel like I got through my degree but wasn't super passionate about any certain industry or field. I ended up in the field that I excelled at naturally, I guess in school. Do I feel passionate about that industry? Not really. But yeah, when I was an engineer the projects that I liked were like we would help design water treatment plants for like First Nations communities and stuff—that's what I really like. Again, it's like the helping people aspect of it. *-Maria*

I feel like the reason why I wanted to [work in a university] was because of ENGAP—I feel like the whole ENGAP experience was what I loved most about the university. So I guess that experience was the most impactful. Definitely. When I look back at my time as a student, I think about everything that happened in it, and all the support that I got. Everything else is just sort of I felt like was—you may have received the same experience in different faculties, like, if that makes sense. Like any classes or any people

outside of ENGAP, I felt like the people in ENGAP were the most impactful for sure. And the safest space kind of thing. Yeah, I don't really know how my degree would have gone if I wasn't in ENGAP. But now coming back to university, in a role that's so different than what I was in, when I read the job description for the job that I'm in for example it's like, oh, this is so different, it's not technical at all, but you can still make a huge impact on students' lives, you can help people in industry, and you can still have an engineering degree while doing that. It's still impactful work, I find...I've also started attending [student recruitment events] because I remember when I was a student going to those it's like "Oh, that sounds really cool, but like I don't know if I want to move. I don't know how I would move there." There are just all these factors. So, if a student is thinking that they're going to go out of province or somewhere...I know I didn't feel supported, and I know some of them feel even less supported so yeah, I go to those lunches just to understand what employers are saying to the students. So then, if they have questions about any barriers they're facing while applying to jobs like that then I could try to help them. Yeah, but just getting started with that. I just started doing that this Fall. But I'm happy—I've met with maybe 5 or 6 students so far, so I feel like it will take a while for them to know you and feel comfortable coming to you. But ENGAP's been really great too. They'll they like bring students to me, point students in my direction. -

Maria

Braid 6: Support

Throughout the interviews, it was clear that all the participants had a support network that had a substantial impact on day-to-day life and eased the struggle of engineering studies. For the

graduates, the support network included family, friends, partners, and the ENGAP staff (Randy, Diane, Kristin, Tannis, as well as Dawit).

Support from Family

Supportive families were present for all the participants. For Alexander, having family members and partners to help bear the load of being a university student in a challenging program, financial support from his band, and general support from his partner allowed him to give his full attention to his studies:

I wasn't working because I was funded by my Band, so I had time at home, and my wife, or fiancé at the time, was super supportive and took care of lots of stuff and I could do eight hours of school and then another four or five hours at home. *-Alexander*

Stan noted that his partner was important in supporting him and bringing balance to his life:

Right around when I started university, I started a relationship with my girlfriend, and we still are together. So that's been the most important. I mean, I think that's important for having something which is important outside of school. *-Stan*

Maria had the support of her family throughout her studies. As well, she met her partner in ENGAP, who was a positive influence on her study habits:

I'm really close with my sisters. My middle sister was going through university at the same time as me, in a much easier degree. But at least I had her, you know? At least I had someone outside of engineering. And then I was able to make connections with other people, not just in the engineering faculty which I feel is healthy. And then my parents were really supportive. Yeah, I met my husband [during my time in] ENGAP, so he was

obviously very supportive. And he was a year ahead of me. So that was helpful. Yeah, I feel like he really taught me how to study. He was very strict on that kind of stuff. Very disciplined. And I wasn't, so when I met him, I started practicing the same study habits he did. Because well, if I wanted to spend time with him, that's what he was doing. And then I really excelled at school after that. So, I feel like that was a pretty impactful relationship that I had. But yeah, him, my family, they were very supportive. I feel like I could have gone to any of them, right? Like my family, ENGAP, and my husband, for support whenever I needed it. *-Maria*

Ernest echoed the support of family, adding that friends both in and outside of school were supportive and helped motivate him:

I lived at home throughout my entire degree. My parents were extremely supportive of me at every step and pushed me to keep going when I struggled. My friends were important—I got to watch most of them grow alongside me as they embarked on their own endeavours. Many of them inspired me and motivated me. My peers at school were important to me as well and were also friends. It would have been difficult to get through engineering all alone. *-Ernest*

Support from ENGAP Students

Friendships with other ENGAP students were important as a support system for participants when it came to doing well in school. Having peers who were in the same situation and were willing to help one another was appreciated:

There were a couple of times when there was no one in my class, and I had to work with non-ENGAP students, which is fine, and you know, they were cool people. But I think

those partnerships and friendships [with ENGAP students] were the most meaningful. They really contributed to my success as well, especially when I wasn't doing so great in my classes and needed some help. So yeah, I would say kind of the other ENGAP students, I think, would probably be the most significant relationship impact on my degree. -Joseph

Support from ENGAP Staff

The ENGAP staff were highly supportive and available for the participants, which contributed to a feeling of comfort:

The supports at ENGAP are really good. I used Dawit a lot to help get me through my degree, and he was always super available, right? That's the one thing about ENGAP I find, is they're all—I mean. I guess that's their job—but they're all available to you almost whenever you need them. I felt safe there. I felt like I could get through anything with the help of that program, whether it was applying for funding or if you're having trouble in a class. I never really got into any sticky situations or anything like that in school, but I feel like they'd be able to support you with that kind of stuff as well. And just having somewhere to hang out and study is a game changer. Somewhere where you feel comfortable, rather than just going to the library or something. I found those helpful. So, I loved ENGAP. -*Maria*

At school, I mean like I said before, when you meet the other ENGAP students, I literally felt pride in just knowing them...I felt with other ENGAP students that when they did well, I was proud, or when they did bad, I would look out for them, and if they feel that

towards me, then that makes me feel so proud. And I think all of the ENGAP staff.

Randy, Diane, Kristin, and Tannis, have helped me so much. Kristen being a counsellor—there's been a lot of times when I needed counselling, needed a counsellor to listen to me. And Diane, she just loves math so much, and we just connected on that level, even though she wasn't my teacher, formally at least. *-Stan*

You're making friends, you and your colleagues in school having a place to meet up was something that I never experienced before. The support you got from the people in the front—I didn't take full advantage of what they could all do, but it was there, and it's kind of like a good backup—having somebody to go talk to, if you needed any kind of advice on the school administration...you know how the maze of things you have to do to get anything done in any university is. You need experience, so having people with experience is huge. And with Dawit there to help you with any kind of math you have, it couldn't have been better, I don't think. *-Alexander*

Braid 7: Challenges

Participants mentioned a variety of challenges that affected them and the people around them throughout their studies. These included being affected by the hardships of others in the ENGAP community and the non-completion of many students in the program.

Attrition in ENGAP

Being active in the ENGAP community was not without challenges. Many students in the program did not make it through, with a large portion of each cohort departing engineering studies within the first two years, by the estimation of the participants:

I must say as well, another thing that stuck with me was how many people don't make it through and seeing a number of people that either transferred or dropped out or whatever. And I don't know. It's kind of sad in a way, but that's just kind of how the process goes.

-Joseph

Most of the students in my cohort (there were quite a few of us) didn't make it through engineering. Most of them left within the first two years, I'm assuming in some cases they did not have the grades to get into a department. Virtually all of these students just stopped showing up at some point and were not seen or heard from again. It was a little bit demoralizing to watch this happen. Others continued but seemed to be stuck in their studies, moving through their degree seemingly in slow motion. This was also sad sometimes, as one would hope to keep taking courses and studying alongside these peers.

-Ernest

The loss of classmates was disheartening for the participants who were continuing their studies. From Maria's perspective, the non-completing ENGAP students were noticed around the PFofE as well, and there was a perception that ENGAP students are destined to fail and that the success they do have are handed to them:

There's also this perception that the students in ENGAP are never going to make it. Not all of them, obviously, because some people in reality don't need ENGAP, right? It's just

there as a nice support. They would have gone into engineering direct entry, or however else. But yeah, I don't think there are any positive vibes...people just think that most of the students in ENGAP aren't going to graduate, so it's hard when you know that that's how people perceive you. So, I don't think that really helps because people are sort of expecting you to fail. -*Maria*

When I rave about ENGAP, because I love the program so much, and I love the people in the program so much, whether they made it through engineering or not I feel like it's still a good life experience for them. And you know sometimes you say, “oh, ENGAP would be my dream job”, or something like that, like to go back and help support that program. And some people say, “well, it would be nice if, like more than like 3 students graduated a year, because it sucks that like half of them don't make it” —like “they're never going to make it” kind of thing. Or referencing back to like “oh, Diana is a really good teacher, but it must be so hard when half the students like don't even make it through calculus,” it's like, that's your perception of the people in the program. It's almost like they're saying like they're...it's their traits that they're commenting on, right? Like they're stupid, or they don't have any ambition or things like that. So, I feel like that's a common thing that I still hear now. -*Maria*

“Winnipeg Education”

For many ENGAP students (not necessarily the case for the participants in this study), there is a struggle to adapt to university life and expectations coming from remote communities. Stan explains his view on this challenge, having known students who struggled with the

transition to postsecondary and the academic and cultural expectations that come with it. Stan points out the importance of what he called a “Winnipeg education” —which means to have had access to the educators and resources of a large city (Winnipeg) that generally better prepares students for postsecondary. Not having this path available creates challenges for students from distant communities. Stan was conscious of this, having known many students in ENGAP who were not prepared due to their experience in an education system outside the city:

Well, I think really when you're a part of ENGAP, you feel like you're connected to all the people that come into ENGAP. That's how I feel and that's how a lot of people feel, I think. People come into engineering with different strengths, and one of the privileges I had was being able to take pre-calculus in high school and having teachers who were the highest educated, or whatever. So even though I didn't take physics in high school I had a good education for university. University is designed for the standard stuff which is mostly looking at people who are in the city. Even a short drive outside Winnipeg, education starts to become harder to find teachers, basically. The more you're in Winnipeg you have even private schools and things like that, which I didn't go to, but I'm just saying, you know it even affects...a private school near your school will affect your school because people will be around each other. So anyway, with people in ENGAP, having different strengths, being from all over, and you know, I have seen situations where they didn't have physics in their schools, and didn't have math, or they had math, but not like grade 12 precalculus, or the same education in that Western science way that I got. So basically, you look at it as a system which is not really the engineering program is not designed for people who don't have a full, say, “Winnipeg” education. It's designed for people with a Winnipeg education. So basically, that's why I started to care more and

more all the time, to see other people's experiences...the difficulties. I've seen a lot of people not complete the program. And that is very sad to me, because they have passion. Sometimes people don't complete because they don't commit to what they need to do for work, and in those cases, I don't look at it as sad of a situation because they didn't do what they needed to do, though this I feel for the people, and I hope they do well in life. But when people come here and work hard every day, and they're not succeeding, that just is heartbreaking. There are situations where people come in and don't put in the work and, like I said, I hope they do well, I hope they do well in life, but it's not as heartbreaking of a situation, but when people come in and you just see how hard they're working—their nights or their mornings, they're on time every time, all of that and it's not working, that is just sad. -*Stan*

