DECOLONIZING TECHNOLOGY THROUGH A TIPI: CREATION OF AN INDIGENOUS MOBILE APPLICATION AT YORK UNIVERSITY

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A THESIS SUBMITTED TO
THE FACULTY OF GRADUATE STUDIES
IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF
MASTER OF ARTS

GRADUATE PROGRAM IN INTERDISCIPLINARY STUDIES
YORK UNIVERSITY
TORONTO, ONTARIO

JUNE 2016

Abstract

This research explores the possibilities of how Information technologies can be designed and created by/for/with Indigenous peoples in order to be potentially decolonized. Indigenous members of the Centre for Aboriginal Student Services at York University participated in the design of a mobile application to address the needs of, and challenges faced by Indigenous students within a largely non-Indigenous university environment in Canada. The interdisciplinary design of said application integrated Indigenous knowledge of Tipis into a software development methodology in order to create a safe space and include some fundamental cultural elements. The analysis of current cases in the context of Indigeneity and technology around the world provided the principles to design this integrated software design methodology.

Key Words: Indigenous, Technology, Mobile, Decolonizing

Acknowledgements

I would like to acknowledge the Creator and Mother Earth.

I would like to acknowledge the strength I have received from all my ancestors and the hope I received from the generation before me.

I would like to say Chi Meegwich, Nya:weh and Wela'lin to the Aboriginal members of the Center for Aboriginal Student Services of York University, who welcomed me and believed in me: Billie, Brenda, Jared, Jesse Thistle, Joseph, Lisa, Mariah, Nancy, Randy, Rob, Robyn Grant-Moran, Sam, Serena, Thane, Tsitra, among many others.

I would like to say Nya:weh and Wela'lin to Dr. Koleszar-Green and Blu Waters for all your emotional, intellectual and, especially, spiritual support in this journey.

I would like to say thanks to Cheryl, Stephen, Bill, Miguel and Fiona who believed in me and guided me throughout this path.

I would like to say thanks to Jose Alberto García (Mexico) and James Montgomery (Australia). They opened possible technological paths to follow, shared information and clarified my doubts.

I would like to say thanks to Tauheed for all his endless support and patience.

I would like to say thanks and gracias to Haily and Alan, who welcomed me to Canada and support in all my journey.

Me gustaría decir gracias a mis padres, Alejandro y Diana, que sin ellos, esto no hubiera sido posible.

Me gustaría decir Ta' bin dio a Gero, quien me formó y me ayudó en mi descubrimiento.

Me gustaría decir Paxkatkatxini' a todas las personas de la sierra del Totonacapan en México que me enseñaron y me formaron.

Finally, I would like to say thanks to Barbara and Terry, who are believing on the potential of this research.

Mitákuye Oyás'iŋ

All my relations

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1. Introduction

"We talk about decolonization, but we are talking about decolonization in a colonized context of learning and so there's that inherent contradiction in what we are doing."

Kathleen Absolon (as cited in Kovach, 2009, p. 85)

Absolon, through this quote, reflects the tensions, which the concept of decolonization brings to academia, considering that this space has been traditionally used to colonize knowledge production. In the same way, technology, which has been usually used to force created needs inside the dominant[1] capitalist society, generates epistemological discomfort and skepticism about its possible decolonizing effects. Technology can also be used in the long term to perpetuate the colonizing power over others.

Typically, Indigenous scholars need to justify their research and knowledge systems within the dominant perspective in order to gain credibility and to support their results for academic purposes (Wilson, 2008, p. 12). Therefore, in this introduction I hope to clarify and justify why Indigenous research paradigms are used to work with Indigenous communities, including the presentation of results, and how they are indispensable in creating new effective methodological principles in Indigenous software design.

First, in this chapter, I explain the objectives, argument and motivations of my research. In this part, I recognize different conceptual and historical aspects of technology and Indigeneity in the context of this research. Next, I provide an overall explanation of the key concepts, which are used throughout the development of my argument in relation to

[1] *Dominant* is used as an adjective to describe the culture of Eurocentric, Christian, heterosexist, male-oriented society (Wilson, 2008, p.35).

Indigenous paradigms. Subsequently, I introduce the reader to fundamental considerations of Indigenous research, which include relational accountability as an essential element. With this in mind, I then introduce myself to the reader. Finally, I present the main structure of the whole thesis.

1.1 Objective and hypothesis

This research explores the possibilities of how technology can be designed and created by/for/with Indigenous peoples. The aim of this thesis is to produce methodological and technical principles for decolonizing technology through the creation of a mobile application. In addition, the software design of the mobile application creates supportive Indigenous networks and digital spaces[2] among different Indigenous peoples and groups.

My argument is that technology can be decolonized just as long as it is developed by/for/with Indigenous peoples through a process that valorizes Indigenous knowledges (epistemology). This process should emphasize culturally appropriate methodological principles (methodology) during the whole procedure of the design of such technology (e.g. the mobile application). Often, these methodological principles that are relevant to technology in Indigenous contexts do not correspond with the standards of the industry and of academia.

Thereby, in the creation of this particular mobile application, the Indigenous knowledge about Tipis[3] is reclaimed and acknowledged as the key design element with which to decolonize technology. In other words, throughout the chapters, I refer to different traditional

[2] *Digital Space,* or also called *cyberspace* is "an infinite artificial world where humans navigate in information-based space" (as stated by Gibson in Benedikt, 1991). It describes its physical existence as a world of computers linked by telecommunications lines.

[3] *Tipi* is a traditional conical dwelling of Indigenous Peoples (a further explanation is addressed in Chapter 2: Indigeneity and Technology).

teachings and knowledge around Tipis, which were incorporated as a fundamental part of the software design. Indeed, before I can explain further how these traditional teachings, which represent Indigenous knowledge, were incorporated in the methodology of software design, some important aspects and considerations have to be acknowledged.

First, it is important to mention that, with the term *Native* or *Indigenous*, I am referring to peoples who identify their ancestry with the original inhabitants of Canada and other countries worldwide, who are unique in their cultures, but who share common experiences of colonialism and understandings of the world. In the particular case of Canada, the term "Aboriginal" refers to First Nations, Métis and Inuit peoples. *First Nations* is a term that refers to status and non-status "Indian" peoples in Canada and it was first used in the 1970s to replace the word *Indian,* which tends to have offensive connotations. The term *Métis* represents people of European and First Nations mixed ancestry. Finally, *Inuit* are the Aboriginal people in northern Canada, living mainly in Nunavut, Northwest Territories, northern Quebec and Labrador. The epistemological, political and historical differences and intrinsic implications embedded in the terms *Native*, *Indigenous* and *Aboriginal* are beyond the scope of this research. However, these terms are used interchangeably throughout this research.

Second, when I relate Indigeneity and technology, it is essential to recognize the transformative power that technology has had in the context of Aboriginal communities. Indeed, as a consequence of colonializing policies and the world economic changes after the Industrial Revolution (mid 18th to early 19th centuries), the vast majority of Indigenous peoples around the globe gradually became part of the industrialized economies. Throughout this conversion process, technology was one of the most significant transformative means that integrated different Indigenous groups into the waged labour

economy (e.g. firearms, assembly line, mass production, etc.). In the specific case of Canada, dispossession policies and treaties, along with technology (e.g. firearms), legitimized several assimilation actions towards Aboriginal peoples. Therefore, when I mention “Indigenous peoples,” I am referring to societies that, despite maintaining cultural, spiritual, intellectual, physical and emotional styles of life, are part of the industrialized economies of the world.

Finally, in the case of the term “decolonization” or “decolonizing,” I am referring to the process of restoration of cultural practices, thinking, beliefs and values that were discontinued or forbidden, but are still important or necessary for survival (Gray, Coates & Bird, 2008, p. 284). The implications of this term in relation to technology will be addressed in Chapter 2: Technology and Indigeneity.

1.2 Indigenous Paradigm in this research

To achieve the thesis objective, this research adopted a transdisciplinary cycle process of analysis that delves into epistemological / theoretical issues that connect Indigenous knowledge (i.e. the Tipis) and software development methodologies to formulate new methods for the development of practical applications of technology and Indigeneity (Figure 1). To understand this process of creation, it is necessary to explain the framework of the research through its three fundamental facets—epistemology, methodology and methods—and their relationships (paradigm).

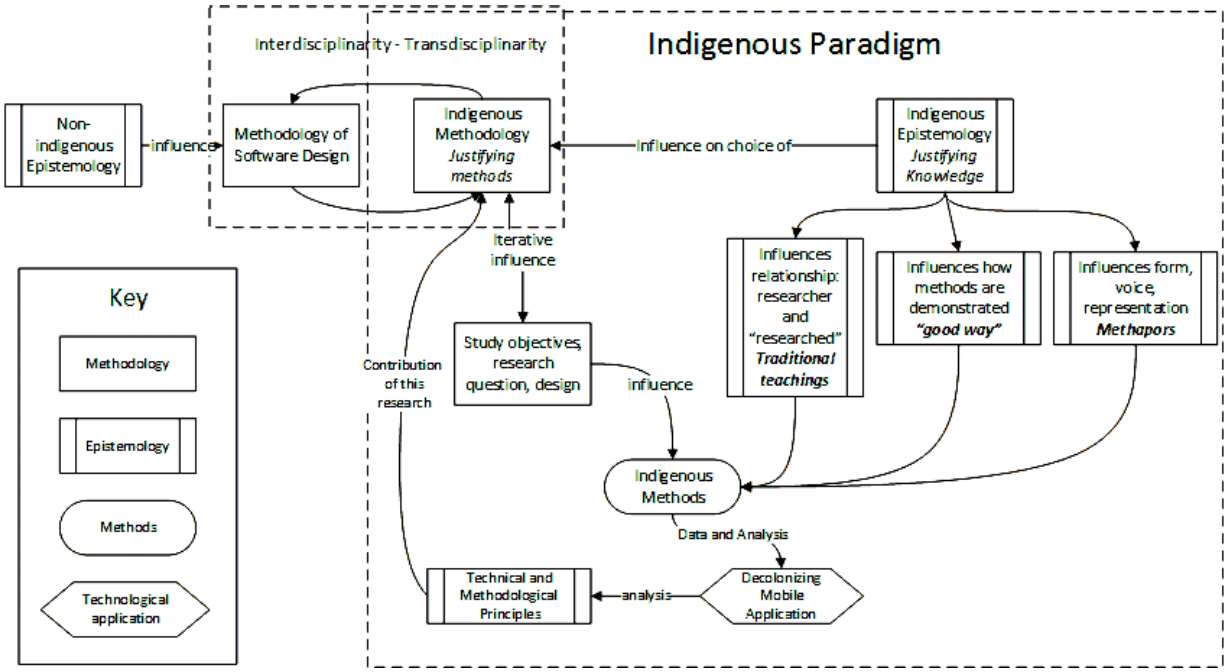

Figure 1: Indigenous Paradigm of this research
Adapted from "Justifying knowledge, justifying method, taking action: Epistemologies, methodologies, and methods in qualitative research" in *Qualitative health research*, United States, by Carter & Little, 2007, p. 1320, Copyright 2007 by *Sage Publications*.

First, *epistemology* is the study of the nature of knowledge and its justification. Epistemology is thus asking, "How do I know what is real?" (as stated by Schwandt in Carter & Little, 2007, p. 1317; Wilson, 2009, p. 33). Therefore, Indigenous epistemology is the beliefs and assumptions held about Indigenous ways of knowing, where they come from, and whom they involve (Kovach, 2009, p. 21, 46). In this specific case, the beliefs and assumptions around the Tipis were used in order to create a specific type of technology.