If you ask me my experience as an Indigenous student...so, I'm an Indigenous person. I grew up in the city. My mom is Ukrainian. So, one thing, which, like people talk about in some stuff, is I can be just—with my handle on the language—my education earlier, growing up in the city, makes it so that you can in some sense be Indigenous at certain times, and not be Indigenous in other times, and what I mean by that is, it's a privilege. ...How I view myself in general, not just in engineering, but I view that I have the privilege of when people talk to me, they don't always know that I'm Indigenous sometimes and they see the way that English is my first language, so they'll just treat me as someone else that they know, or whatever. It's not the same experience for everyone. So, my experience as an Indigenous person is going to be obviously different. But for some people, if English is their second language, you know, but even things like that. My

hair is short, for example, I don't have a ponytail or other things that people might notice that I'm Indigenous. So, there are certain factors, not just in engineering, but in general that make it so that people will treat me in a certain way that maybe if they have a...not saying necessarily in engineering, but anywhere if they have a negative attitude towards Indigenous people, they may not reflect that on to me. *-Stan*

Work-Life Balance

Striking the right balance between studies and life was challenging for participants. One of the results of this was that the participants struggled to get involved in extra-curricular activities, and there was little time to find enjoyment in the journey of being an engineering student.

I guess if I did it slower, I would have enjoyed myself more...Looking back, maybe taking one extra semester, like when that would kill me? I could've joined a club or something I guess...You know, I might have enjoyed it a little bit more; like I think that I was pretty driven to complete it and get back out into working and stuff because coming from working and going back to school was tricky. But no, I used to think—while I was in school, I didn't want to be in school, I wanted to be done. *-Alexander*

I think the biggest thing that stands out is the fact that I feel like I didn't get involved enough with university-type of events. You know I didn't...I mean I'm not really the party type, but I didn't really do any social events at the engineering level, or whatever. Very few of them. I was always kind of just buried in my books and studying, and now that I look at it, it's kind of...I don't know. It's kind of unfortunate that I kind of didn't

experience that university atmosphere a little more than I did, because again, in hindsight, it would have been kind of nice now that I'm gone. And oh, I'm just working as this guy that has left school, you know? -*Joseph*

Chapter Summary

In this chapter, I used thematic analysis to braid the words from the participants into seven braids using Métissage to provide multiple perspectives on these broader topics: educators, community, identity, belonging, giving back, support, and challenges.

Chapter 5: Discussion and Analysis

Analysis of these narratives could take many forms depending on what one is aiming to accomplish. One of my goals in writing this thesis is for the voices of ENGAP graduates to be heard. There is also value in directing their words to specific recommendations. Drawing from Donald (2012), I use “hermeneutic imagination” in this chapter to interpret the findings rather than summarizing what has been presented in Chapter 4. To accomplish this, I use multiple frameworks to analyze the braided narratives, in addition to comparing the findings to the literature. I intend these distinct frameworks to provide alternative perspectives for meaning making when interpreting the participants’ words. In doing this work, I consider and include relationality and holism.

Approaching Discussion Through Relationality

To discuss the findings and draw meaning from the collective narrative, I consider the relationships present throughout these braided stories and their significance to us as ENGAP graduates. The types of relationships considered in this discussion follow Wilson’s (2008) summary of relationality, which includes relationships with people, place, cosmos, and ideas. Following those categories is a discussion on the concept of self as relationship – the concept that people are not only in relationships with people/places/things but *are* those relationships, as described by Wilson (2001a) – focusing on how the participants of this study defined themselves through the relationships they described. Through this process I make apparent how the participants were related to ENGAP and the PFofE, and by extension, how those contexts shaped participants’ experiences.

Relationships with People

Relationships with and between people is the first category I considered in this relational analysis, as it is the most relevant and most prominent in the experiences and opinions of the participants. During the interviews, the participants were asked what relationships were most important to them throughout their studies. Those answers are largely what inform this section.

Relationships with(in) ENGAP. Relationships with the ENGAP staff were impactful for participants. Their presence was valued by all of us, even though we rarely *needed* their help through our degree. The fact that they were present and available, and the fact that the same core group of staff was consistent over the years, was comforting for us.

Each of us mentioned, Dawit, ENGAP's tutor, in our interviews. Every participant had a relationship with Dawit. The underlying reason for the significance of this relationship was the respect Dawit had for the students and the rapport he built with us. He at once managed to juggle truly appreciating what we were doing with a pragmatic approach to helping us succeed in coursework. This is to say that Dawit expressed the importance of understanding the coursework while also teaching us in a way that was guided toward getting us through our exams. Dawit was like a friend and was often available. Having him within arm's reach made him accessible, breaking down a barrier to getting help.

Our relationships with other ENGAP students were extremely important as well. Each of us discussed this in some form during our interviews. Stan in particular spoke at length about the value of the other students to him, and to the community. Joseph discussed how, despite having friends outside of ENGAP, the friends he made in the program were the most important to him, and when he had classes without other ENGAP students, he found them less enjoyable.

Relationships with(in) the Price Faculty of Engineering. There was a level of uncertainty expressed by the participants when it came to the broader faculty, as well as the profession. The relationships between the participants and their program, their professors, their peers, and the culture of the community were complicated. One participant had at least one poor experience with an instructor. This same individual struggled with the culture of this institution. This was exemplified both by his perception of the attitudes of engineering students in the greater PFofE as well as the meaning associated with traditions in the profession, such as the iron ring ceremony. Stan used the example of an “engineering hockey jersey”, as a negative representation of the pride common in engineering students’ attitude toward their profession.

The education braid demonstrates a disconnect for one participant between ENGAP and the PFofE. This disconnect was identified by participants to be in the student body as well as in educational practices. For example, the recollections of ENGAP upgrading courses and tutoring were positive, while the reflections on the philosophies of the PFofE were more critical. Stan spoke generally of university instructors lacking mindfulness toward students and recalled an instance of an instructor treating him disrespectfully. Regarding the disconnect among students, Maria perceived an incompatibility between some general engineering students and ENGAP students.

Division between the PFofE and ENGAP was evident particularly for one participant. Maria recalled a division between her friends in and outside of ENGAP. In Figure 1., the conceptual framework presents ENGAP as being nested within the PFofE. While this might be true bureaucratically, Maria suggested that in spirit, ENGAP feels displaced from the rest of the faculty—her student communities did not mesh well, due in part to the judgmental mentality in the student body toward ENGAP and /or Indigenous students that Maria experienced.

There was some ambivalence toward the profession among this group of participants. Issues with the profession ranged from minor frustrations on the job (Joseph and Alexander) to more complex questions of whether engineering was/is the right place for that person (Maria and Ernest). In the case of Stan, the desire to be an engineer was never the true goal, and the engineering degree was a compromise. ENGAP allowed that individual, Stan, to get an engineering degree and work toward his greater goal.

Other Personal Relationships. It was apparent that among this group of participants, there was a uniform feeling that their relationships held a high level of significance in their lives. It was made explicit that each of us felt that other people, family or loved ones, contributed to our success. This is an aspect of our collective experience that cannot be ignored.

Strong support systems were in place for all the participants. At least one of family, friends, and partners were cited as important relationships by all of us, and acted as a foundation for the graduates as we traversed our studies.

Relations with Environment/Place

When Styres (2017) discusses to “Land” or “Place”, she is referring to the natural environment that our livelihood and knowledges stem from. In the context of this study, the importance of Land is indirect and complex, as the participants come from different places and the focus was not on any Place, but rather unifying context of the U of M. However, there is significance in the role of the U of M and ENGAP as places that the participants have relationships with. In this sense, viewing the U of M, the PfofE, and ENGAP as places of significance and of knowledge transfer is worth pursuing.

Places are foundational to people's sense of being (Styres, 2017). It follows that if someone is defined by their relationships with everything around them, that places where people spend time would be influential on their being. Wilson (2008) writes,

Knowledge itself is held in the relationships and connections formed with the environment that surrounds us...The space and therefore the relationship between people or between people and their environment is seen as sacred a key concept within many Indigenous peoples' spirituality. By reducing the space between things, we are strengthening the relationship that they share. (p. 87)

Stan's criticism of the way space was used reflects this. He felt the PFofE's complex, comprised of three large buildings connected by an atrium, was sprawling, and made it difficult to find a community within that space. Contrasting this, the physical space of ENGAP did reduce the space between things – specifically students and support staff – making the relationships between them stronger. The ENGAP lounge allowed for congregation between students to form friendships and work together, while the ENGAP staff's offices being directly adjacent made them accessible and allowed those staff members to interact with the students on a frequent basis.

Relations with Cosmos

Spirituality, or relations with the Cosmos as Wilson (2008) names it, is a fundamental set of relationships for people (and for everything/everyone). Discussing spirituality in the engineering context is complicated - the engineering worldview emphasizes rationality and falls into a positivist ontology, which leaves little room for the subjectivities of spirituality. Spirituality was not touched on explicitly by the graduates. Thinking about the university environment did not evoke memories related to spirituality. The absence of spirituality within the narratives is, in

terms of holism, concerning, as, when considering this finding in terms of the Medicine Wheel, it suggests an imbalance, and a person's fundamental relationships are not all present.

Relations with Ideas

Knowledge itself is relational, and epistemologies and ontologies are culturally based, according to Wilson (2008). Engineering and engineering education have their own sets of ideas and values that inform how engineering students are taught, and by extension, how they think. The participants in this study all made it through the program, suggesting we can operate within engineering epistemology. This does not mean, however, that we subscribe to engineering epistemology wholeheartedly. Rather, we showed that we were developing our own relationships with ideas through our narratives.

Stan described Randy as having the “spirit of math”. This was important to him – he felt that Randy, as an educator, was interested in what he was teaching and wanted to instill that in his students. Having a teacher who has a deep interest in the subject they are teaching was valued by Stan and helped him realize what was possible with the knowledge he was being taught. This conceptualization may also help ENGAP find the ‘spirit’ (see previous section) in the program to balance students’ experiences.

When discussing curriculum and preparation for professional life, participants noted some discrepancies between what they learned in school and what would have helped them as professionals. Stan and Joseph specifically question certain pedagogical and curricular decisions, like the need to test mathematical proofs. Stan gave his interpretation of engineering values, which he felt placed emphasis on testing in a way that was not reflective of his own values, and which did not evaluate his knowledge and skills. He also pointed out how those testing methods failed to account for skills and knowledge outside of a constructed notion of what engineers

should know and value, which isolated and excluded students with diverse knowledges.

Additionally, common practices in the engineering program were, in his view, antithetical to concepts like Indigenization. This ranged from the methods of assessment and evaluation common in engineering courses, to the ideas related to the iron ring ceremony, to the dynamic of the relationships between students and instructors.

Self as Relationship

The participants repeatedly spoke of others throughout our conversations. We valued the people who were around us during our studies. When asked about experiences, memories involving their relationships with other students and staff were what first came to our minds. Our relationships with those around us influenced who we were/are as people – consistent with the concept of self-as-relationship.

Being in the ENGAP community helped some participants grapple with their identity as Indigenous people. Identity is a complicated topic for many Indigenous people, and the Métis population is a group that tends to struggle with their identity as a people who are living in a space between two cultures. This personal struggle of identity and how it shaped our experience was felt by us participants. Stan shared that he had always questioned his identity, asking “who am I”. Alexander said he was “not aware” of his culture and community before his engineering studies.

As Stan explained, having the ENGAP community provided connections that bolstered that identity. We found a sense of identity in our relationships with each other. Alongside that, some of us shared that the guidance of Elders helped provide clarity and confidence in our individual identity. The ENGAP community in general helped us with the questioning of our identities.

After considering the relationships of the participants and how those shaped our realities and experiences, I move inward to interpret those experiences through the concept of holism, considering more specifically the mental, emotional, physical, and spiritual aspects of the graduates' lives.

Approaching the Discussion through Holism

Drawing from the medicine wheel as a framework for interpreting the participants' experiences, I interpret how each of the directions of the Medicine Wheel were manifested. The four directions of the medicine wheel, representing the four aspects of being – mental, emotional, spiritual, and physical - were present in the experiences of the graduates, though some aspects more explicitly than others. This analysis considers the realities of being an engineering student, and the ways each direction in the Medicine Wheel was shaped for the participants throughout their studies. The inclusion of this framework presents an opportunity to interpret the participants' experiences in a way that emphasizes the needs of the individual students. This section builds on the relational discussion by focusing on how the relationships in the prior section impacted us in terms of the Medicine Wheel, and how the relationship of self is formed through the four directions.

North: Mental

The material and learning style of engineering was not always relevant to individual participants. The participants had to adapt to seeing things in a certain way. We were able to adapt, but some struggled to make this adjustment.

Stan recalled feeling like he was always at fault or out of place, perhaps a result of the stifling bureaucracy and impersonal treatment of the university. The lack of alignment Stan

experienced on an ideological level, in terms of his values versus those of engineering, left him feeling uncertain of himself.

We valued that ENGAP provided us access to a tutor who was able to supplement our studies. A factor in this was that our tutor, Dawit, had a strong understanding of two things: what was required of students for their math exams, and how students best learned those materials. Having an additional avenue to learn from a patient individual attuned to student needs made it possible for all of us to learn what we needed.

Upgrading courses offered by ENGAP were also considered to be valuable in preparing us mentally, for those of us who took them. Alexander recalled being initially unenthusiastic about taking courses that would not count toward his degree, but in hindsight appreciated that they benefited him. They were important for the mental development of those who registered in them, and they also created opportunity for other aspects of being to be addressed through developing relationships with the other students.

South: Emotional

In the culture of engineering reasoning and logic are considered to be key skills, and emotion is perceived to run counter to the requisite rationality of an engineer (Kellem et al., 2018). Thus, emotions tend to go undiscussed in these spaces. However, emotion is considered one of the primary aspects of being in the Medicine Wheel, and the ubiquity of emotion was apparent in the findings.

Some participants felt a lack of belonging which they attributed to being created by instructors and the university environment. Stan spoke in detail about how instructors hold immense power over students, and how negative feedback can take a toll on students. He

expressed how the lack of relationship between students and instructors only exacerbates the challenges faced by students in those courses.

Pride was one of the commonly discussed emotions by participants throughout our conversations. Participants felt pride in the ENGAP community, and pride in becoming an engineer. Stan and Maria both mentioned pride in being an engineer explicitly. They felt they had worked hard to earn their degrees in a field that is valued. That value, based on how Maria described her relationship with the profession, is rooted in the engineer's role in helping others.

Sadness and disappointment were described by all of us regarding the loss of ENGAP classmates. Part of why the attrition of ENGAP students was so impactful to us was because of how those students created the community where we found our sense of belonging. Joseph described how destabilized he felt during his first two years of study, as numerous students around him were leaving their studies behind and he struggled to find people to develop relationships with. Noticing those students leave also made him doubt himself, as he wondered if he should also be considering leaving engineering studies. Joseph pointed out that this attrition was “part of the process” —there is an inevitability to losing some students that comes with ENGAP's model, but also with engineering students in general. Stan also pointed out that not all non-completers have the same situation – for some of them, their leaving engineering is not a sad thing, but a deliberate change because either they wanted to do something else or were not committed to engineering. But there were students who were highly committed who faltered; for Stan, those students were the ones whose attrition made him sad.

Comfort was often discussed, and ENGAP was typically at the center of those recollections for participants. ENGAP was described as a safe space, and that feeling of comfort and safety was beneficial to the participants. The ENGAP staff were specifically mentioned as

people who made participants feel comfortable. The ENGAP staff were there to provide support in terms of academics, logistics, and counselling. Having this support system readily available was helpful in managing all aspects of being in school, which in turn helped participants manage their emotions. It was clear that being comfortable within the university setting was important to all of us, and that by being comfortable, it was easier to succeed.

East: Spiritual

As discussed in the relational analysis, spirituality is a complicated subject to broach in an engineering context. Because spirituality did not come up explicitly in the interviews, discussing the graduates' relationship with spirituality is difficult. Here, I consider how, implicitly, the spiritual dimension of our lives was shaped by our university experiences. To contextualize the place of spirituality in the context of an individual's development and journey, Lane et al. (2004) explain:

The spiritual dimensions of human development may be understood in terms of four related capacities. First, the capacity to have and respond to realities in a non-material way such as dreams, visions, ideals, spiritual teachings, goals and theories. Second, the capacity to accept those realities as a reflection of unknown or unrealized potential to do or be something more or different than we are now. Third, the capacity to express these nonmaterial realities using symbols such as speech, art or mathematics. Fourth, the capacity to use this symbolic expression to guide future action - action directed toward making what was only seen as a possibility into a living reality. (p. 10)

Through this explanation of spirituality, I expand on some themes from the findings that could be considered spiritual in these terms. Interpreting the findings using this frame of reference will

allow for broader interpretation of spirituality and a more thorough discussion of the spiritual elements present in the participants' experiences.

Connecting with culture was discussed. This relates to Lane et al.'s (2004) spiritual dimension, as the concept of culture and identity are nonmaterial and guide actions. Alexander talked about how he had not been able to connect to his culture before enrolling in ENGAP.

In the findings, participants' struggle with identity was shown to not only be rooted strictly in oppression, but also in a desire to learn about one's past and one's culture. For the participants in this study, 'finding' or connecting with our Indigenous identity was part of our journey; and for some of the participants in this study (including myself), ENGAP was a place of exploration and learning.

The desire to help others is a more action-oriented example of spirituality, with the participants understanding that our actions as students and as professionals affect others. This was prominent as an expression of the cultural and personal values that all of us had in common. This was apparent in each of us participants: our descriptions of why we did or did not want to be engineers were rooted in non-material ideals.

Stan's comment about Randy possessing the "spirit of math" also relates to this idea of spirituality. Stan felt that Randy understood and appreciated the subject in such a way that he was able to express, through mathematics, the importance and value of learning about math and physics. This is significant, as this ability could, and in the case of Stan, did, demonstrate the importance of non-material things to students.

As mentioned by Stan, an Elder-in-residence was available to meet with in the ENGAP offices. This made personal discussions, including those on culture, identity, and spirituality

accessible for ENGAP students. The specifics of how each of the participants benefitted from interacting with Elders were not shared, and there is an implication that, like the primary ENGAP staff, these particular graduates did not require help from the Elder-in-Residence on a regular basis. However, the presence of the Elder was known to us, and we were grateful to have the opportunity to seek guidance.

West: Physical

Lack of community in the greater PFofE due to physical limitations was noted by Stan and discussed in the Relationality section. He made it clear that there were important relationships to these places and that those places impacted other relationships. The sprawling nature of the Engineering and Information Technologies Complex (EITC) made it difficult to find a place to be comfortable, and by extension, to find community.

Stan emphasized that part of the reason he was proud of his engineering degree was how physically committed students must be to be successful, in terms of attending labs and spending long hours on campus. Getting a degree in engineering is physically demanding and can take a toll on the students.

As alluded to in the relational discussion, the ENGAP lounge was an important place for us participants. The space in the ENGAP lounge facilitated completion of day-to-day tasks in a communal way. It also provided a place to form relationships which gave us new avenues to learn and improve. The 24/7 availability of the ENGAP space was valued by the participants—Joseph and Stan both noted that they spent long hours in that space. This relates back to the feeling of belonging, as having a space that was so inclusive made us feel at home.

ENGAP's upgrading courses were an extension of this – the smaller classes with familiar classmates allowed us to learn in an environment unlike typical engineering classrooms. That proximity allowed for a more comfortable learning environment and facilitated a relationship between the instructor and the students, and relationships between students.

Reflecting on Balance in the Four Directions

The four directions, as referred to in this section, are all related to each other – the mental, emotional, spiritual, and physical aspects all influencing one another. For example, it is easy to imagine that if the mental needs of a student were not addressed, their emotional stability would be affected, or vice versa. Thus, it is crucial that all directions be remembered and prioritized for a person to be balanced. The participants were generally positive in their reflections on life as engineering students. However, they were not without their hardships, which I discuss briefly here.