Second, the term *methodology* refers to the theory of how knowledge is gained in order to justify the methods. It is an analysis of assumptions, principles, and procedures in a particular approach to inquiry. Methodology is thus asking, "How do I find out more about this reality?" (Carter & Little, 2007, p. 1317; Wilson, 2009, p. 34). Thereby, Indigenous Methodology is the description of the theory and method of conducting research that flows from an Indigenous epistemology (Kovach, 2009, p. 20).

Third, the term *method* is defined as a procedure, tool and technique of research. Method is thus asking, “Specifically, how can I find out more about this particular time and space?” (Carter & Little, 2007, p. 1317). Hence, an Indigenous method is the particular strategy utilized to understand a phenomenon in an Indigenous way.

Finally, the relationships among these concepts frame Indigenous paradigms. In an Indigenous paradigm, the Indigenous epistemology is central because it justifies Indigenous knowledge. At the same time, Indigenous methodologies justify Indigenous methods, and these methods produce data and analysis. Indigenous knowledge is produced from these data and analysis. Therefore, Indigenous methodologies have an epistemic content (Carter & Little, 2007, p. 1320). This point is where a cyclical process of analysis is inserted to include software development methodologies, which, typically, will contain non-Indigenous epistemic content.

However, to guarantee that the non-Indigenous epistemic content would not override the Indigenous knowledge, Indigenous epistemology offers three main influences on the methods of this research (Carter & Little, 2007, p. 1321).

1) Indigenous epistemology influences the relationship between the researcher and the “researched” community. Traditional knowledge and values guided all my interactions with the community.

2) Indigenous epistemology influences the way in which quality of methods is demonstrated. In a “Good way” is a traditional Elder expression, which literally means to *speak the truth,* to

offer validity, relational accountability and credibility (Kovach, 2009, p. 52). All the methods were guided in a “good way.”

3) Indigenous epistemology influences the form, voice and representation in the methods. In other words, Indigenous epistemology defines how I, as a researcher, communicate with my audience, as well as how I conceptualize the audience, the analyst, and the “researched” community (as stated by Mantzoukas in Carter & Little, 2007, p. 1322). In the specific case of this research, I placed the concept and traditional teachings around the Tipis in the center of the design. Also, the use of metaphors during the sharing circles and the continuous active role of the community determined the communication among all research collaborators.

Subsequently, the data and analysis produced by these methods offer necessary elements to develop a decolonizing mobile application, which aims to create Indigenous networks and support Indigenous youth. The analysis of this mobile application and its software design provides technical and methodological principles (Indigenous knowledge) for decolonizing technology, which is the objective of this research.

As an Indigenous scholar, my transdisciplinary exploration seeks to provide other Indigenous researchers, activists and community members, with technical and applicable methodological elements to contribute to the creation of methodologies in Indigenous software and hardware designs. Therefore, these elements could have new decolonizing applications in different areas of Indigenous knowledge. Avoiding considering applicable elements would circumscribe this knowledge to the dominant discourse of academic institutions.

My motivations to create a methodological interdisciplinary thesis about the creation of mobile applications within Indigenous contexts are not just for the explicit purpose of earning my Master's degree; they are also for the recognition of my ancestors, my life story, Indigenous traditional knowledge, and my personal journey. Unfortunately, since I started to explore my Indigenous roots, I have been discouraged through the discourse of the academia and by Indigenous activists from speaking about Indigeneity and technology in the same context.

1.3 Characteristics of Indigenous Research

To familiarize the reader with this methodological journey, I will clarify several aspects of this work as this type of research could be misinterpreted because it results from a process conducted within the dominant system of academia and knowledge production (Wilson, 2008, p. 35; Kovach, 2009, p. 28, 151).

Essentially, the overall process of this research was guided by the following principles, as identified in Atkinson's understanding of Indigenous research:

1. Aboriginal people themselves approve the research and the research methods;
2. A knowledge and consideration of community and the diversity and unique nature that each individual brings to the community;
3. Ways of relating and acting within community with an understanding of the principles of reciprocity and responsibility;
4. Research participants must feel safe and be safe, including respecting issues of confidentiality;
5. A non-intrusive observation, or quietly aware watching;

6. A deep listening and hearing with more than the ears;
7. A reflective non-judgemental consideration of what is being seen and heard;
8. Having learned from the listening a purposeful plan to act with actions informed by learning, wisdom and acquired knowledge;
9. Responsibility to act with fidelity in relationship to what has been heard, observed, and learned;
10. An awareness and connection between logic of mind and the feelings of the heart;
11. Listening and observing the self as well as in relationship to others;
12. Acknowledgement that the researcher brings to the research his or her subjective self (as cited in Wilson, 2008, p. 59).

I decided to write all the principles in the introduction, as I make continuous reference to them in the methodological section; they summarize the academic and spiritual essentials of my journey in creating the mobile application. I honour these principles and the worldviews of Indigenous peoples with ethical responsibility and sensibility.

Also, these principles infer basic considerations about the acknowledgement of the relationships and the relational context of the research as the principles recognize community as a source of knowledge (Kovach, 2009, p. 13, 32). This is significant because describing relationships in the application development process through an Indigenous paradigm plays a more important role than simply the level of *accuracy/outcome of* that was reached to develop the mobile application (Wilson, 2008, p. 122) and therefore, the Indigenous methodologies emerge as a result of the description of these relationships (Wilson, 2008, p. 8, 77).

Moreover, these relationships also require accountability as an essential element of storytelling, in oral tradition, transmitted via written text (Wilson, 2008, p. 126, 127). For these reasons, I will not separate myself from my community because that minimizes the value of the contributions of myriad people to this work and also it does not allow me to share several experiences that I learned from that community during this process. In this sense, most of this written presentation is in first person, as, in my analysis, I acknowledge the previous relationships that I have had with the community and I identify those collaborators who gave me permission to do so. According to Wilson, the recognition of my relationships is called *relational accountability* in an Indigenous paradigm (2008, p. 119,123; Kovach, 2009, p. 52).

Indeed, in qualitative research, *reflexivity* is how some scholars call this type of self-reflection on the meaning-making process (Kovach, 2009, p. 32, 112; Routledge, 2002, 488-489). However, it is important to differentiate *reflexivity* from *relational accountability* to avoid merely conflating a non-Indigenous paradigm with an Indigenous paradigm (as stated by Wilson in Kovach, 2009, p. 177). The main disparity occurs because *relational accountability* is guided by tribal epistemologies, and this tribal knowledge is not Western knowledge (Kovach, 2009, p. 30-31). Therefore, this differentiation will be reached through the incorporation of traditional teachings in the narrative that might not fit into a mainstream academic dominant discourse.

It is important to highlight that part of the relational accountability is that, as a researcher, I have to be accountable not just to the reader, but also to myself (Wilson, 2008, p. 123). This personal accountability means that I will state who I am with humility, honor the lessons that I have received in my entire journey, and recognize that I am an integral part of the Indigenous communities with which I have worked. This humility means that I am no more

important or knowledgeable than anyone else and I will just share the relationships and connections that make up this research in a *"*good way*"* (Wilson, 2008, p. 134).

Finally, one fundamental pillar of this relational accountability is based upon the collective value of giving back to the community in a way that is useful for them (Kovach, 2009, p. 81-82, 149). This research has had that element since its inception because the mobile application itself was designed to be launched by the end of the research. The mobile application will potentially continue to assist Aboriginal members in creating networks inside post-secondary institutions, even beyond this research. In other words, this research also aims to benefit the "researched" community (Kovach, 2008, p. 29).

Another essential aspect of an Indigenous paradigm is the use of metaphors and symbolism because they allow better comprehension by readers as Indigenous researchers use concrete examples to create relationships with concepts that are abstract (Wilson, 2008, p. 124). Therefore, this enables researchers to offer knowledge in an Indigenous form (Kovach, 2009, p. 84, 94). The abstract conceptions (e.g. roles of the users, the capabilities of different computer systems, security policies) of a mobile application and its design are examples of this necessary generation of relationships, which may benefit other Indigenous researches and developers beyond the academic audience.

1.4 Interdisciplinarity / Transdisciplinarity in Indigenous Research

As stated before, Indigenous paradigms want to transform the academic framework to explore new ways of knowledge production. The inclusion of interdisciplinarity and transdisciplinarity in Indigenous paradigms gives the opportunity for Indigenous scholars to exchange different realities between science and Indigenous knowledge and so to enrich

the discourse between them (Veciana, 2015, p. 11) and to therefore generate a structural change in the relation among science, technology and Indigenous societies.

Essentially, interdisciplinarity gives the capability to include knowledge and styles of thinking from different disciplines to explain a phenomenon, solve a problem, create a new product and/or to raise new questions in forms that would have been unlikely through a single disciplinary approach (as stated by Mansilla in Repko, Szostak & Buchberger, 2014, p. 25). However, transdisciplinarity includes interdisciplinarity and also incorporates an open dialogue and cooperation among disciplinary experts, stakeholders (e.g. agencies, non-profits, community members, and various interest groups) and practitioners (Repko *et al.,* 2014, p. 35).

Particularly, transdisciplinarity contemplates a diverse quality control, which considers heterogeneous points of views and negotiates different interests of key players outside academia (Veciana, 2015, p. 21). In the same way, in an Indigenous paradigm, the articulation and sharing between different community experts, such as medicine people, children, Elders and youth, are essential factors to be considered in the process of knowledge production (Absolon, 2011, p. 128).

As stated by Jahn, Bergmann & Keil (2012), transdisciplinarity is “a reflexive research approach that addresses societal problems by means of interdisciplinary collaboration as well as the collaboration between researchers and extra-scientific actors; its aim is to enable mutual learning processes between science and society; integration is the main cognitive challenge of the research process” (p. 4). Therefore, transdisciplinarity offers the possibility of incorporating scientific knowledge into the Indigenous paradigms through a model of

horizontal power, which could challenge the heterogeneous hierarchy of knowledge in different disciplines (Veciana, 2015, p. 12).

Indeed, transdisciplinarity and Indigenous knowledge apply similar principles of knowledge production, in which their practical distinctness is difficult to separate. For example, transdisciplinarity typically uses the research-action methodology, which has essential characteristics such as participatory approach and a democratic impulse (Veciana, 2015, p. 13). These aspects mirror, respectively, the relation-based processes and sharing circles in Indigenous perspectives (Absolon, 2011, p. 126).

A last relevant aspect between transdisciplinarity and Indigenous perspectives is related to the transgressive and transforming character that both frameworks share. In other words, when Indigenous or transdisciplinary researches are developed, social transforming aspects are implicitly included[4] (Veciana, 2015, p. 12, 21; Absolon, 2011, p. 91).

Finally, interdisciplinarity and transdisciplinarity were used as allied theories in this Indigenous research because they allowed me to use software development methods from my educational background in Computer Science, while allowing me to place Indigenous points of views and thinking at the center of the research (Absolon, 2011, p. 148-150).

1.5 Relational Accountability: Who am I?

In light of these considerations, I would like to present myself and then I will introduce to the reader the structure that we, the reader and me, will follow throughout this written presentation and, which drove my research project.

[4] Thus, due to the active nature of the research, the terms “researcher,”“activist” and “developer” are used also interchangeably throughout the thesis.

My name is Alejandro and my spirit name is “black jaguar;” I am Mexican; I was born and raised in Mexico City. I am the first born of Alejandro and Diana Antonieta. Both of my parents are *mestizos*[5] and they are monolingual Spanish speakers. They are part of the middle class of Mexico and they also grew up in Mexico City.

I was raised as Catholic, but I started questioning the influence of the Church since the beginning of my adulthood. Nowadays, I consider myself more a Spiritual person who believes in the Creator and who does not believe in random coincidences and circumstances. And, interestingly, throughout my research I had several experiences, which strengthened this belief.