A lack of balance was expressed among the participants regarding their time management and priorities – namely, there was a general feeling that they put too much time and focus on their studies, and as a result, other non-academic opportunities were missed. This was a regret among some of the participants.

On the other hand, many of the issues these participants faced were mitigated by ENGAP. For instance, the availability of the ENGAP lounge addressed the struggle to find a place in the engineering building. Personal relationships provided balance in our lives, with support from family and friends having positive influence on each of the directions for us. As Stan said, referring to having those personal relationships, it is important to have valued relationships aside from school, which all of us were fortunate to have.

These stories also reflect the circularity of the Medicine Wheel, representing the cyclical nature of life. Joseph notes how being an engineer is a ‘lifelong process’, acknowledging the cycle of constant growth needed to be a great professional. There was immense growth displayed by us participants. Over the course of our undergraduate degrees, we developed an understanding of what our priorities were, refining them as we traversed the program. For example, three of us concluded that pure engineering was not entirely fulfilling and wanted to work in other areas more focused on people. Stan and Maria both expressed their desire to help people and work with people in ways that they perceived an engineering career is not necessarily conducive.

Ultimately, the four directions were addressed in the findings, some more explicitly than others, with us participants finding balance in aspects of our lives through relationships with friends, family, and supportive staff at ENGAP.

Concepts from Literature

Comparing our narratives and experiences to those present in the literature on Indigenous postsecondary students’ experiences provides an opportunity to see if any of those ideas resonate with what I described in my study’s findings. In doing so, the literature can imbue meaning and provide an avenue for interpretation, while the specific context of us participants in this study adds to the body of literature on this topic. In this section, I will comparatively consider experiences from this study’s Métissage with the ideas from the first section of the literature review.

The participants’ reasoning for going into engineering was mostly aligned with typical reasons for becoming engineers: strengths in mathematics and sciences, wanting to make a difference, wanting a less physically- demanding career, employability (Engineers Canada, n.d.).

Income was the one aspect of the profession that was not cited by any of us participants as a reason for choosing that area of study.

The barriers described in the literature review were relevant to this study to varying degrees. Some of the most common findings in studies relating to Indigenous postsecondary students were either not addressed by the participants or were not applicable to these individuals. For example, financial issues were not something the participants alluded to frequently. Stan mentioned financial pressures as a motivating factor to take his education seriously, but none of the participants ever discussed financial issues specifically as a barrier. Cultural, social, and pedagogical barriers were more prominent.

The ‘desire to give back’ that is often discussed within the literature (Smith et al., 2014; Rios et al. 2021) was prevalent among the participants. Giving back was a theme related to both going into engineering (Joseph), and what was done after engineering (Maria, Alexander, Ernest). Smith et al. suggest those values could dissuade students from completing their engineering program. In the findings of this study, the way the participants discussed their desire to give back was not focused on being unaligned with engineering values, rather wanting to augment engineering values by imbuing them with a valuing of people.

Prioritizing technical ability rather than social focus led to some participants feeling out of place in their studies and beyond. Maria discussed this explicitly. Stan also described his focus on other people. This relates to the communal goals described by Smith et al. (2014).

Engineering culture came up in Stan’s interview. The culture of the student body and of engineering education was questioned at times. This included Stan’s criticism of engineering

culture among the students, recalling some of their behaviours to be unaligned with what he felt was appropriate in the post-secondary environment.

Furthermore, some of the concerns prevalent in the study by Kuley et al. (2017) were present in the reflections in the participants' narrative, mainly regarding quality of instruction, curriculum, and culture among students and staff. Stan had strong feelings about the power dynamic between instructors and students, feeling that there was room for instructors to take more care in how they treat students.

Harper (2007) suggests that program supports are not the primary reason for many people who enroll in a specific Access or support program. Rather, the community is the desirable aspect for many of the students. This was corroborated in our participant narrative, as the participants uniformly suggested that they did not require program supports on a regular basis, with the possible exception of tutoring, yet the program itself was highly influential for them. And to touch on that exception of tutoring, the sense of community around ENGAP's tutor was perhaps just as important as the actual support he was providing. As Alexander stated, regarding other ENGAP students, "they're in the same kind of place as you" —having peers who had things in common, whether that mean background, experiences, or worldview, was meaningful for us.

Chellberg and Bosman (2020) found that student mentorship can increase the confidence, awareness, and self-efficacy of post-secondary students. The experiences of the participants would corroborate this. The participants were mentored by students in the community, and this motivated them, Stan and Maria most notably, to become mentors to students in turn—a role that some of the graduates continued to hold even after graduating. This emphasizes the importance

of the community in creating a student support system where knowledge is transferred from veteran students to newer ones.

Embleton (2012) stated that meaningful relationships, program supports, and clear goals are important for Indigenous students. Our participants would corroborate these. Maria recalled having a mentor who demonstrated a disciplined work ethic was a turning point in her studies. Stan recalled a moment where he realized his hard work could lead him to good grades. These experiences were crucial in establishing how we needed to act to be successful as engineering students.

Martin and Seguire's (2013) findings regarding cohorts, repeated interaction with instructors and administrators, and tutoring were corroborated by the findings in this study. By having familiar support and administrative personnel available through ENGAP, the participants felt comfortable seeking help. As well, the familiarity of the ENGAP staff teaching upgrading courses (Randy teaching physics, Diana teaching pre-calculus and calculus) made those courses more comfortable and engaging while also strengthening those relationships between the staff and students.

The findings of Kuley et al. (2017) regarding curriculum, quality of instruction, and adjusting to engineering workloads were consistent with the opinions of the participants. The approaches of educators and the design of the curriculum were not remembered fondly. However, this fact did not necessarily inhibit the graduates—we were able accept and adapt to the expectations for them.

Some of Stan's anecdotes relate to self-esteem and sense of belonging. This could be for several reasons, one of which relates to the lack of value alignment, especially relating to goals

and importance of community, discussed by Smith et al. (2014). By not feeling like engineering values were aligned with his own, Stan felt out of place. Joseph recalled feeling like an imposter as an engineering student. Embleton (2012) suggests that finding a sense of belonging and self-identity within the postsecondary context is crucial to the success of the student. Not having the opportunity to do so could lead to an opposition toward education non-completion of studies. Those participants who expressed those feelings seemed to find a sense of belonging and identity, and in doing so, were successful in their studies and in general.

Missing from the Literature

Dynamics comparable to the divide described by the participants between their ENGAP community and the PFofE community are not addressed in any literature reviewed for this study. This relationship is highly specific to these participants and the context of the particular engineering faculty in question, but it exposes a dynamic that is worth considering for access programs. Maria had observed general engineering students being judgmental of ENGAP students and having a negative perception of ENGAP student capabilities. There was a divide between ENGAP students and the rest of the student body that seemed to stem from discomfort among the general engineering students. Joseph also talked about how, despite being able to befriend some of his peers outside ENGAP, he was more comfortable spending his time with other ENGAP students. This relationship between general and access students appears to be complex and in need of further study.

The negative effects of non-completers on other students in an access program (or comparable program) were not noted in the literature. This was one of the key topics to emerge among all of us participants, and it clearly left a profound impression. This dynamic is a

byproduct of altering entrance criteria, and while it might be an inevitability, the repercussions it has on morale of the students remaining in the program are not adequately addressed.

Literature on Indigenous students in STEM contexts uniformly fail to discuss Indigenous students and Indigenous-aimed programs in a way that acknowledges the differences between these students and their backgrounds. This is evident from how studies on Indigenous student populations tend to generalize those groups. Furthermore, those studies tend to have a damage-centered focus, which can neglect to acknowledge the positive aspects of their experiences. Both these tendencies are problematic, as they perpetuate harmful notions of Indigenous peoples. Pan-Indigenizing in research reinforces the European-Indigenous dichotomy, undercutting the diversity within the general Indigenous population, and defaulting to a damage-centred view of Indigenous students (i.e. focusing on barriers and marginalization without ever noting successes) perpetuates an image of people who are incapable or in need. Literature on Indigenous students and students in support programs akin to the access model employed by ENGAP tends to generalize the students in the studies. ENGAP has a diverse group of students coming from numerous regions, cultures, and classes. To assume all students in the program are the same or are simply “Indigenous” is inaccurate and fails to grasp the nuances of the community. Without acknowledging those aspects in a case such as an access program, the findings would be less valuable. For instance, to suggest that all ENGAP students had similar backgrounds would be inaccurate, and to neglect to discuss the diversity within that program would most likely lead to the reader taking away knowledge that is inaccurate or incomplete. That misunderstanding could in turn lead to administrators making decisions not in the best interest of the students.

Program Evaluation - Braiding Interpretive Frameworks

The participants' stories can be analyzed to compare those experiences of access program students and the operations of the program with the model that ENGAP is based on.

The implementation of access programs is predicated on “the belief that if academic, social, personal, and financial barriers are addressed, minorities and disadvantaged groups, for whom post-secondary education has not been a viable option, will enroll and succeed in post-secondary studies at the same levels as non-excluded members of society” (Alcorn and Levin, 1998). It is evident that the modified entrance criteria functioned in this way for the individuals in this study, as participants were offered a path that would not have been otherwise available, and without ENGAP as an entry, some of the participants likely would not have pursued engineering. These participants would have had a more complicated path getting into engineering without ENGAP's adjusted entrance criteria. In some cases, the participants might not have been aware of engineering as a possible area of study or would not have considered it a possibility. This fact alone is suggestive that ENGAP is functioning as intended.

While most of the elements of the access program model—recruitment, selection, integrated student supports, financial support, academic support and remediation, and personal supports (Alcorn and Levin, 1998)—were alluded to by the participants, the focus of the participants' stories, reflections, and opinions was directed elsewhere. Namely, the participants were focused on the community as a whole. This included the other students in addition to the dedicated support staff. As the holistic analysis displayed, the support from the program was present in the various dimensions of being/learning, and the support from ENGAP and its community played a crucial role in balancing out some of the challenges and stressors present in our studies.

The other students, the program's tutor, and ENGAP as a place were extremely impactful on both personal and academic levels for all the participants. These elements, and the way they have manifested as ENGAP, are not described in Alcorn and Levin's (1998) model. For example, Stan described Dawit, the tutor who ENGAP outsources work to, as a friend. All of us felt that way. His being approachable made it very easy to ask for help and provided a relational support that isn't nuanced in Alcorn and Levin's (1998) definition. It is clear from the participants that simply having access to a tutor is not what led to success. It was important that the tutor was an individual who motivated and empowered the students, and who made it comfortable to ask questions. As Stan put it, "he was a friend" to the students.