My second great-grandfather (the grandfather of my father’s dad) and all his ancestries belong to Santo Domingo Yanhuitlán. This small town is in the Mixtec region of the state of Oaxaca in the south part of Mexico and it has had an Indigenous tradition since its origins. Before Spanish colonization, this town was an important Mixtec religious center, where several Mixtec peoples converged for commercial and religious purposes (Instituto para el Federalismo y el Desarrollo Municipal [INAFED], 2010).

On the other hand, my mother is originally from Santiago Pinotepa Nacional, a municipality located on the coast of Oaxaca. This place is still a locality with a Mixtec tradition and where

[5] In the specific context of Mexico, the usage of categories of *Mestizo* and *Indígena* (Indigenous in Spanish) are problematic because their limiting definitions (i.e. *Mestizo* as a person with mixed blood between *Indigenas* and *Spaniards;* and *Indígena* is a person with pure Indigenous blood) will not recognize the history of the Indigenous Peoples in Mexico, nor their post-colonial communitarian organization and it will erase the memory of violence against people with Indigenous identities in the twentieth century (Robichaux, 2008, p. 36-40).

19.97% of its population continues to speak the Mixtec native language (INAFED, 2010). ~~A~~ncestors from the side of my mother had an Indigenous background.[6]

Despite these connections with the land, neither of my parents consider themselves as Indigenous. Hence, the person who influenced my connection to my Indigenous roots, was my Godmother *Francisca Gerónima,* a bilingual Mixtec-Spanish Indigenous woman who lived with me from when I was one year old until I moved to Canada in August 2014 (25 years of relation). She is originally from *El Añil,* a small town 10 kilometers away from Santiago Pinotepa Nacional.

She taught me the Indigenous values and teachings of humility, honesty, respect, love and truth. My relationship with her has been special because I always feel a different connection towards her. Now, I understand that this association with her is a form of communication between my ancestors and myself. Sadly, I could never learn the Mixtec language.

In a more active way, I continued my journey with Indigenous communities in 2007, when a group of friends and I were invited to participate in social projects in the Totonac Indigenous Communities in the state of Veracruz (Mexico) by the Elder Obdulia Cotero. This invitation, two years later, became the base for the creation of the Indigenous non-profit organization of *Magtayani.*[7]

[6] In the context of Latin America, the cultural factor (i.e. lifestyle) is more significant than the biological aspect to define Indigenous identity considering that genealogical blood quantum research would be impossible in most cases. Therefore, the conception of *Indigenous* assumes the recognition of no biological or cultural antecedent, either separate or in specific combination (Esteva, 1995, p. 3-4). Also, studies in Latin America during the twentieth century emphasized that the Indigenous category is defined by cultural / racial signifiers and the boundary among *Indígena* and *Mestizo* is potentially crossable by changing those expressions (Wade, 1997, p.37).

[7] *Magtayani* means “help in the harvest” in the Totonac language

From within this organization, I worked with Totonac communities from 2007 to 2014 in the creation of social entrepreneurships with fair-trade schemes. Throughout those seven years, I participated actively in several ceremonies and traditional dances, integrating myself with the roots of the Totonac culture. The level of my inclusion within the communities reached a maximum momentum in 2010, when the people gave me my Indigenous name: *Lagkachixiwa (*which its literal translation from Totonac is “face with hair” that can be interpreted as “beard man”).

One year later, in 2011, I traveled to Nova Scotia, Canada, for four months to do a comparative research between the Mi’kmaq and Totonac culture, which allowed me to also observe ongoing struggles resulting from the colonization of Indigenous communities in Canada. This insight led me to question whether or not the consequences of colonization were similar in Mexico and Canada in order to find common applicable solutions to those struggles. Then, I went back to Mexico to get my degree in Computer Science and continue working with *Magtayani* in the Totonac communities in Veracruz. Finally, in August 2014, I moved to Canada to pursue my Master’s degree in Interdisciplinary Studies at York University in Toronto.

I will end this focus on my self-presentation here because from this point my personal history will be interwoven with this research presentation, therefore you may get more details about me in future chapters. And, although I might have overlooked some factors, as much as possible, all of my actions were done in a “good way.”

1.6 Thesis Structure

Before I can explain the creative process of designing and implementing an Indigenous mobile application through the concept of the Tipi, it is necessary to clarify several key concepts (e.g. tipi, technology, decolonization), detail the context of the community where this application was developed and to explain why technology can be a possible answer to some struggles of this particular Indigenous group.

Therefore, this research is structured in six different chapters, which aim to provide the reader with the necessary elements to understand how technology and Indigeneity were articulated to develop an Indigenous mobile application.

In this first chapter, I provide the reader with the framework in which this research was developed, the characteristics of Indigenous research, the reasons why transdisciplinarity and interdisciplinarity were necessary to make this analysis, and finally, I introduce myself and the Tipi.

Chapter 2 reviews the concepts of the Tipi, decolonization and technology and their potential positive and negative relationships. Along with this, I provide several examples of connections between Indigeneity and technology around the world.

Then, Chapter 3 provides the context of the territories where this research was developed, along with the overall status of Aboriginal peoples in Canada in terms of population, access to post-secondary education and Internet connectivity. Finally, I provide an explanation of the specific context of Aboriginal members at York University.

In Chapter 4 and 5, the Tipi Ceremony as an Indigenous knowledge and software methodology is explained, along with an explanation of the different capabilities and features, which the mobile application includes in order to fulfill the needs of the Indigenous student community of York University.

Finally, Chapter 6 provides the conclusions and future steps of the overall process of software design, the key methodological and technical principles to decolonize technology, and the future directions of this research.

To finish this introductory chapter, I identify the spirit that accompanied and guided me throughout this process: the Tipi. This life-force inspired and helped me during the development of the mobile application. His/her/their story will be presented throughout each of the chapters of this research presentation.

2 Indigeneity and Technology

As stated throughout the introductory chapter, my argument is that technology can be decolonized just as long as it is developed by/for/with Indigenous peoples through a process that enhances the value of Indigenous epistemology and emphasizes culturally appropriate methodologies through the whole process of technological design. In the case of this particular research, this technology is a digital mobile application, and the Indigenous epistemology used was the traditional teachings of the Tipis.

Moreover, similar to a tipi, the digital mobile application aims to provide spaces for Indigenous peoples, which will then suit their current personal needs for safety, comfort and privacy. However, before we can explore in detail its design and implementation, it is necessary to explain the key concepts, which frame such a technological application.

The hypothesis of this research is that technology can be decolonized through the creation of this mobile application, by including Indigenous methodologies and epistemologies (traditional knowledge). Nevertheless, several fundamental questions emerge from this argument: What is technology in the context of this research? What is “decolonizing” or “decolonization”? Are there tensions between the concepts of “Indigeneity” and “technology”? Therefore, in this chapter I examine scopes and boundaries of these themes and their relationships to one another. In the first part of the chapter, I address the central conceptual elements of the research, i.e. the Tipi, technology and decolonization, as well as how they intersect between each other. Thereafter, I explore in more detail applications from around the world in which Indigeneity and technology have been integrated.

2.1 What is a Tipi? Why are Tipis important for this research?

The Sioux word *Tipi* is formed of *ti*, which means dwell or lives, and *pi* that means *used for;* in this manner *tipi* means “used to live in.” The tipi is a conical tent that serves as a sacred shelter and home for many Indigenous peoples in Canada, United States and the Arctic Region. It provides safety, comfort and privacy for its occupants (Laubin & Laubin, 1971, p. xvi). In a Tipi there is a central fire, a smoke hole at the top, an eastern entrance and a place of honor opposite the door. However, to be considered a “real tipi,” it must follow the principles of the buffalo hunters of the Great Plains (Laubin & Laubin, 1971, p. 2; P. Cote, personal communication, February 8, 2016). A real tipi is not a symmetrical cone, but a tilted one, steeper at the back with the non-centered smoke hole on the top (Figure 2). This hole is pitched aside, commonly to the front of the tent and with two flaps, which are supported by movable outside poles to control the draft, ventilate the tent and discard the smoke (Laubin & Laubin, 1971, p. 2).

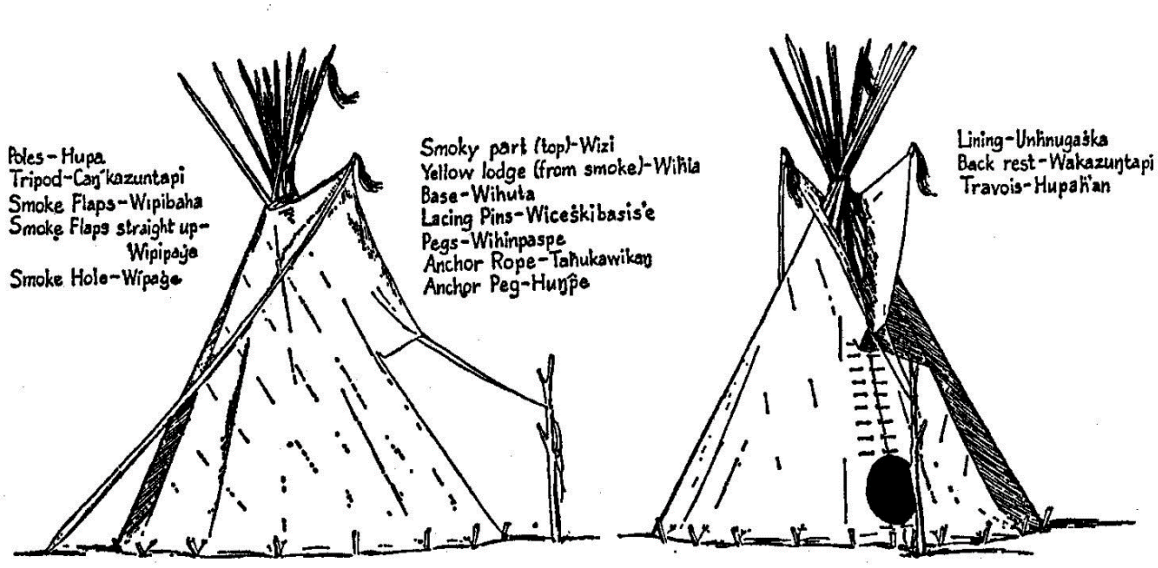

Figure 2: The Sioux Tipi
Reprinted from “*The Indian Tipi: its history, construction, and use”* in United States, by Laubin & Laubin, p. 55, Copyright 1971 by Ballantine Books.

Nowadays, the importance of the tipis for Indigenous peoples is not just for dwelling and shelter, but also for healing and listening. Indeed, the conical form of tipis is compared with the shape of the skirts of women, and the ways in which they provide shelter for young children who are scared or threatened. In accordance, the well-being of the tipi is typically considered a responsibility of women (B. Waters, personal communication, October, 26, 2014).

Throughout my personal journey of building a Tipi, I have realized that the relevance of the concept itself is significant because it frames several considerations and teachings (e.g. tipi's construction, usage, traditional protocols, etc.), which were included in the design and implementation of the mobile app. In other words, my research argument relied on the traditional teachings of Tipis during the whole process of design of the mobile application, because they were incorporated as Indigenous knowledge (epistemology) and they emphasize culturally appropriate methodological principles and protocols (methodology). The specific connections between this Indigenous knowledge and the mobile application will be explained in detail in Chapter 5.

2.2 Technology

In order to include the traditional teachings of raising a Tipi, it is fundamental to clarify the concepts of technology and decolonization, as well as the relationships between these two concepts.

The concept "technology" is a problematic term by itself. According to the Merriam-Webster dictionary, *technology* is the practical application of knowledge, especially in a particular area (technology, n.d.). Indeed, Bigelow, who coined the term *technology* in 1829, defined

technology as “the principles, processes and nomenclature of the more conspicuous arts, particularly those which may be considered useful” (1829, p. v). These definitions infer that technology is a consequence of knowledge.

In contrast, Dugger & Gibberti state that technology is one of the new sciences of this millennium and they relate technology to the behavior of tools, machines and technical systems (2000, p. 4). Similarly, Giblett defines technology as “the conjunction of theory, knowledge, discourse, power and practice. Technology is an institutionalized practice of meaning-making before it is the mechanical production of machines and the use of those machines” (2008, p. 17). Moreover, in this respect, Williams asserts that “a technology is first, the body of knowledge appropriate to the development of technical skills [or techniques] and applications [in a technical invention] and second, a body of knowledge and conditions for the practical use and application for a range of devices” (Giblett, 2008, p. 17). Therefore, according to these authors, technology is a consequence of different knowledge, i.e. technology is an epistemology[8] by itself.

In this regard, Martin Heidegger analyzes the concept of technology based on its ontological essence. He asserts that this concept has two components: 1) *technology* can be a means to an end; 2) *technology* can be a human activity. According to him, these two aspects belong together and therefore, technology can be defined as a human activity to posit an end, which procures and utilizes means to reach such end (1954/1977, p. 3-5). In other words, technology is not an end by itself and its conceptualization depends on the manner in which it is manipulated as a means. Moreover, Heidegger affirms that technology is a way of revealing the truth (as a process) and therefore, it cannot be the truth by itself. He labelled

[8] *Epistemology* is the study of the nature of knowledge and justification. Epistemology is thus asking, “How do I know what is real?” (as stated by Schwandt in Carter & Little, 2007, p. 1317; Wilson, 2009, p. 33)

this fundamental characteristic of technology *instrumentality*. According to him, instrumentality is considered to be the fundamental characteristic of technology (1954/1977, p. 12).

If instrumentality is a key element of revealing the truth, then technology is a means for different epistemologies and not a type of knowledge by itself. As stated in the introductory chapter, epistemology is the study of the nature of knowledge/truth (as stated by Schwandt in Carter & Little, 2007, p. 1317), therefore technology can be considered a practical application of such epistemologies. As a result, technology itself cannot exist without an epistemology and its focus remains on the "way of revealing the truth." In other words, technology is better defined as a "way of revealing" (methodology[9]) rather than as an epistemology.

Nowadays, instrumentality is strongly related with the concept of technology in the context of Indigenous peoples. According to Orticio, technology in relation to Indigenous Peoples (in the form of Information and Communication Technologies), has an instrumentality value because it is a medium to promote Indigenous peoples' welfare and development around the world (2015, p. 100).

Therefore, the objective of the technological application of this research is to address the challenges that Aboriginal youth are facing in postsecondary institutions. Moreover, the incorporation of the teachings of the Tipi into the process of creation (methodology) frames the research into Heidegger's concept of technology of "ways of revealing the truth." In this way, the beliefs and values of Indigenous peoples are not affected. On the other hand, this

[9] Methodology is the description of the theory and method of conducting research that flows from an Indigenous epistemology (Kovach, 2009, p. 20).

conceptualization is a form in which technology can be used as a means for empowerment and self-determination.

After clarifying the concept of technology, it is necessary to consider its different levels of specification that will be used during the analysis. The first level of specification of the term *technology* is called Information and Communication Technologies (ICTs). ICTs are "all kinds of electronic systems used for broadcasting, telecommunications and computer-mediated communications" (Dutton in Haddon, 2004, p. 1). ICTs are "transformative economically, socially and politically. Indeed, ICTs are everywhere, with its manifestations, including computer, multimedia, and Internet technologies as well as audiovisual technologies such as television, film and video, radio and sound recording" (MukaroBorrero, 2013, p. 1).

The second level of particularization of technology is "mobile technologies." Mobile technologies are part of the ICTs. Naismith, Lonsdale, Vavoula & Sharples (2004) define mobile technologies as portable and personal technologies (p. 2). According to Invest Northern Ireland, mobile technologies include: laptops, tablets, mobile phones, global positioning system (GPS) devices, wireless debit/credit card payment terminals, etc. (Mobile technology, n.d.). However, Nasimith *et al.* assert that mobile phones are the most common example of mobile technologies (2004, p. 2). These devices can use a variety of communication technologies such as:

- Wireless fidelity (Wi-Fi) - a type of wireless local area network technology.
- Bluetooth – a protocol that connects two mobile devices wirelessly for short distances.
- Cell Data Networking Services – a protocol that connects two devices wirelessly for long distances.

- Dial-up services - data networking services using modems and telephone lines.[10]
- Virtual private networks - secure access to private networks (Mobile technology, n.d.).

It is important to mention that including the specifications and differences of every type of communication is beyond the scope of this research.

2.3 Decolonization

Decolonization or *Decolonizing* is a concept that has been explored extensively in academia. Decolonization is a problematic concept because groups around the world were oppressed and colonized in different forms and at different times (Crawford, 2002, p. 135). For this reason, the homogenization of colonizing experiences through a single definition is not accurate. Several scholars, such as Crawford and Gray and Coates, suggest that in order to understand this concept, colonialism needs to be first defined (Gray & Coates as stated in Gray, Coates & Bird, 2008, p. 282; Crawford, 2002, p. 135). In this regard, colonialism is commonly understood in one, or both, of the following two forms: first, colonialism refers to the establishment of political, economic, social, intellectual, cultural, and even spiritual, domination of one group over another. Second, colonialism refers to the set of beliefs used to legitimize the power of one group over another, especially the belief that the customs of the colonizer are superior to those who are colonized (Gray & Coates as stated in Gray *et al.*, 2008, p. 282).

[10] If the telephone line is a fixed-line, the technology cannot be considered "mobile" because it is not portable anymore (Nasimith *et al.,* 2004).

With these references, decolonization can be understood in two forms, which reconcile several conceptualizations of different authors: firstly, decolonization is the "end of formal political, economic, and military control of a colonized territory by another power. […] A formal independence is granted to the colony and sovereignty (legal autonomy) is declared by the inhabitants of the former colony" (Crawford, 2002, p. 136); second, and more significantly for this thesis, decolonization is "a process that begins with the understanding that one is colonized (at whatever level that may be). It is creating and consciously using various strategies to liberate oneself from, or adapt to, or survive in oppressive conditions. It is the restoration of cultural practices, thinking, beliefs and values that were taken away or abandoned, but are still relevant or necessary for survival and well-being" (Gray & Coates as cited in Gray *et al.*, 2008, p. 284). Decolonization is "the intelligent, calculated and active resistance to the forces of colonialism that perpetuate the subjugation and/or exploitation of our minds, bodies and lands, and it is engaged for the ultimate purpose of overturning the colonial structure and realizing Indigenous liberation" (Wilson & Bird, 2005, p. 5). However, as previously stated, the concept of decolonization may differ between communities and groups because the processes of colonization varied from place to place and occurred at different times.

2.4 Decolonizing technology in this research

After exploring concepts of the Tipi, technology and decolonization, a question emerges: what is decolonization of technology? As stated before, technology is focused on the "way of revealing the truth" (instrumentality). Hence, when I talk about *"*decolonizing technology*"* in this research, I am referring to the conscious strategy (methodology) of liberating the means (i.e. technology, and more specifically ICTs), and using them in order to address the particular needs of Indigenous peoples. Moreover, it includes the restoration of cultural

practices, thoughts, beliefs and values within technological applications that were taken away and are necessary for survival. In the particular case of this research, the teachings of the Tipis are restored and incorporated in the design of the mobile application (e.g. tipi's construction, usage, traditional protocols).

Therefore, with all the previous considerations about technology, epistemology and decolonization, the relevance of this research resides on its contribution to Indigenous methodologies to create technological software applications capable of strengthening Indigenous values and cultures. However, an immediate controversy emerges from these previous arguments: Is it possible to decolonize with ICTs in the context of Indigenous peoples? If the idea of technology is a practical application of knowledge (commonly Western knowledge), then is it possible to conceive of the concept of decolonizing technology within Indigenous contexts*?*

In the following section, I focus on the discussions of these questions around the world and how Indigenous peoples are responding to them.

2.5 ICTs: Colonizing or Decolonizing Indigenous Peoples?

In the last twenty years, there have been several concerns about the neutrality of ICTs in different contexts, as almost all cultures around the world are connected to the Internet (Dyson, 2004, p. 58). Furthermore, ICTs have been recognized as a key dimension of globalization (MukaroBorrero, 2013, p. 1). At the same time, the expression of authentic Indigenous cultures and knowledge has been used frequently as an antagonist term in relation to technology and globalization (GarcíaCanclini, 2005/1989, p. xxviii).

In this regard, this section analyzes whether information technology is a new form of colonial power or a potentially decolonizing instrument for Indigenous cultures. This section is guided first, by a theoretical examination of the implications of technology and new conceptualizations of culture, followed by case studies of how ICTs are permeating various Indigenous communities in the Americas, Europe, Asia and Oceania. At the end of this chapter, I provide an overall conclusion of this analysis.

According to various authors, technology has been used as a form of colonization. Moahi argues that colonialism is the first stage of globalization, which started centuries ago, incited by the four major engines of society: religion, economy, empire building, and technology as a special ally (2007, p. 56). Moreover, the Frankfurt School (a neo-Marxist interdisciplinary social theory born in Germany), claims that technology legitimizes power structures of society because capitalism has based its oppression through technology and therefore, the possibility of self-determination will not be feasible (Marcuse, 1964/2013). In this sense, Herbert Marcuse (1964/2013) claims that:

> [D]omination perpetuates and extends itself not only through technology but as technology, and the latter provides the great legitimation of the expanding political power, which absorbs all spheres of culture. In this universe, technology also provides the great rationalization of the unfreedom of man and demonstrates the technical impossibility of being autonomous, of determining one's own life (p. 162).

The Frankfurt school asserts that technology is generating cultural goods as mass products, instead of creating them artisanally or individually. The implication is that technology will allow the absolute manipulation of the media for profit and it will consider the receivers as submissive targets (García Canclini, 2005/1989, p. 186).

All of the previous approaches are also framed by Neil Postman who argues that the nature of *community* will be altered through technology, because it has the power to modify how people interact between each other and change their own structures of interests (i.e. things that people think about their own societies, including for example, culture). In other words, technology will change the institutions and the social organizations of these communities (1992, p. 32-34). On this subject, Mark Oppenneer notes that a "wide range of technologies and services implies the involvement of multiple stakeholders and various opportunities for systemic abuse" (as cited in MukaroBorrero, 2013, p. 2). In the specific case of ICTs, the main controversy lies in the Internet, which is a key element of information and communication (Dyson, 2004, p. 58). The connection to the Internet implies a connection between the local community and the global society (Dyson, Hendriks & Grant, 2007, Preface). On this matter, Belton agrees that this interconnectedness of the world is part of the globalization force and therefore, the boundaries between local matters and global affairs gradually become blurred (2010, p. 194-195). Martinand asserts that technology is attached to the social, cultural, historical, and political environment that produced it (as cited in Dyson, 2004, p. 59), meaning that ICTs, through the Internet, are likely to change the society that uses them. This is a form of colonization that was created based upon Western values. Indeed, Ray asserts that the United Nations programs of ICTs have imposed "Western processes or structures upon Indigenous recipients," constituting a form of "Computer-mediated colonialism" (as cited in MukaroBorrero, 2013, p. 2). According to the previous authors, the Internet (as a key element of ICTs) has become an instrument to impose globalization on Indigenous cultures.

In other cases, the outcomes of ICTs are considered threats to Indigenous revitalization; this includes the creation of cyberspace,[11] which, according to Iseke-Barnes and Danard, reflects a colonizing mentality because it strives for dominance over humanity through the creation of artificial connections that isolate human beings from the universe (as cited in Dyson *et al.*, 2007, p. 34). In addition, Craig Howe asserts that cyberspace is not a place for Indigenous cultures until its universalistic and individualistic foundation is restructured to include spatial, social, spiritual, and empiric dimensions through the understandings and the needs of the communities (1998, p. 27). Salazar asserts that cyberspace is mainly written about, developed to use, and presented in English and it is not adapted to the language needs of the communities (2002, p. 75). This aspect – language imposition and cultural control - is taken as a fundamental criticism in the design of the mobile application of my research, and is addressed through the incorporation of the traditional teachings and knowledge of Tipis (more details in Chapter 4 and 5).