It is also worth considering that the participants generally had supportive families or other loved ones, and finances were not cited as a major source of tension—thus, the financial and personal areas of the access model were not necessarily at the forefront of why these individuals needed or wanted to be included in this community in the first place.

The access model does not explicitly account for the effects of students dropping out of the program and how the community is impacted. One of the few phenomena to come up in conversation with all the participants was the impact of those non-completing students, and the lack of closure involved in their departures. It is logical that even by opening access pathways for students into an otherwise inaccessible program, that some students still will not want to complete or will not be able to complete the program despite the supports provided—this is the reality of altering entrance criteria for students (attrition is already common among engineering students with conventional paths into the program). However, because ENGAP is an access program, and because community is so central to the success of the students in ENGAP, when a student 'disappears' from that community with no explanation and no acknowledgement, the

impact on students is profound. This affects the other ENGAP students directly, as they are losing a peer. It also influences how ENGAP students see themselves, as the level attrition makes each student wonder if they will be able to succeed. As Maria discussed, it also influences how people outside the program view ENGAP students – it is assumed that they will fail.

Indigenization

I feel it is very important to review ENGAP and the PFOE in terms of how they are Indigenizing and consider the program on Gaudry and Lorenz's (2018) spectrum of Indigenization. By using Métissage to interpret through both Indigenous and Western frameworks, we can interpret how Indigenization was present in the findings.

As an access program, achieving Indigenous inclusion is somewhat of a given, and ENGAP has been extremely successful in that aspect of Indigenization. But even Randy Herrmann has said that mere inclusion does not go far enough and is not an adequate long-term goal (Wiseman and Herrmann, 2019). This raises the question: how far should ENGAP be going in terms of Indigenization, and what are they doing now?

As I engaged in this study, I suspected that ENGAP might be merely dealing with inclusion and was perpetuating the system of the dominant culture fully within their operations. Now I am not so sure. The words and reflections of these participants have reminded me of the significance of what goes on within that program. The presence of an Elder is a good example of reconciliation Indigenization – they have made space for an Indigenous person to share their wisdom with the students. One could argue that the upgrading courses offered by ENGAP are the foundation of an alternative pathway through engineering. Whether this system could have decolonial potential is debatable, but there is a level of (Indigenous) autonomy within that separate stream of courses that is worth considering.

Stan expressed desire for Indigenous values to be present in the engineering program. Kristoff and Cotrell (2017) found that adding Indigenous knowledges to the curriculum and administrative practices could better allow students to consider effects of colonialism and also grow in terms of culture and identity. This shows that Stan felt that Kristoff and Cotrell's line of thinking is vital and imperative for engineering education, and that there is further room for The PFofE to grow in terms of Indigenization.

Some of the graduates—Stan explicitly, Ernest and Maria implicitly—struggled with the feeling that to take part in engineering was to help to perpetuate colonial attitudes and actions. In each of their cases, they found ways to give leverage their engineering studies toward something they were more comfortable doing (by pursuing further studies in other areas or shifting career path). Nevertheless, the fact that such a shift was necessary for several participants represents the deep colonial ties in engineering. If engineering education is to be Indigenized, much will need to change in terms of how and what students are taught, and what the underlying values are for engineers.

Chapter Summary

In this chapter, I analyzed and interpreted the findings from Chapter 4 through two frameworks: Relationality and Holism, and comparatively, through the literature. I interpreted participants' experiences and ENGAP's impact through relationality, holism, and concepts from the literature using a Métissage approach. Interpretation of the participants' words lead to discussion on Indigenization within the PFofE and ENGAP, revealing the ways that engineering education, Indigenization, and colonialism are intertwined.

Chapter 6: Conclusions and Recommendations

In this study I used conversational interviews within a narrative design guided by Métissage to gain insight into the experiences and opinions of Indigenous engineering students enrolled in an access program, as well as myself, as a participant-researcher. The aim of this study was to embody Métissage and Indigenous research methodologies to gather and disseminate the experiences of Indigenous engineering graduates who were enrolled in the Engineering Access Program (ENGAP) in the Price Faculty of Engineering (PFofE) at the University of Manitoba (U of M). In doing this, Indigenous voices were elevated, and their experiences formalized in a way that will assist in understanding the experiences of Indigenous engineering students both within and beyond the access program they were enrolled in.

In this chapter I summarize the philosophical and methodological basis of the work, state the limitations and biases of the study, review the research questions and findings, provide some recommendations, and offer a personal reflection on my work.

How Métissage Shaped this Work

Métissage informed this study on several levels: my dual role as a participant and researcher; the braiding of several participants' perspectives; and the blending of both Western and Indigenous frameworks to interpret the participants' stories. Without a research paradigm/theory/sensibility like this, it would have been difficult for me to complete this study in the way that I felt it needed to be done, which required me to be accountable to the participants and ENGAP while creating a document that is useful to the PFofE and engineering education researchers. For these reasons, it is important that the reader approaches this work with a mindset that embraces the interpretation of participants' experiences.

Limitations and Biases of the Study

There are numerous limitations within my study, stemming from methodological decisions. Additionally, there are biases built into my study that are crucial to consider.

These findings, while being somewhat representative of the ENGAP community, cannot be generalized. Nor can this view of an access program be generalized to other comparable programs. The social and cultural characteristics of ENGAP are fluid and specific to the context of the PFofE, the U of M, and Manitoba. Knowledge can be drawn from the accounts and interpretations in this study and applied to other contexts but cannot be assumed to be directly transferable.

There are biases in the study relating to the selection criteria for the participants. Because all the participants are graduates, it follows that they have a more positive view of postsecondary education, engineering, and ENGAP. Thus, even aside from the small sample size of participants, a full understanding of this community cannot reasonably be expected within the scope of my study. For example, the finding that none of us as participants regularly utilized the resources and personnel that were available in ENGAP would not be true for many ENGAP students over the years—graduate or not.

With this study I set out to do research that embodies Indigenous worldviews while also being useful for Western administrators and scholars. In trying to do both things, it is possible that neither was done to their full potential.

There are limitations stemming from me as the researcher as well—both in terms of the specific nature of my role, as well as myself as an individual—that influenced the study. I reflect on these in the final section of this chapter.

Answering the Research Questions

My study's findings provided insights into the research questions, 1) what are the lived experiences of Indigenous engineering students enrolled in an Access program, and 2) how were those lived experiences influenced by the social and cultural contexts of ENGAP and U of M. The participants described their experiences being engineering students and reflected on those experiences, providing insight into their own individual views as well as a collective view of ENGAP, the program that connected all of us.

It is apparent that there is more to a successful access program than providing the support services described in the model by Acorn and Levin (1998). Providing the support delineated in the model has potential to help students, but what resonated with us when reflecting on our years as engineering students—having people who were invested in us as students, who were available to us and who were mindful in how they helped—were more relational.

The participants in this study came from situations that were not the stereotypical barrier-laden upbringings associated with Indigenous students in post-secondary. Assumptions held by people outside the program that ENGAP students need help or are getting “handouts” are erroneous. The assumptions of this community should be challenged.

Through the narratives in this study, some participants described a division between the ENGAP community and the PFofE student body. This was evident for these participants in the attitudes of the various student groups, the way relationships formed (or did not form) within and across communities in the university context, and the way educators engaged students.

The exodus of non-completing ENGAP students was stressful and discouraging for participants, especially given the lack of communication through those processes. The students were/are important to each other, so when a student opted out of their engineering studies

without letting others know, it had an impact on the continuing ENGAP students who had lost a peer and a friend.

Ultimately, the views, opinions, and experiences of all of us in this study were not entirely aligned—and this is the point. Some of us were drawn to “giving back” or working with Indigenous communities, while others had other motivations. Some were happy with where their engineering degree led them, while others needed to deviate. Some had negative experiences in university, while others look back at their experiences at the university positively. It is the diverse voices that are drawn together collectively that met the purpose of and give strength to this study.

Recommendations

The recollections of the participant ENGAP graduates in this study provided information that could be useful to several parties. This section will briefly summarize how individuals and entities can learn from the participants in this study when considering Indigenous students in engineering and the operations of ENGAP, access programs, or other comparable support programs, as well as the greater PFofE.

The Engineering Access Program at the University of Manitoba

I make several recommendations for ENGAP, based on the experiences of the participants.

ENGAP should consider reviewing their policies regarding student departures and non-completions. The effect of ENGAP students leaving the program was profound for the continuing/remaining ENGAP students, and more so when their departure was not explicitly addressed. If not already in place, exit interviews could provide useful information to help inform the ENGAP students still in the program. Formalized year-end interviews and/or surveys

of all ENGAP students could also be informative for the program and provide opportunities for students to give feedback. When appropriate, ENGAP student departures from ENGAP and the PFofE could be addressed with the ENGAP students who remain, with or without providing details about the departing students. For example, a general discussion about how students feel about the departure could provide the remaining students with a chance to address and grieve the loss or destabilization or other emotions they may experience.

Discussing topics like culture, identity, and values with students throughout their studies could be valuable to students. Communicating cultural ideas and having discussions on values could be one way for ENGAP to further their role in Indigenization. As an extension of this, providing opportunity to explicitly discuss spirituality within the university context could be valuable, as it is an integral aspect of being.

The Price Faculty of Engineering

For the PFofE there are two primary recommendations. The first is to continue ENGAP research, broadening the scope of this study to include more students who did, and students who did not complete their engineering degrees. Students who did not complete their engineering studies for any reason would provide additional insight into the experiences of Indigenous students in engineering and the role that ENGAP plays in their studies. Additionally, hearing more ENGAP students' stories to explore if their experiences are similar to the participants in this study would be worthwhile.

The second recommendation is to investigate the potential cultural divide between ENGAP students and the rest of the student body, to understand if this is something that needs to be addressed. In the meantime, it may be worthwhile to explicitly highlight and educate PFofE students, staff, and faculty about ENGAP and access programs in general, to mitigate any

potentially negative or stereotypical perceptions before they are formed or before they grow. As I discussed in the literature review in Chapter 2, Gaudry and Lorenz (2018) identify three distinct levels of Indigenization—inclusion, reconciliation, and decolonization. The objective of an Indigenous access program such as ENGAP is rooted in inclusion. It is worth considering whether ENGAP should be moving into at least reconciliation. According to Gaudry and Lorenz (2018), to work toward reconciliation Indigenization, beyond creating space for Indigenous people, Indigenous knowledges must be emphasized, and people in that context (in the case of postsecondary, this includes students, staff, and faculty) must alter their thinking and consider those knowledges. Although Randy Herrmann, current the Director of ENGAP, is involved in reconciliation and decolonization efforts, this is not explicitly the role of ENGAP. Perhaps ENGAP can have a broader role in the PFofE in leading work for reconciliation and decolonization. For example, ENGAP could offer decolonizing and Indigenizing programming to students in the entire faculty, which would shift its reach in the faculty from Indigenous students enrolled in ENGAP to the broader PFofE. This could more explicitly and hopefully positively connect ENGAP and the PFofE.