Despite these previous assumptions of the conceptualization of technology, there are several arguments about how these "alterations of culture" are positively changing the lives of Indigenous peoples around the world and are providing to Indigenous peoples the power to decide their future.

First, at the time when the Frankfurt school was established and developed, ICTs were not yet seen as an avenue to revolutionize the social dynamics of political discourse; this is an excellent example of the democratic potential of social media (Balkin, 2004; Monasterios, 2001, p. 6). In other words, today ICTs are helping Indigenous peoples to articulate claims in ways not seen before: to re-deconstruct their identities and aspirations, to advance their

[11] *Cyberspace* is sometimes also called digital spaces. Cyberspace is "an infinite artificial world where humans navigate in information-based space" (as stated by Gibson in Benedikt, 1991).

political goals, to seek broader support and to organize themselves strategically (Soriano, 2011, p. 33).

In contrast to Postman, García Canclini asserts that the important relationship between technology and culture relies on how technological development shapes society and matches social movements. This is because, nowadays, technology and its expressions have different cultural capitals and dispositions for appropriating them. Those meanings, he says, are created according to the ways that technologies are socialized and institutionalized (2005/1989, p. 227-228). García Canclini argues that the meaning of technology will depend on the aspirations and goals of the society and institutions which use it.

Similarly, Dyson asserts that the only way that ICTs could have colonizing power is if they are institutionalized to that end. She claims that technological pessimists are trying to protect power hierarchies and keep Indigenous peoples isolated from technology (2004, p. 69). Salazar agrees, claiming that ICTs are not positive or negative by themselves, but they take the mode and direction of the societies in which they are introduced. Therefore, ICTs may have the potential to empower Indigenous peoples if they take the mode and direction of the Indigenous societies (2002, p. 62)

In relation to this statement and the perspective of Martinand about the “attachment” between technology and the environment that produced it, Dyson argues that technology is effectively determined partly by the technological devices, but also by the cultural/pragmatic needs of the society in which technology is embedded. She calls this phenomenon as

domestication[12] (2015, p. 28). In this circumstance, technology is not only attached to the culture which produced it, but also to the culture that uses it.

On this subject, Oppenneer recognizes Ray's argument about computer-mediated colonialism, but he makes an important consideration to change its colonialist effect. He affirms that:

> [T]he critics are right: misguided 'ICT for Development' implementation that does not take into consideration a wide range of cultural factors and explicitly or implicitly imposes Western processes or structures upon Indigenous recipients does constitute a new form of computer-mediated colonialism. And yes, the proponents of 'ICT for Development' are right: ICT, when implemented thoughtfully and respectfully – keeping the needs of the recipients at the fore– can be a powerful agent of change in the fight to reduce poverty and improve the lives of marginalized peoples (as cited in MukaroBorrero, 2013, p. 2).

In the same respect, Kenneth and Hakansson recognize that "Indigenous peoples consistently emphasized that the information society must serve their needs and ensure their ability to shape their future without risking the loss of their cultural identity" (as cited in MukaroBorrero, 2013, p. 3).

Additionally, Richard Heek proposes innovative categories to describe how technology initiatives are designed in the context of marginalized Indigenous communities (Heek, 2008,

[12] Domestication, according to Dyson, "describes the particular ways in which a cultural group makes a technology its own, adapting the technology to its needs and preferences but also adapting its behaviour to the technology" (Dyson *et al.*, 2015, p.28).

p. 29-31), which MukaroBorrero adapts to assess Indigenous programs and initiatives. These Indigenous categories are:

> Pro-Indigenous innovations derive from outside of the targeted communities, but are undertaken on behalf of Indigenous Peoples; Para-Indigenous initiatives are undertaken alongside Indigenous Peoples' communities; and Per-Indigenous efforts mark innovations around processes, new products and business models that are devised by Indigenous peoples with reference to their own self-defined needs and wants (Heek, 2008, p. 29-30; MukaroBorrero, 2013, p. 4).

Indeed, most of the computer-mediated colonialism initiatives reside within the first category of Pro-Indigenous "innovations." The mobile application of this research (as stated in the thesis argument in Chapter 1) is a proposal by/with/for Indigenous peoples, which aims to locate itself within the Per-Indigenous efforts.

Certainly, García Canclini asserts that Indigenous cultures are expanding rapidly to become cosmopolitan when they discover that the pure conservation of their knowledge might not be the only viable source to re-elaborate their condition. Therefore, Indigenous cultures are testing new non-conventional routes of empowerment, such as the Internet and ICTs (1997, p. 114). For Marcelo Bonilla, these aspects are examples of new patterns because ICTs are appropriated and used by non-conventional local cultural rationalities that most of the time are opposed to the universal contemporaneous scientific and technological rationalities (as cited in Salazar, 2002, p. 74). Creating this new cultural representation positions ICTs in the context of Indigenous peoples, outside of the positivist Western vision of society and science. Indigenous peoples are taking some aspects of the Western society, such as ICTs, adapting them and using them to face the problems that Western society brought into their societies. This concept is what Dyson previously framed as "domestication."

Indeed, Dyson claims that ICTs are allowing Indigenous peoples to "counterbalance the tide of incoming Western media and combine their traditions with the mainstream if they wish, bringing them into the global conversation" (Dyson *et al.*, 2015, p. 29). In this regard, GundermannKröll and Gonzalez Cortez (2008) analyze the phenomena of *disruralisation* (emigration to the cities) and *translocalization* (belonging to two different localities: origin and residence), which are affecting almost all Aboriginal communities around the world. According to these authors, Indigenous peoples create an important space in which to utilize ICTs as a mechanism to maintain and sustain their social fabric.

Indigenous people around the world are exploring the opportunities that ICTs bring to their cultures and societies. They have already started using ICTs to revitalize their cultures, to attain political representation and to reduce power gaps (Dyson *et al.*, 2007). As, Molyneaux *et al.* assert ICTs, through social networking sites, are not just supporting Indigenous peoples, but also reconstructing their identities. ICTs allow the circulation of cultural resources between and among groups. This contributes to the creation of community resilience (2014, p. 284, 285). In the same vein, Becker and Delgado assert that the Internet is giving the opportunity to Indigenous peoples to formulate questions about their personal and collective identities through storytelling (as cited in Monasterios, 2003, p. 3)

According to Lanzelius, Indigenous peoples are presently seeking political power and recognition of their human rights based on their cultural differences, and to this end, ICTs are giving them the opportunity for real time dialogue (2006, p. 17). Aboriginal people, she says, are becoming more cyber active, using and assimilating ICTs "to" and "for" their objectives, as well as they are integrated into local common practices and beliefs (Lanzelius, 2006, p. 2-5). As some scholars have commented, cyberspace offers possibilities to create and integrate spaces for different expressions, which embrace interculturality and diversity (Monasterios, 2003, p. 6). This integration is possible because the communication style of

Indigenous peoples is oral and ICTs are able to support Indigenous orality (Mundy & Compton, 1991; Petersen, 2013).

Brady, Dyson & Asela claim that ICTs can support orality because different technologies (e.g. mobile phones, MP3, websites) are based on oral communications (e.g. video, sounds, voice, music), which are able to create communities of interest, connect people who are separated and record different cultural expressions (2008, p. 386-388). In contrast with Marcuse's vision, these oral expressions are not made as mass products but rather as culture-specific artisanal manifestations because they reflect the daily lives of Indigenous peoples. In contrast with Craig Howe's point of view, these new uses of technology that revitalize orality offer possibilities to transform the cyberspace into a system that includes spatial, social, spiritual, and empiric dimensions of Indigenous peoples. Additionally, Belton claims that cyberspace gives opportunities for Indigenous peoples to make connections and achieve political goals because it is less regulated than other environments (e. g. public spaces, mass media) and is not bound to a physical territory (2010, p. 197).

In this regard, international organizations also recognize the importance of ICTs to revitalize Indigenous orality. Nfah-Abbenty states that in the last two decades the United Nations Educational, Scientific, and Cultural Organization (UNESCO) has aimed to raise awareness about intangible cultural heritage (ICH) that is manifested through oral traditions and expressions, including language as a vehicle for cultural expression. ICH emphasizes Indigenous knowledge and orality, oral literature in social sciences and Indigenous knowledge in the age of globalization and technology (2012, p. 1-2).

In summary, ICTs are instruments for indigeneity that can help to decolonize Aboriginal cultures and societies as long as these technologies are articulated, designed and institutionalized according to the Indigenous peoples self-described needs and aspirations.

Aboriginal peoples have to decide the purposes of ICTs. In addition, these technological solutions should include forms of orality in order to reflect Indigenous emotional, intellectual and spiritual dimensions.

Before I explain in detail the similarities between these authors and the mobile application of this research, I consider it to be essential to explore specific examples of these approaches. This exploration will then provide the reader with a better understanding of the possibilities of technology and Indigeneity.

2.6 Examples of Indigenous Revitalization around the world through ICTs

In the previous sections of this chapter I mainly focused on the discussion between Indigeneity and technology. However, to simplify the analysis I did not provide specific examples. Therefore, this last part will focus on several cases in different countries in America, Europe, Asia and Oceania in which Aboriginal cultures are using ICTs to empower their cultures and finally, I will explain some common problems that are being faced by these groups.

In order to make connections and organize the discussion, the examples will be categorized based on their instrumentality, i.e., their main purpose(s) for which they were developed or implemented. These categories are: revitalizing Indigenous culture and knowledge(s), seeking political representation, communicating people with their communities, improving their economy through the promotion of their local products/services, and providing access to public services.

2.6.1 Indigenous Culture and Knowledge

ICTs have the potential to maintain the spatial, social, spiritual, and cultural dimensions of Aboriginal Peoples. The preservation of knowledge and wisdom of different ethnicities using orality gives ICTs the opportunity to preserve those dimensions.

Among other fascinating experiences of revitalization of Indigenous cultures and knowledge through the use of ICTs, some specific examples include:

1) The geographic information systems (GIS) that Native communities in the US are using to map and track problems and resources in their communities in order to make decisions about their future (Palmer, 2009);

2) The Inuit initiative of ISUMA TV that uses Internet to preserve, promote and revitalize Inuktitut language and culture (Alexander, Adamson, Daborn, Houston & Tootoo, 2009; Petersen, 2013);

3) The *Nanisiniq Inuit Qaujimajatuqangit Adventure Website (*literally translated as: "that which has long been known by Inuit"), which is being used to reconnect youth with their traditional Elders and make transnational connections with people around the world (Alexander *et al.*, 2009, 240);

4) The Smithsonian's National Museum of the American Indian Cultural Resources Center, which uses a unique software that embraces Indigenous knowledge (Hunter, Koopman & Sledge, J., 2003);

5) The Sioux Lookout region of Northwestern Ontario, where Ojibway, Oji-Cree and Cree communities are using the Internet, creative hardware (e.g. a syllabic keyboard with a layout

in Cree and Oji-Cree), and social networking sites to generate social capital and then community resilience (Molyneaux *et al.*, 2014);

6) The Mapuche's websites such as ADMALEN-KAXAWAIÑ, FOLIL Foundation, XEG XEG Centre and NEWEN Enterprise, which promote Mapuche culture through the creation of authentic content directly from the Mapuche people (Salazar, 2002, p. 72-73);

7) The mobile Indigenous journalists (mojos) in the Northern Territory of Australia, who are trained to record, edit and publish news stories from their iPhones to the Internet (Burum, 2015);

8) The InSight Sápmi, a mobile application that recreates a Sami linguistic landscape in Sweden (Cocq, 2015).

All of these examples reflect the trend of Indigenous peoples to maintain their heritage and knowledge of their communities through ICTs. Additionally, a commonality among these cultural approaches is that the larger projects, and the majority of them, are located in Indigenous communities that are part of advanced (or developed) countries such as Australia, Canada and the United States. The projects of Mapuches in South America are hosted on servers located in advanced countries, and are subsidized by private foundations. Perhaps, the first reason for this phenomenon is related to the infrastructure, as better technical conditions exist in developed contexts (e.g. accessibility to bandwidth, access to larger servers and qualified personnel to manage the technical infrastructure). Second, and more importantly the extreme socioeconomic situation of Indigenous peoples in developing countries may pressure Aboriginal groups to use ICTs for other objectives such as seeking political representation, maintaining contact with their communities and/or improving their

economic situations. Some examples of these approaches will be explored in the following three sections.

2.6.2 Political Representation

As previously discussed, cyberspace also allows Indigenous organizations to demand Indigenous self-determination as a form of decolonization. This political claim and representation is present, especially in developing countries where Indigenous peoples are struggling towards increasing their social and political representation at the national level. For example:

1) In Asia, the approach of *Tebtebba* or Indigenous Peoples' International Centre for Policy research and education (the head office is located in Manila, the Philippines) uses social media to embrace Indigenous political activism in different regions such as the Philippines and Latin America (Soriano, 2011);

2) In Latin America, the well-known Zapatista movement in Mexico has disseminated their political claims and agendas through the Internet (Delgado & Becker, 1998; Salazar, 2007, p. 22);

3) The Guatemalan Mayan Organization works collectively to create the consciousness about Mayan political rights and to support Mayan politicians to promote laws to benefit Indigenous communities through the Internet (Monasterios, 2003, p. 5);

4) The Indigenous Salvadorian National Association educates Indigenous users about human and political rights (Del Alamo, 2003);

5) The Confederation of Indigenous Nations of Ecuador was also able to coordinate and organize mass mobilizations to seek Indigenous representation through the Internet (Salazar, 2007, p. 22-23);

6) At the international level, INKARRI Net is an initiative promoted by the United Nations to create a global Indigenous People Telamatic Network for promoting debates and communication among the members of the International Network of Indigenous Organizations (Red Inkarri, 2004);

7) The International Indigenous ICT Task Force (IITF) is a global not-for-profit group of Indigenous individuals who have an interest in decreasing the disadvantages between Indigenous peoples and the rest of the world (as stated by MukaroBarrero, 2013, p. 5).

Across all of these political approaches, there are several commonalities that help Indigenous peoples to reinforce their presence in their political environments, such as the creation of pan-Indian support networks at the national and international level, as well as the ability of self-representation. These common aspects resonate with Salazar's concept of cultural construction of Indigenous peoples in Latin America (2002, p. 65-66) and reinforces the vision of García Canclini in regard to the expressions of cultural capitals and dispositions that construct meaning.

2.6.3 Communicating: maintain contact with communities

The emigration of Indigenous population to the cities is a phenomenon that is happening globally. This is causing different consequences, but one of the most important common effects is *translocalization* (GundermannKröll and Gonzalez Cortez, 2008). This concept means that Indigenous peoples are identifying themselves with their communities of origin, but at the same time, they are creating new forms of identity (GundermannKröll and

GonzalezCortez, 2008). Although the implications of this phenomenon are outside the scope of this research, *translocalization* necessitates ICTs, which connect the people who are outside of their communities to maintain their identities and remain in contact with their families.

Some examples of ICTs that help Aboriginal peoples communicate with their communities are the following:

1) The Northern Territory communities in Australia, where young Aboriginals are using mobile phones to access the Internet and communicate with their families when they are out of their communities (Taylor, 2012);

2) Brady *et al.* (2008) also examined how mobile phones are fitting with Indigenous cultures and orality in the remote island of Torres Strait in Australia where Indigenous peoples use phone calls and text messages in the local language *Kala Kawa Ya* to communicate with their families;

3) The Indigenous Internet users of the Sioux Lookout region of Northwest Ontario who are using social networking sites to share their experiences with their families (Molyneaux *et al.*, 2014);

4) The Indigenous villagers of Papua New Guinea who are using mobile technologies to communicate privately over wide distances (Watson & Duffield, 2015);

5) Keewaytinook Mobile and Rhizomatica Mobile, which are community built and owned mobile phone carriers located in Northern Ontario (Canada) and the mountains of Oaxaca (Mexico), respectively (Beaton, Burnard, Linden & O'Donnell, 2015; Rhizomatica, December 23, 2015).

A common characteristic of all experiences presented above is that Indigenous peoples are using ICTs to maintain relationships with their relatives and friends who are far from them. With the proliferation of mobile technologies, they are able to maintain their identity and traditional knowledge through the usage of their Indigenous languages. This phenomenon is possible because nowadays the technology is cheaper and the infrastructure of cellular phones has improved since 2005 (Brady *et al.*, 2008).

2.6.4 Improving Indigenous economies

The new economic challenges of the world are impacting almost all societies around the globe. ICTs are giving Indigenous peoples the opportunity to market their local products and services in the global society. Some examples of this approach are:

1) *Tosepan-Titataniske* in Puebla, Mexico which is a union of co-ops formed by more than 10,000 Indigenous peoples, which promotes local products to national and international markets through social media (Monasterios, 2001; UCT, 2015);

2) The Otavalo Initiative in Ecuador, which is selling local products through a website (Del Alamo, 2003, p. 18);

3) The innovative Tamaani Satellite Internet in Northern Quebec, which is a solution for the financial problem of Internet in Nunavut, is led by Inuit people (McMahon & Mangiok, 2003);

4) The Guatemalan initiative of “Tesoros Mayas,” which is seeking new markets online for artisanal products of Mayan women (Del Alamo, 2003, p. 19).

The previous examples describe initiatives, which clearly illustrate how ICTs are progressively helping Indigenous peoples to improve their economic situation. Moreover,

the commonality among the previous examples is that Indigenous ownership, control, access and possession principles are present as key aspects of their success (Kakeskapan, O'Donnell, Beaton, Walmark and Gibson, 2014).

2.6.5 Providing access to public services

Access to public services such as education and health, plays a major role in human rights. Investment in education for, and training of, Aboriginal peoples in the use of new ICTs motivates and encourages Indigenous peoples to create and own technological innovations. Telemedicine can improve the health accessibility of remote and/or isolated communities. Some of these approaches are:

1) The Guatemalan Association of Nutzij, which created a Mayan Women Communicator's Telecentre to educate and train Indigenous women to use computers and the Internet (Del Alamo, 2003, p. 11);

2) The Amazon Telehealth Program, which provides medical care/advice to remote Indigenous communities in Brazil (Del Alamo, 2003, p. 13);

3) The use of mobile technologies in Latin America for the birth registration of Indigenous children by text (Kim, Alfaro & Miller, 2015);

4) The use of mobile health applications among American Native and Alaska Native teens and young adults to promote sexual health and wellbeing (Rushing *et al.*, 2015).

The common characteristic of these examples highlight that most of the initiatives were conceived by organizations that are external to Indigenous communities. They reside in the category of *Pro-Indigenous* innovations because they were designed on behalf of Indigenous Peoples. This may be a weakness for this type of ICTs, because the processes

of cultural assimilation can easily start during the stages of design and implementation (Brady *et al.*, 2008). However, the integration of Indigenous peoples and knowledge during the process of administration, maintenance and evaluation can shift the model towards a *Para-Indigenous* approach, or even better, to a *Per-Indigenous* paradigm (MukaroBorrero, 2013, p. 4-6) because Indigenous peoples play the main role in the design of these technologies.

2.6.6 Digital Divide and Mobile technologies

In the examples mentioned above regarding Indigeneity and technology, an important factor is present in almost all cases: the accessibility of Indigenous peoples to ICT infrastructure is often precarious and inconsistent. This phenomenon is called “the digital divide” (Alexander *et al.*, 2009, p. 241; Becker & Delgado, 1998, p. 2; Belton, 2010; Fisser & Jeffrey, 2013; Monasterios, 2003; Petersen, 2013; Salazar, 2002, p. 75; Taylor, 2012; McMahon *et al.*, 2011). Before 2010, economic poverty of most Indigenous communities reduced their access to expensive digital devices and to Internet connections (MukaroBorrero, 2013, p. 2).

Since 2010, more funds are being invested to improve connectivity and develop better technological policies. Some of the most relevant examples are:

1) Internet.org by Facebook in Latin America and South Asia, which is trying to improve Internet connectivity in those regions (Facebook, 2015).

2) NorthwesTel Company and its modernization plan for telecommunication infrastructure in Northwest Territories and Nunavut in Canada (Fisser & Jeffrey, 2013).

3) The First Mile policy approach in Canada, which consists of re-framing broadband development in First Nations and Inuit Communities through principles of Ownership, Control, Access and Possession of ICT infrastructure (Kakeskapan *et al.*, 2014).

Furthermore, the continuous decrease in hardware prices, the growth of broadband networks, the explosion of social media and, most importantly, the expansion of mobile technologies, have made ICTs more accessible to many Indigenous peoples (Dyson *et al.*, 2015, p. 18).

While fixed-line and satellite technologies fail for the majority of Indigenous peoples (due to their high costs and terrain complications), mobile technologies are "appropriate to their geographic locations, their socioeconomic circumstances and their cultures**"** (Dyson *et al.*, 2015, p. 18)**.** As Spence and Smith assert, ICTs serve as "a catalyst, knowledge provider and propagator of innovations" in relation with mobile phone technology because they "enable or facilitate a range of economic and social innovations among impoverished populations" (as cited in MukaroBorrero, 2013, p. 4). Indeed, Brady & Dyson argue that Indigenous peoples are choosing mobile technology over other types of technologies due to socioeconomic constraints (low incomes), cultural factors (orality), the portability of the devices (promoting mobility, privacy and possible circumvention of sharing), billing structures (pre-paid, debt-free), cost of hardware (low initial outlay, replaceable), and the proximity to technicians (2015, p. 67). In fact, Dyson, Grant & Hendriks assure that mobile technologies "empower [Indigenous] people in both rural and urban communities to improve their economic well-being and employment opportunities. Mobiles empower!" (Dyson *et al.*, 2015, p. 379). These authors claim that mobile technology, when used for/with/by Indigenous peoples, is proving that self-determination becomes achievable through the revitalization of identity using technology (Dyson *et al.*, 2015, p. 379-380).

2.7 Conclusion of Indigeneity and technology

A rich discussion is ongoing regarding the use of ICTs by Indigenous peoples. This review explored selected works on the positive and negative effects. In this chapter, I argued that Aboriginal communities are already taking advantage of several ICTs and are demonstrating how technology can be a medium to seek political representation, a form of cultural and social organization, and a way to revitalize their culture and knowledge(s). The challenging conditions that Indigenous peoples face are giving them the opportunity to use ICTs as an important instrument to redefine and to empower themselves. However, it is clear that in doing so, Indigenous peoples have been constructing new cultural representations of themselves to realize their political, economic and social aspirations. Therefore, I believe two possible interpretations of this statement are possible.

First, this new form of cultural representation might be the “adaptation” of Indigenous cultures to the global society and economy. Consequently, a contradictory discourse and action are happening in the political sphere because this means that, while Indigenous peoples are agitating for self-determination and political representation, they are also creating a new cultural identity for themselves that could possibly alter their local interests. This reinforces the vision of Marcuse who, as previously noted, claims the technical impossibility of being autonomous, of determining one’s own life.