Other Universities and Programs

For entities such as universities looking to form comparable programs, there are two important takeaways from the participants in this study.

It is imperative that all support staff involved are committed to the students on a personal level. Having meaningful relationships with the students is part of what has made ENGAP as successful as it is, and to miss such an investment in the students on a personal and emotional level would diminish the potency of such a program.

It is also important that there is adequate space to create a place for the Indigenous students in the program to make connections. Having a communal space for the students is key in fostering relationships among the students, who in turn can support each other. There are other factors that can support successful access programs, as discussed in the literature review in Chapter 2; however, these two components of ENGAP resonated most strongly with all the participants in this study, including me.

A Personal Reflection

The challenge of this work was to at once honour the community and the participants while also creating a document that could be of use to the program, university administration, or the academic community. This was a challenging study to piece together for me. Drawing from Western and Indigenous paradigms, all the while only being educated in engineering and having no experience in the world of qualitative research, was completely overwhelming. To close this thesis, I offer a reflection on my process of completing this study, my own thoughts on some of the key takeaways of the study, and my role as the participant-researcher.

Reflecting on the Research Process

Each step of the process in this study included challenges and decisions that I had to justify philosophically and practically. This was complicated by my commitment to try to justify my work both in Western research terms and in Indigenous research terms. Every section of the study, from the literature review to drawing conclusions, included complex decisions and in some ways, barriers that are, in my experience, not inherent to doing research in the ‘conventional’ sense—or in the way that I was taught in my undergraduate engineering degree. For instance, performing a literature review in a meaningful way was difficult due to the lack of directly relevant literature. Furthermore, Wilson (2008) questions if, when using Indigenous

research methodologies, one should even be doing a literature review, as critiquing others' work implies that the reviewer has a better understanding than the writer of the literature being critiqued. I struggled with this myself. My decision to do a literature review was based largely on the fact that it is the conventional approach to research; I felt it was expected of me and even now as I reflect on that finished chapter I question if I approached it the right way. Wilson's suggestion that the literature review can be approached expressly as a means of contextualizing the research subject and building upon the literature rather than critiquing it was how I hoped to approach that chapter. By doing this, I would be able to perform a literature review relevant to the study and consistent with my methodology. These kinds of decisions extended to subsequent steps of the study as well, such as choosing the methodology and the approach to analysis, with me having to approach them with 'rigor' to satisfy the western research approach, and understanding what would be considered sufficiently rigorous but also didn't take away from an Indigenous research methodology or paradigm was difficult for me to discern.

My own abilities as a researcher, and my training as an engineer, which is more objective and less emotional/spiritual, especially during the interviews, are a substantial limitation of this study. Even with how rich the interviews were, I feel that, had I been more experienced in interviewing, they might have been even richer. Upon reviewing the interview transcripts, it became clear to me that there were many instances where, had I been more astute, I might have been able to pursue a thread of conversation to new depths. However, without having the experience to perceive the moment or the understanding that I could have pursued the moment even if I had perceived it, I would steer the conversation toward my next prompt. On the other hand, I feel that my pre-existing relationships with the participants was conducive to them being candid and open in the interviews, which was crucial to my study. While their outlooks on their

experiences were largely positive, they were clearly comfortable sharing uncomfortable aspects of their experiences and did not seem inhibited in providing any details that resonated with them. I appreciated hearing what seemed to be honest reflections on their experiences, as I wanted to express, if possible, a thorough representation of their thoughts, and hold both their positive and negative thoughts in tension.

Even the writing of this reflection, and the inclusion of my own voice in this study were deliberate decisions that put me out of my comfort zone. My discomfort in centring myself in the research probably inhibited me from using my own perspective as much as I should have; that inclusion of my own voice to guide the research is important in Indigenous research, but I struggled to embrace my own voice throughout the study. In hindsight, this entire thesis could look quite different, but as I navigated the design and methodology of this work it was difficult for me to seize (or even to notice) the opportunities to present this work in this way. Rather, I've gone back and inserted myself into this thesis through my revision process.

Reflecting on the Findings

In reflecting on the findings, I felt myself relating to much of what the other participants spoke about, even when their views ran counter to each other. For example, at once being proud of my accomplishment in obtaining my engineering degree while also having reservations about the profession.

I am glad the importance of community in ENGAP came out in the findings, because it was important for me, and was evidently the most important thing for the participants, and I think it needs to be emphasized. So many memories came back as I went through the interview and analysis processes, almost all relating to the people who I knew during my engineering studies. Looking at the bigger picture, the most urgent and previously unreported findings, such

as the impact of the attrition of ENGAP students and the possible existence of a disconnect between ENGAP and the rest of the engineering faculty, are fundamentally concerned with community.

I had not realized how impactful the attrition of ENGAP students was for me until it came up in this study. This was a significant finding in the research, and an issue that was important to articulate for ENGAP and the PFofE to hopefully be able to address it in the future; hearing the participants discuss this had me reflecting on my undergraduate experiences. The strength of the ENGAP community, as well as the hardships that we went through collectively, are things I had not taken the time to think about to this depth.

While the disconnect between ENGAP and the general engineering community of students and instructors might be difficult to define, I do feel there are many people with negative feelings toward Indigenous students and ENGAP by extension. This is my own perspective based on my experiences and from what I know from others. How exactly these communities interact, and whether a tangible divide exists, is highly subjective. Perhaps a divide is merely a byproduct of ENGAP's tight-knit community, and from this perspective that separation is a feature of the community rather than a failure. I feel that this could be the case. Conversely, one could suppose that even an ostensibly positive view of ENGAP from anyone within the faculty could stem from something malicious, as the program could be seen as a way for the university bureaucracy to keep those students separate from the general student body. While I do not necessarily think this is a prevalent line of thinking, I feel it is important for everyone to be diligent, reflective, and self-aware in their relationships with a program like ENGAP.

Reflecting on My Role

It is important for the reader to keep in mind the limitations that come from my role as a participant researcher. Approaching this study this way included the benefit of me getting to work with participants whom I know. The limitation is that my own perception of being an Indigenous engineering student enrolled in an access program for many years, means that I had expectations of how the study would unfold, which influenced my approach. I tried to address this through the study, and I hope that the work is strong not despite this, but because of it.

In Closing

Completing this study was a profound learning experience for me, and I don't take for granted the unique opportunity to do research with people and within a context so personal to me. I hope the conclusions I've drawn and the recommendations I provided will be helpful in Indigenizing engineering education and improve the engineering profession by extension. In addition to my own conclusions, I hope that new interpretations of my findings will be made, and that the knowledge and experiences that the participants were gracious enough to share with all of us will continue to provide valuable insights into ENGAP and the experiences of Indigenous people in engineering more generally.

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APPENDIX A



University
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Research Ethics and Compliance

Human Ethics - Fort Garry
208-194 Dafoe Road
Winnipeg, MB R3T 2N2
T: 204 474 8872
humanethics@umanitoba.ca

PROTOCOL APPROVAL

TO: Jillian Seniuk Cicek
Principal Investigator

FROM: Zana Lutfiyya, Chair
Education/Nursing Research Ethics Board (ENREB)

Re: Protocol #E2019:120 (HS23448)
Investigating the perceptions and experiences of ENGAP engineering
students at the University of Manitoba

Effective: February 13, 2020

Expiry: February 13, 2021

Education/Nursing Research Ethics Board (ENREB) has reviewed and approved the above research. ENREB is constituted and operates in accordance with the current *Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans*.

This approval is subject to the following conditions:

1. Approval is granted for the research and purposes described in the application only.
2. Any modification to the research or research materials must be submitted to ENREB for approval before implementation.
3. Any deviations to the research or adverse events must be submitted to ENREB as soon as possible.
4. This approval is valid for one year only and a Renewal Request must be submitted and approved by the above expiry date.
5. A Study Closure form must be submitted to ENREB when the research is complete or terminated.
6. The University of Manitoba may request to review research documentation from this project to demonstrate compliance with this approved protocol and the University of Manitoba *Ethics of Research Involving Humans*.

Funded Protocols: Please e-mail a copy of this Approval, identifying the related UM Project Number, to the Research Grants Officer at researchgrants@umanitoba.ca



**University
of Manitoba**

Research Ethics and Compliance

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RENEWAL APPROVAL

Date: February 4, 2021 **New Expiry:** February 13, 2022

To: Jillian Seniuk Cicek
Principal Investigator

From: Andrea Sz wajcer, Chair
Research Ethics Board 2 (REB 2)

Re: Protocol # E2019:120 (HS23448)
Investigating the perceptions and experiences of ENGAP engineering students at the University of Manitoba

Research Ethics Board 2 (REB 2) has reviewed and renewed the above research.

REB 2 is constituted and operates in accordance with the current [Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans – TCPS2 \(2018\)](#).

This approval is subject to the following conditions:

- i. Any changes to this research must be approved by the Human Ethics Office (HEO) before implementation.
- ii. Any deviations to the research or adverse events must be reported to the HEO immediately.
- iii. This renewal is valid for one year only. A Renewal Request Form must be submitted and approved prior to the above expiry date.
- iv. A Study Closure Form must be submitted to the HEO when the research is complete prior to the above expiry date, or if the research is terminated.

APPENDIX B



University
of Manitoba

Research Ethics and Compliance

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AMENDMENT APPROVAL

September 22, 2022

Principal Investigator: Jillian Judith Seniuk Cicek
Protocol Number: HS23448 (E2019:120)
Protocol Title: *Investigating the perceptions and experiences of ENGAP engineering students at the University of Manitoba*

Andrea L. Szwajcer, Chair, REB2

Research Ethics Board 2 has reviewed and approved your Amendment Request submitted on August 18, 2022 to the above-noted protocol. The Human Ethics Office (HEO) is constituted and operates in accordance with the current *Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans- TCPS 2* (2018).