On the other hand, these new cultural representations could signal a new form of decolonization because they allow Indigenous peoples to generate new solutions to face their struggles and needs with technology created by, with and for them (this is to say, a Per-Indigenous peoples’ approach). As claimed by Dyson *et al.*, Indigenous peoples are being empowered through mobile technologies and they are using them actively to revitalize their cultures.

Mobile technologies are gradually helping Indigenous communities to be situated at the same level of opportunity with other groups at the national and international level, regardless of their economic, social or geographical situation. A deep exploration and evaluation of the potential opportunities of Indigenous peoples and ICTs in different environments (e.g. universities, cities, schools, workplaces), is crucial because their conception, design, ownership, control, access and possession are essential for real and effective decolonization processes within contemporary complex societies.

3. Context

Throughout my personal journey, the design and implementation of the mobile application was created and developed within the context of the Aboriginal[13] community of York University in Toronto, Canada. This Canadian postsecondary environment, as well as the traditional territories on which York was established, involve several variables and considerations that are necessary to explain before I can describe the methodological process.

In this chapter, firstly I explain my personal introduction to the traditional space and community where the mobile app was developed. Later, I explore the historical context of the traditional territories where this space was established. Then, I describe the current context of Aboriginal Peoples in Canada and Ontario, including an explanation of their current population and structure. Next, I explain the context of Indigenous peoples and their current struggles to access postsecondary education, including some statistics about their presence within institutions. Then, I describe the specific case of the Center for Aboriginal Students Services (CASS) at York University. And finally, I incorporate some statistics of access to technology and internet by Indigenous Peoples in Canada.

It is important to mention that in order to recognize the historical context of the topic, in some parts of this chapter, I will use the term “Indian,” as it continues to be used by various Band Councils and by Canadian governmental institutions.

[13] As stated in the introduction, the terms “Aboriginal” and “Indigenous” have different meanings and political implications. However, they are used interchangeably throughout this research.

3.1 Finding my community and my introduction to the Tipi

> "Greetings Alejandro,
>
> The School of Social Work hired an Aboriginal faculty member, Dr. Ruth Koleszar-Green (Mohawk Nation, Turtle Clan). I have included her on this e-mail.
>
> Much success within your MA program."

This is the content of the last email I received from a faculty member of the Social Work Department at York University. It was the end of September 2014 and in those days, I was having a hard time because I was missing my family, culture and mother tongue. I contacted the Social Work Department because I was trying to find a community with which to settle down in the university. Indeed, I did not know that this email was going to change the entire direction and impact of my research.

I immediately contacted Dr. Koleszar-Green to book an appointment. In our first meeting, she understood my situation and we openly shared our points of view about life and the cosmos. Indeed, in that conversation, Dr. Koleszar-Green explained to me that my struggle was common to many other Aboriginal students when they start their postsecondary education and are new to Toronto. To a certain degree, I was living my research "problem" without knowing it.

At the end of that day, I was confident that I was getting nearer to finding my Indigenous community in Canada. Then, after a couple of weeks, on October 23rd, 2014 Ruth introduced me to Elder Laureen Waters Gaudio, who likes to be called simply "Blu," at the Center for Aboriginal Student Services (CASS) of York University. Blu, who is a Métis Elder with Mi'kmaq heritage, belongs to the Wolf Clan and her spirit name is Istchii Nikamoon, which means Earth Song. That same day, Blu introduced me to the community through a sharing circle and this moment marked my integration into the CASS community. Through this circle, I also met the

coordinator of CASS, Randy Pitawanakwat, who is an Anishinabe man from the Wikwemikong Reserve on Manitoulin Island. Randy and I talked about culture and traditional teachings. At the end of this exchange, Randy introduced me with the spirit that has since inspired me and helped me throughout this journey:

> "Alejandro, this coming Sunday, the CASS community is going to host a ceremony to raise our Tipi. You are welcome to join."

3.2 Traditional Territories of York University

York University has two main campuses: Keele Campus and Glendon Campus. These facilities are located in the area of Toronto, in the province of Ontario, Canada.

Toronto is a space that is currently recognized as the traditional territory of the Huron-Wendat Nation, the Mississaugas of New Credit First Nation and the Haudenosaunee Confederacy, which includes the Mohawk, Oneida, Onandaga, Cayuga, Seneca, and Tuscarora Nations (Six Nations Council [SNC], 2013; CASS, 2015; Mississaugas of the New Credit First Nation [MNCFN], 2015). However, this area has historically been a meeting and gathering space for other Indigenous peoples and therefore, it has been also the responsibility of the Tuscarora Nation and the Métis Nation of Ontario (SNC, 2013; CASS, 2015).

The Mississaugas of the New Credit First Nation (MNCFN) are part of the Ojibway (Anishinabe) Nation, one of the largest Aboriginal Nations in North America.

In the mid-eighteenth century, the Ojibway occupied almost all of Southern Ontario (Rogers & Smith, 1994, p. 92; MNCFN, 2015). The New Credit peoples' ancestors used and occupied all the territories from Long Point on Lake Erie to the headwaters of the Thames, Grand, Humber and Rouge Rivers (Smith, 1987, p. 21; MNCFN, 2015).

Around the territory of the Mississaugas, there were other Indigenous groups, including the Hurons (later called the Huron-Wendat Nation) and the Haudenosaunee Confederacy (Mohaws, Onondagas, Senecas, Cayugas, Oneidas and Tuscaroras). As stated by MNCFN (2015):

> After routing the Hurons [beginning of the seventh century], the Five Nations [Haudenosaunee Confederacy] attacked the Ojibway who had sheltered many refugee Hurons. The Ojibway defeated the invaders in several battles on Lake Superior, then on Lake Huron. By 1700, they had conquered most of Southern Ontario. With the Ojibway defeat of the Iroquois [the Haudenosaunee Confederacy], and the dispersal of the Hurons, the entire area was now [sic] inhabited by Ojibway tribes. Some of the Ojibway [people], who went south, came from the Mississagi River area on the north shore of North Channel, which is located at the head of Lake Huron. Consequently, the French and later on others termed [sic] these Indians, "Mississauga Indians." Although a majority of the Ojibways remained in the Lake Huron and Georgian Bay areas, the band from the Mississagi River began to drift towards the Southeast section of Upper Canada [Ontario].

Indeed, the term "Mississauga" means into "many river mouths." The Mississaugas believe they had obtained this word from the mouths of the Trent, Moira, Shannon, Napanee, Kingston, and Gananoque Rivers (MNCFN, 2015).

On the other hand, the term “Credit” refers to the “Credit River” in Ontario. The Credit River, which is within the traditional territory of the Mississaugas, is where they met annually with European traders. The origins of the river name come from the time when French fur traders supplied goods to the Indigenous people on “credit” against furs, which would be provided the following year. Therefore, Mississaugas became also known as the Credit River “Indians” (Smith, 1987, p. 21).

Finally, the term “New” is in reference to the relocation of the Mississaugas in May of 1847 when approximately 266 members of the “Mississaugas of the Credit River” moved from their village on the Credit River to Tuscarora Township in the Grand River Valley (MNCFN, 2015; Rogers & Smith, 1994, p. 183).

The importance of recognizing the traditional territories, on which York University is located, relies, according to Tuck & Yang, on the principle that any decolonization process should include the repatriation of land and simultaneously, it should recognize how land and relations to land have been differently understood and enacted (2012, p. 7).

Additionally, the recognition of the Aboriginal history of Toronto allows me to open the possibility that the mobile application can also be a space of gathering and meeting for different Indigenous groups as Toronto has been for different Nations.

3.3 Aboriginal Peoples in Canada and Ontario

This section provides the reader with an understanding of the current situation of Aboriginal people (i.e. First Nations, Métis and Inuit) in Canada and Ontario in order to frame the possible boundaries and scopes of the mobile application.

In 2011, the National Household Survey (NHS) indicated that 1,400,685 people identified themselves as Aboriginal Canadians, representing 4.3% of the Canadian population. From the total of 1,400,685 Aboriginal individuals, 851,560 people identified as a First Nations person (60.8% of the total), 451,795 people identified as Métis (32.3% of the total) and 59,445 identified as Inuit (4.2% of the total). An additional 26,475, or 1.9%, reported other Aboriginal identities[14] and 11,415 or 0.8%, reported more than one Aboriginal identity (STATCAN, 2016, NHS).

In the case of the 851,560 First Nations peoples, 637,660 persons have Indian status, which represents 74.9% of the total. Indian status refers to a specific legal identity. Status Indians are registered under the Indian Act 1951 (the most recent amendment was in 1985).

There is a long history of treaties between Aboriginal Peoples and the Canadian Government, dating back to the period of the European colonization. Some First Nation peoples are also called Treaty Indians but not all status Indians are Treaty Indians. On the other hand, there are many people who claim to be First Nations but are not recognized as such. These people are often called 'non-status Indians.'

[14] This includes people who reported having Registered Indian status and/or being members of an Indian band or First Nation without reporting an Aboriginal identity.

Of these “Indian Status” individuals, 49.3% live on reserves. This means that over 50% of First Nations (Status and Non-Status) peoples are not in their community of origin (STATCAN, 2016, NHS).

The largest numbers of Aboriginal people live in Ontario and in the western provinces (Manitoba, Saskatchewan, Alberta, and British Columbia) – (Statistics Canada [STATCAN], 2016).

In 2011, Aboriginal children aged 14 and under made up 28.0% of the total Aboriginal population, Aboriginal youth aged 15 to 24 represented 18.2% of the total and about 6% of were aged 65 and over.

For the mobile application, I focused on the needs of Aboriginal youth and young adults (ages 15 to 34), which represent over 31% of the Aboriginal population in Canada (Table 1 / Figure 3).

Table 1. Aboriginal Population in Canada by Age (2011)

Age	Males	% Males	Females	% Females	Total
0 - 4	68925	4.92%	67175	4.80%	136105
5 - 9	64310	4.59%	61525	4.39%	125835
10 - 14	67520	4.82%	62650	4.47%	130165
15 - 19	71835	5.13%	67225	4.80%	139065
20 - 24	57520	4.11%	57935	4.14%	115455
25 - 34	87650	6.26%	99700	7.12%	187350
35 - 44	83645	5.97%	96150	6.86%	179795
45 - 54	87085	6.22%	98185	7.01%	185275
55 - 64	56185	4.01%	62775	4.48%	118960
65 - 74	27320	1.95%	31000	2.21%	58315
75 - over	10200	0.73%	14170	1.01%	24365
Total	682195	48.70%	718490	51.30%	1400685