This approval is subject to the following conditions:

- i. Approval is granted for this amendment only.
- ii. Any further changes to the protocol require subsequent amendment approvals from the HEO before implementation.
- iii. Any deviations to the research or adverse events must be reported to the HEO immediately through an REB Event.
- iv. Amendment Approvals do not change the protocol expiry date. Please refer to the original Protocol Approval or subsequent Renewal Approvals for the protocol expiry date.

APPENDIX C

Investigating the perceptions and experiences of ENGAP engineering students at the University of Manitoba

Email requesting past and present ENGAP students to participate in an interview sent on behalf of the researchers by the ENGAP office

Dear (Name of ENGAP Student),

I am emailing you on behalf of Dr. Jillian Seniuk Cicek and Mr. Reed Forrest, who are requesting you contact them if you are interested in participating in an ENGAP study.

The study is designed to learn about the perceptions and experiences of past and present ENGAP students, to inform the advancement of the ENGAP program and to find meaningful ways to uphold Indigenous cultures, advance Indigenous content in the curriculum, and enhance Indigenous peoples' inclusion in the engineering education.

Dr. Jillian Seniuk Cicek is an Assistant Professor in the Centre for Engineering Professional Practice and Engineering Education in the Price Faculty of Engineering, University of Manitoba. Mr. Reed Forrest is a graduate student in Dr. Seniuk Cicek's research group and is working on this study for his master's thesis research. **Participation will involve granting Mr. Forrest an approximately 60-90 minute interview, with the option of having a follow-up interview/discussion if you both agree.**

As compensation, you will be given a \$25 gift certificate (i.e., Tim Hortons, Starbucks, the U of M Bookstore, or Subway, etc. gift cards will be on hand or mailed to you) to show our appreciation for your time.

If you agree to be contacted to participate in this study, we ask that you email Mr. Reed Forrest or Dr. Seniuk Cicek to let them know. Mr. Forrest will then send you a letter of informed consent that will outline the study and the interview process and will schedule an interview time with you. The interview could be in person, by telephone or virtually via Microsoft Teams or Cisco Webex, whichever you prefer. Please note that your participation in this study is voluntary and will be confidential.

If you would like to participate, please email Mr. Reed Forrest (forrest6@myumanitoba.ca) or Dr. Jillian Seniuk Cicek (Jillian.SeniukCicek@umanitoba.ca) to let them know.

Thank you for considering being a participant in this study. Your experiences and perspectives are extremely important for this study.

Sincerely,

Randy Herrmann (*ENGAP Director*) or Tannis Geddes Administrative Assistant
Engineering Access Program (ENGAP)

APPENDIX D

Investigating the perceptions and experiences of ENGAP engineering students at the University of Manitoba

Email Reminder to Potential Interview Participants sent on behalf of the researchers by the ENGAP office

Dear (Name of ENGAP Student),

Several weeks ago, I contacted you about participating in an interview for an ENGAP study carried out by Dr. Jillian Seniuk Cicek and Mr. Reed Forrest from the Price Faculty of Engineering. They are looking for past and present ENGAP students to share their perspectives and experiences in the ENGAP program to advance the ENGAP program and find meaningful ways to uphold Indigenous cultures, advance Indigenous contents in the curriculum and enhance Indigenous peoples inclusion in the engineering training and professional practice. Your experiences and perspectives are extremely important for this study.

Participation includes an approximately 60-90 minute interview with Mr. Reed Forrest.

Please note that participation is voluntary and confidential.

As compensation, you will be given a \$25 gift certificate (i.e., Tim Hortons, Starbucks, the U of M Bookstore, or Subway, etc. gift cards will be on hand or mailed to you) to show our appreciation for your time.

If you would like to participate, please email Mr. Reed Forrest (forrest6@myumanitoba.ca) or Dr. Jillian Seniuk Cicek (Jillian.SeniukCicek@umanitoba.ca) to let them know.

Thank you for considering being one of the participants for this important study.

Sincerely,

Randy Herrmann (*ENGAP Director*) or Tannis Geddes Administrative Assistant
Engineering Access Program (ENGAP)

APPENDIX E

Investigating the perceptions and experiences of ENGAP engineering students at the University of Manitoba

Letter of Informed Consent for past and present ENGAP students to grant an interview

(original on Institutional Letterhead)

Research Project Title: Investigating the perceptions and experiences of ENGAP engineering students at the University of Manitoba

Principal Investigator Contact Information: Jillian Seniuk Cicek

Centre for the Engineering Professional Practice and Engineering Education

SP-333 Stanley Pauley Engineering Building

University of Manitoba

Office: 204-474-9698

Jillian.SeniukCicek@umanitoba.ca

[Date]

Dear (Name of ENGAP Student),

My name is Jillian Seniuk Cicek. I am an Assistant Professor in the Centre for Engineering Professional Practice in the Price Faculty of Engineering, University of Manitoba. I am working with Mr. Reed Forrest, a master's student in Biosystems engineering also at the Faculty of Engineering, University of Manitoba. We are conducting a study to learn about the experiences of past and present ENGAP students.

The information below tells you more about the research, in the formal language required by the University's Research Ethics Board and asks for your informed consent to participate. This letter is provided to you to outline the purpose and nature of the study.

This consent letter, a copy of which will be left with you for your records and reference, is only part of the process of informed consent. It should give you the basic idea of what the research is about and what your participation will involve. If you would like more details

about something mentioned here, or information not included here, you should feel free to ask me by emailing Reed Forrest (forrest6@myumanitoba.ca) or me at Jillian.Seniukcicek@umanitoba.ca. Please take the time to read this carefully and to understand any accompanying information.

The purpose of this study is to learn about the experiences and perspectives of ENGAP engineering students (past and present) in the Price Faculty of Engineering at the University of Manitoba to better understand and advance the ENGAP program and find meaningful ways to uphold Indigenous cultures, advance Indigenous contents in the curriculum and enhance Indigenous peoples inclusion in the engineering training and professional practice.

We request your participation in this study by granting us an approximately 60-90-minute interview, with the option of a follow-up interview if you agree. The interviewing period will span from approximately September – December 2022.

This interview is designed as an informal discussion to obtain your opinions, feelings, and perceptions on a defined area of interest in a permissive, non-threatening environment. The discussion is intended to be relaxed, comfortable, and enjoyable to participants as they share ideas and experiences. Your participation is voluntary and will be held confidential. Only Mr. Reed Forrest and I will know who participates in the interview or not.

The interview will be held at a time and location on the University of Manitoba campus convenient for you, or by phone or virtually on MS Teams or Webex, and will be conducted by Mr. Reed Forrest. Field notes will be used to record any thoughts, feelings or impressions that Mr. Forrest has in response to the discussion, as well as to record any non-verbal cues that pertain to the discussion.

The interview strategy will follow qualitative interviewing norms. As opposed to a structured question and answer session, the format will be conversational and relaxed. Mr. Reed Forrest will use a prepared interview guide with open-ended questions to guide the conversation (see attached) and will work to ensure the atmosphere is one in which you feel comfortable disclosing your feelings, perceptions, and opinions relative to your experiences in the ENGAP program in the Price Faculty of Engineering.

The discussion during the interview will be audiotaped using a Sony recorder, a phone recorder, or the MS Team recording, and following the interview, the recording will be transcribed using Dictate, and by Mr. Reed Forrest or a transcriber. Both Mr. Forrest and the transcriber will sign a Pledge of Confidentiality indicating that they will keep your information and identity confidential. Your identity as an interview participant will be kept confidential, as well as any disclosures or data you provide. *In the transcription and any written summary notes of the interview session, you will only be identified by a generic description with a letter or number, such as “participant 1” or “participant A” or by a pseudonym, unless you prefer to waive your confidentiality. If you waive your confidentiality, note that the researchers have the sole discretion to include your name in any report or publications that arise from the study. Note that you do not have waive your confidentiality now. You can inform us via email (forrest6@myumanitoba.ca; Jillian.SeniukCicek@umanitoba.ca) after member checking your transcript (this is where you will review your transcript once it is transcribed and make any*

corrections, additions, or deletions to ensure you are comfortable with what you have said during the interview.)

I will keep all the consent form and data from the interview, including the summary notes, the transcription and audiotape in a confidential and locked cabinet in my locked office located in the Engineering Building, Stanley Pauley 333, and/or in a digital folder in Microsoft Teams. Once the interview has been transcribed, the audio/digital recording will be securely erased from our files.

All data and the consent forms from this study will be kept securely until the study and dissemination is complete. After that time, and not exceeding 5 years, all identifiable data from this study will be securely destroyed: electronic data will be destroyed securely; hard data will be destroyed by shredding the paper. The unidentifiable data will be kept until the data are no longer needed, or until Dr. Seniuk Cicek retires, which we anticipate to be no later than September 2040.

You will be invited within four weeks after the interview to review the written summary and send any comments of clarification, correction, or additional thoughts and ideas to us within two weeks. We will make any corrections/deletions/additions identified by you. You will also be invited to participate in the interpretation of data and review of research findings and send any comments of clarification, correction, or additional thoughts and ideas to us. This process will occur after data analysis and before Mr. Forrest finalizes his thesis research, which we anticipate to be no later than May 2023. All quotations, citations, or paraphrases of the data used for dissemination will be made generic with respect to unique personal features or identifiers, including but not limited to your gender, age, ethnicity, and speech habits. Direct quotes from the data used in publications will refer to the participant using only a general descriptor, such as “one participant” or “participant A.” We will consult with an Indigenous scholar (to be determined), to review all interpretation of data and review of research findings before finalization of relevant publications or reports reporting from the data.

Findings from this study will be disseminated in Mr. Reed Forrest’s thesis, and to the Price Faculty of Engineering at the University of Manitoba for the purposes of improvement of engineering education. Research findings from this study will also be presented at relevant conferences and published in conference proceedings and/or in journals.

Compensation:

For past ENGAP students who are not on University of Manitoba campus: we will pay for your parking on University of Manitoba Campus if that is where you agree to conduct the interview, for a three-hour duration to give you enough time to get to and from your car on the day of the interview. You will also be given a \$25 gift certificate (i.e., Tim Hortons, Starbucks, the U of M Bookstore, or Subway, etc. gift cards will be on hand or mailed to you) to show our appreciation for time.

For present ENGAP student: you will be given a \$25 gift certificate (i.e., Tim Hortons, Starbucks, the U of M Bookstore, or Subway, etc. gift cards will be on hand or mailed to you) to show our appreciation for your time.

Also, refreshments will be provided during the in-person interview.

Right to withdraw: Before providing written consent, you should be aware that you have the right to withdraw any of your comments and/or your data or withdraw completely from this study at any time, without prejudice, consequences, or penalty. Before or after the interview, you may express your desire to withdraw by contacting me or Mr. Reed Forrest via email, phone or mail using the contact information below. During an online, phone, or in-person interview, you can withdraw verbally. During an online interview, you can also withdraw via the chat. Once you have stated your intent to withdraw during the interview, you do not need to follow up with any additional communication. If you choose to withdraw from the study before the data are analyzed, your responses will be struck from all the data and your contact information destroyed. If you choose to withdraw from the study after the data are analyzed, the analyses will remain, as it will not be possible to separate your data from other data in the analyses, but your individual data and contact information before the analysis will be destroyed.

This project has been assessed as a minimal risk study. However, some participants may find the conversation uncomfortable or upsetting. To make an appointment with the Elder-in-Residence in the Faculty of Engineering, Elder Meade, please phone 204-474-8850. You can contact the University of Manitoba Student Counseling Centre in-person or by telephone (204-474-8592). *You can also phone “Hope for Wellness Help Line for Indigenous Peoples” at 1-855-242-3310 if you would like to access a resource outside the University of Manitoba.* You can also stop the interview at any time. Additionally, if you would like the Elder-in-Residence to be present during your interview, we will be happy to arrange that.

You will benefit from this experience by having the opportunity to discuss your perceptions of, and experiences in the ENGAP program at the Price Faculty of Engineering, University of Manitoba.

Your signature on this form indicates that you have understood to your satisfaction the information regarding participation in the study and agree to participate in the study. In no way does this waive your legal rights nor release the researchers, sponsors, or involved institutions from their legal and professional responsibilities. You are free to withdraw from the study at any time, and /or refrain from answering any questions you prefer to omit, without prejudice or consequence. Your continued participation should be as informed as your initial consent, so you should feel free to ask for clarification or new information throughout your participation.

Please you can send your signed informed consent letter to forrest6@myumanitoba.ca or Jillian.SeniukCicek@umanitoba.ca or give it to us in person before you meet the us for the interview, or at the beginning of the interview session, before the interview begins.

Our contact information is as follows:

Dr. Jillian Seniuk Cicek

Principal Investigator

Centre for the Engineering Professional Practice and Engineering Education

SP-333 Stanley Pauley Engineering Building

University of Manitoba

Office: 204-474-9698

Jillian.SeniukCicek@umanitoba.ca

Mr. Reed Forrest

Research Assistant and Graduate Student

Department of Biosystems Engineering

E1-268 EITC

University of Manitoba

forrest6@myumanitoba.ca

The University of Manitoba may look at your research records to see that the research is being done in a safe and proper way.

This research has been reviewed and approved by the Education and Nursing Research Board at the University of Manitoba. If you have any concerns or complaints about this project you may contact any of the above-named persons or the Human Ethics Coordinator at 204-474-7122 or humanethics@umanitoba.ca. A copy of this consent form has been given to you to keep for your records and reference.

FIPPA Notification Statement:

Notice Regarding Collection, Use, and Disclosure of Personal Information by the University

Your personal information is being collected under the authority of *The University of Manitoba Act*. The information you provide will be used by the University for the purpose of evaluating the delivery and learning outcomes of the course ENG 4100/EVDS 3710 by assessing students' learning outcomes and investigating instructors/community stakeholders' retrospective perceptions of, and experiences in/with the course. Your personal information will not be used or disclosed for other purposes, unless permitted by *The Freedom of Information and Protection of Privacy Act* (FIPPA). If you have any questions about

the collection of your personal information, contact the Access & Privacy Office (tel. 204-474-9462), 233 Elizabeth Dafoe Library, University of Manitoba, Winnipeg, MB, R3T 2N2.

Sincerely,

Jillian Seniuk Cicek

Please sign below to indicate your informed written consent to participate in this study by granting us an approximately 60-90 minute interview to discuss the the experiences and perspectives of ENGAP engineering students (past and present) in the Price Faculty of Engineering at the University of Manitoba to better understand and advance the ENGAP program and find meaningful ways to uphold Indigenous cultures, advance Indigenous contents in the curriculum and enhance Indigenous peoples inclusion in the engineering training and professional practice.

I consent to having an approximately 60-90-minute interview with the researchers with a possible follow-up interview if I agree, to discuss the experiences and perspectives of ENGAP engineering students in the Price Faculty of Engineering at the University of Manitoba to better understand and advance the ENGAP program and find meaningful ways to uphold Indigenous cultures, advance Indigenous contents in the curriculum and enhance Indigenous peoples inclusion in the engineering training and professional practice.

Participant's signature

Date

Researcher's signature

Date

OR:

I choose not to remain anonymous in the dissemination of these findings. I have the right to change my mind but must inform the researcher directly if I do change my mind. If I change my

mind, the researcher will not be able to retract identity in any findings already disseminated, but the researcher can ensure all future findings are made anonymous.

Participant's signature

Date

Researcher's signature

Date

To receive a summary of the findings of this study, please fill out this page and bring it to the interview, or return to:

Dr. Jillian Seniuk Cicek

Principal Investigator

Centre for the Engineering Professional Practice and Engineering Education

SP-333 Stanley Pauley Engineering Building

University of Manitoba

Office: 204-474-9698

Jillian.SeniukCicek@umanitoba.ca

Name: _____

I would like to receive a summary of the findings:

Yes _____ No _____ (please check one)

I prefer to receive the summary as an (check one)

E-mail attachment to the following e-mail address:

Hard copy to the following mailing address:

Participants can expect a summary of the findings by approximately May 2023.

APPENDIX F

Investigating the perceptions and experiences of ENGAP engineering students at the University of Manitoba

Assurance of Confidentiality to Interview Participants

This standard text will be used for all interviews. The moderator will read or paraphrase the following:

Thank you for agreeing to participate in this study. Everything you say will be held in confidence. The purpose of this interview is to discuss the experiences and perspectives of ENGAP engineering students (past and present) in the Price Faculty of Engineering at the University of Manitoba to better understand and advance the ENGAP program and find meaningful ways to uphold Indigenous cultures, advance Indigenous contents in the curriculum and enhance Indigenous peoples inclusion in the engineering training and professional practice. The interview questions have been designed to explore these areas. The goal is to see our time together as a relaxed conversation and not a structured question-and-answer period. You are free to withdraw any of your comments or withdraw completely from this study at any time, and you are under no obligation to answer any of the questions. The interview will be recorded. The recording will be transcribed and the research assistant and/or transcriber will sign a Pledge of Confidentiality. When we transcribe the interview and report the findings of the study, I will use a code (letter or number) or a pseudonym only to identify you and will not use any quotations that would identify you specifically, unless you agree to be named. After the interview has been transcribed, the transcript will be sent to you for your review, and once you return it, the recording will be securely destroyed. As mentioned earlier, all comments you provide will be held in confidence. Do you have any questions about these procedures?

APPENDIX G

Investigating the perceptions and experiences of ENGAP engineering students at the University of Manitoba

Interview Guides

Current ENGAP students

What were your expectations for Engineering before enrolling in the ENGAP program?

Have your expectations been met?

How has your experience been so far as an Indigenous student in Engineering?

How is the ENGAP program facilitating/ contributing to your experience?

In general, how would you describe your experience in the ENGAP program?

Are there any specific things/ issues you would like addressed to improve the program and your enrolment in Engineering?

What has been great in Engineering/ ENGAP program that you think should be continued?

Do you have anything more to say/add?

Prompts:

Tell me more...

Can you explain/expand...

What do you mean by...

Do you have anything more to add?

Past ENGAP students

What were your expectations for Engineering before enrolling in the ENGAP program?

Were your expectations met?

How was your experience as an Indigenous student in Engineering?

How did the ENGAP program facilitate/ contribute to your experience?

In general, how would you describe your experience in the ENGAP program?

Are there any specific things/ issues you would like addressed to improve the program and your enrolment in Engineering?

What has been great in Engineering/ ENGAP program that you think should be continued.

Do you have anything more to say/add?

Prompts:

Tell me more...

Can you explain/expand...

What do you mean by...

Do you have anything more to add?

Reed Forrest's interview protocol

Topic: What are the experiences of Indigenous students in engineering education and the Engineering Access Program?

Preamble

Hello, I'm Reed Forrest. As you know, I am interviewing you today as a current/former ENGAP student who went through the engineering program at the University of Manitoba—I would like to hear about your experiences during that period of your life. Thank you for agreeing to participate. There are no wrong answers to these questions. Please answer them in whatever way feels right to you. This interview should take approximately 60 minutes, though its length will depend on you and what you would like to share with me. You do not need to answer any questions you do not want to answer. This interview will be recorded. Only I and this study's principal investigator will have access to this recording, and all information will be kept confidential. You will be de-identified when your stories are disseminated, but you may waive this de-identification and be referred to by your name in the study. Is this alright with you? Do you have any questions? Would you like to begin?

Introductory Questions

1. How are you today?

2. Tell me a bit about yourself: where are you from? What are you up to these days?
3. What years were you in university?

Questions on experiences in engineering and ENGAP:

Now I would like you to recall your experiences as you went through your engineering degree.

1. Tell me about what drew you to engineering, and your journey into/through the program.
2. What was an impactful experience from the beginning of your engineering studies?
3. What surprised you about engineering?
4. Tell me about your experiences in ENGAP.
5. Were there any experiences as you approached the end of your degree that stuck with you?
6. Did your attitude toward school change over the years? Whether that be something to do with your comfort level, your goals, or your general outlook.
7. Did you feel comfortable at school?
 - a. What were some things that made you feel this way?
8. What do you think is the biggest thing you took away from your time as an engineering student?
9. What relationships in your life were meaningful to you during your studies?
10. Looking back at your time in university, is there anything you would change/do differently?
11. How do you feel about being an engineer?
 - a. Has your perception of the profession changed throughout your studies?
12. Tell me about a negative experience in university.
13. Tell me about one of your best experiences in university.

General Probing Questions (applicable to all questions above):

1. Could you tell me more about that?
2. How did that make you feel?
3. Could you give me an example of that?

Closing Questions/Statements:

1. Is there anything else you would like to add or elaborate on?
2. Do you have any questions?
3. May I contact you if I have any further questions or require clarification?

Thank you for your time!