Note: Data from National Household Survey (2011), STATCAN

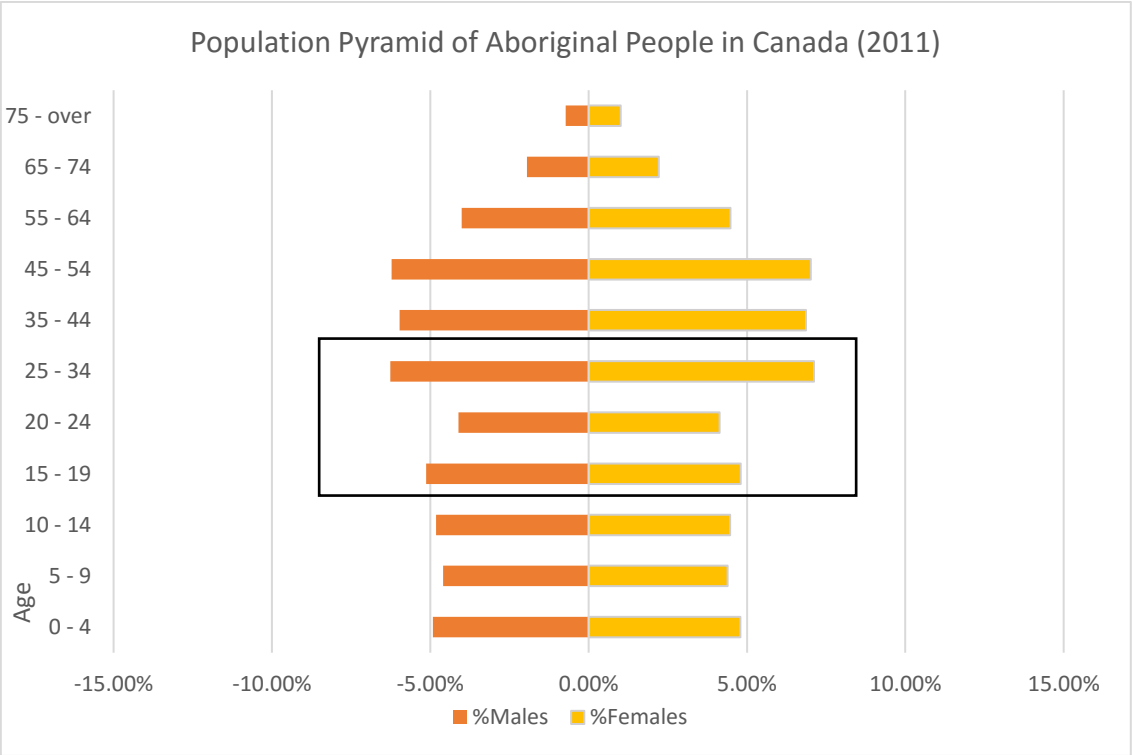

Figure 3. Population Pyramid of Aboriginal Peoples in Canada.
Data based on information in Table 1. Source: STATCAN (2016), NHS 2011
Note: Data for Canada National Household Survey (2011), STATCAN

The term *Urban Aboriginal people* refers primarily to Aboriginal individuals (First Nations Status and non-Status, Métis and Inuit) currently residing in urban areas. According to 2011 Census data, off-reserve Aboriginal people constitute the fastest growing segment of Canadian society. The cities with the largest Aboriginal populations are Winnipeg (78,420), Edmonton (61,765), Vancouver (52,375), Toronto (36,995), Calgary (33,370), Ottawa-Gatineau (30,570), Montreal (26,280), Saskatoon (23,895), and Regina (19,785) (Aboriginal Affairs and Northern Development Canada [AANDC], 2015).

By September 2015, the Aboriginal Affairs and Northern Development Canada (AANDC) recognized 636 Band Councils/First Nations, of which 139 were located in Ontario (21.9%

of the total) (2015, calculated from First Nation Profiles). Moreover, according to the NHS, there are over 60 Aboriginal languages.

In the case of Métis, one-quarter lived in four western census metropolitan areas. Winnipeg had the highest number (46,325), followed by Edmonton with 31,780, Vancouver with 18,485, Calgary with 17,040 and Saskatoon with 11,520. In 2011, 9,980 Metis lived in Toronto (STATCAN, 2016).

In the same year, 309,845 Aboriginal individuals (First Nations Status and non-Status, Métis and Inuit) lived in Ontario, representing 22% of the Aboriginal identity population in Canada (the highest of all provinces and territories). These individuals represent 2.4% of the total population of Ontario. Significantly, one in ten Aboriginal people in Ontario resided in Toronto (Kelly-Scott, 2016, p. 3).

In the case of population structure in Ontario, Aboriginal children aged 14-and-under made up 24.6% of the total Aboriginal population, Aboriginal youth aged 15-to-24 represented 13.3% of the total and about 6.7% of the total population were seniors aged 65-and-over. Aboriginal youth and young adults (ages 15 to 34) who are the potential mobile application users, represent 30.3% of the overall Aboriginal population in the province (close to the 31% proportion of the national level).

From the total Aboriginal individuals, Ontario was home to 209,510 First Nations people, 86,020 Métis, and 3,360 Inuit, with the rest reporting other Aboriginal identities[15] (8,050) or more than one Aboriginal identity (2,910). Of those who identified as First Nations people in

[15] This includes people who reported having Registered Indian status and/or being members of an Indian band or First Nation without reporting an Aboriginal identity.

2011, under two-thirds (64% or 133,835) reported being a Status Indian. In the case of First Nations people, just over one-quarter (27% or 55,885) lived on a reserve. From these 55,885 individuals, 54,730 are Status Indians (41% of the total Status Indians).

Also, the most relevant fact of Ontario's First Nation population in comparison with the national level is the decrease of people living on reserve (from 49.3% to 27%), which means that Aboriginal peoples in Ontario are more likely to be moving from their communities to the cities and vice versa. Indeed, this statistical information matches with the stories and struggles that most of the Indigenous members, who participated in the development of the mobile application.

3.4 Postsecondary Education for Indigenous peoples in Canada

It is projected that in 2016 at least 72.5% of Canada's new jobs will require a postsecondary education (Miner, 2014). According to Carr-Stewart, Balzer & Cottrell, postsecondary education in the context of Indigenous peoples in Canada is a "vehicle for the attainment of individual and community goals, community self-sustainability, and self-determinations" (2013, p. 26).

In the context of Canada in 2011, nearly 754,055 adults aged 25-and-over reported an Aboriginal identity (Table 1) – (NHS). However, just under one-half (46.6%) of this population had a postsecondary qualification, including 14.2% with a trade certificate, 19.6% with a college diploma, 3.4% with a university certificate or diploma below the bachelor level, and 9.3% with a university degree (Table 2- Canada).

In comparison, almost two-thirds (60.1%) of the non-Aboriginal population aged 25-and-over had a postsecondary qualification. In this group, 11.9% had a trade certificate, 19.6% had a college diploma, 4.8% had a university certificate or diploma below the bachelor level, and 23.8% had a university degree. The main difference between the Aboriginal and non-Aboriginal populations in terms of postsecondary qualifications is the significantly lower proportion of Aboriginal qualifications and university graduates (Table 2 – Canada).

In the case of Ontario, nearly 176,095 adults aged 25-and-over reported an Aboriginal identity (NHS). Over one-half (51.17%) of this population has a postsecondary qualification in comparison with non-Aboriginals, of whom 60.5% have postsecondary studies (Table 2 - Ontario). Again, a higher proportion of non-Aboriginal people with university degrees (26.3%) in comparison with the Aboriginal population (10.8%) is significant with a difference of more than 15%.

Also, in the specific case of Toronto in 2011, nearly 22,735 adults aged 25-and-over reported an Aboriginal identity (NHS) and over 57% of this population had a postsecondary qualification. In comparison, over 64% of the non-Aboriginal population had postsecondary education (Table 2 - Toronto).

The comparison between the provincial and national level of Aboriginal postsecondary education provides important data, showing that in Ontario there is a significant increase in college diploma qualification and university graduates of 6% and 1.5% respectively, over the national level. In the case of Toronto, the proportion of Aboriginal university graduates is approximately double that of the national and provincial level. This higher level of education is understandable due to the overqualified labor market that is required in the province and more specifically in the urban areas, especially, Toronto.

Nevertheless, at the national, provincial and municipal levels, the proportion of non-Aboriginal graduates with a university degree is higher than the Aboriginal population. This factor is understandable due to the difficult challenges that Aboriginal peoples face in postsecondary education. In the next section of this chapter, I explore the most outstanding factors that cause these significant variances.

Table 2. Postsecondary qualification percentages of Aboriginal and non-Aboriginal populations in Canada, Ontario and Toronto

Postsecondary Qualification	Population: 25 and over					
	Canada		Ontario		Toronto	
	Aboriginal	Non-Aboriginal	Aboriginal	Non-Aboriginal	Aboriginal	Non-Aboriginal
1. No certificate, diploma or degree	31.7%	16.8%	25.2%	15.4%	17.2%	14.1%
2. High school diploma or equivalent	21.8%	23.2%	23.6%	24.1%	25.7%	21.9%
3. Postsecondary certificate, diploma or degree[16]	46.6%	60.1%	51.2%	60.5%	57.1%	64.0%
3.1. Apprenticeship or trades certificate or diploma	14.2%	11.9%	12.0%	8.3%	8.3%	6.2%
3.2. College, CEGEP or other non-university certificate or diploma	19.6%	19.6%	25.5%	21.5%	25.1%	18.4%
3.3. University certificate or diploma below bachelor level	3.4%	4.8%	2.9%	4.4%	3.7%	5.9%
3.4. University certificate, diploma or degree at bachelor level or above	9.3%	23.8%	10.8%	26.3%	20.0%	33.4%

Note: All the data comes from the National Household Survey 2011, Retrieved from STATCAN (2016)

Even though the postsecondary qualification is increasing in some contexts, the steps taken to decrease the educational gaps between Aboriginal and non-Aboriginal learners are not enough. The current educational system in Canada (at all levels from primary schooling to postsecondary institutions) has failed to address the needs of Indigenous peoples in culturally and spiritually respectful ways (as stated by Antone, Homels and Weaver in

[16] The sum of percentages in 1, 2 and 3 is equivalent to 100%. The sum of percentages in 3.1, 3.2, 3.3 and 3.4 is equivalent to the percentage in number 3.

Koleszar-Green, 2008, p. 6). Moreover, as stated by Koleszar-Green, authors, such as Baskin, Curwen, Doige, Friesen & Friesen, Monture-Angus, and Sinclair, who assert that postsecondary education in the context of Canada is a replication and a perpetuation of colonial discourse (2008, p. 6).

To explain the current challenges of Aboriginal learners in Canada, it is fundamental to recognize the role of residential schools during the nineteenth and twentieth centuries and the resulting intergenerational trauma within the lives of Aboriginal peoples. Sending Aboriginal Children to residential schools was an educational policy that the Canadian federal government implemented to foster the assimilation of Indigenous peoples. This resulted in many physical, psychological, sexual, intellectual, cultural and spiritual abuses by the religious authorities toward Indigenous children and youth. For generations of Aboriginal peoples, western education was associated with all types of abuses, the loss of Indian status, the severing of ties with family and community, and assimilation into mainstream Canadian society (Carr-Stewart *et al.,* 2013, p. 29).

In this regard, Carr-Stewart *et al.* (2013) claimed that, even though the last residential school was closed in 1996, the legacy of colonial educational policies continues to negatively impact young Aboriginal peoples, even though most of the current, university-aged, generation of students did not personally experience residential schools they still suffer from intergenerational trauma[17] (p. 29). On this subject, Cree educator Verna Kirkness and her collaborator Ray Barnhardt stated that "[Canadian] universities continue to perpetuate policies and practices that historically have produced abysmal results for First Nations students" (as cited in Haig-Brown, 2008, p. 254).

[17] Intergenerational trauma is the transmission of historical oppression and its negative consequences across generations (Carr-Stewart *et al.,* 2013, p.29-30).

Hereof, there is a significant amount of research, which has identified a group of barriers faced by Aboriginal students at the postsecondary level, which include historical, educational, socio-cultural, geographic, person/demographic and economic factors (Carr-Stewart *et al.,* 2013, p. 29; Haig-Brown, 2008). Although the profound analysis of these aspects and their relations is beyond the scope of this research, it is important to acknowledge the most relevant of them in order to have a basic understanding of what Aboriginal peoples are facing in the context of postsecondary education. This exploration will demonstrate the need of a mobile application within the context of a university environment. In this section, I will provide the most relevant of these factors, as identified in vast literature, along with voices of Aboriginal people, who day by day are dealing with these obstacles. The purpose of honouring the voices is to explain these challenges and factors in practical ways of understanding and to create a connection between the literature and the lived reality of Aboriginal people.

3.4.1 Barriers for Aboriginal People in Postsecondary Education in Canada

Aboriginal people in postsecondary institutions are facing several challenges. Dr. Koleszar-Green notes:

> "Alejandro, being an Indigenous person in a university environment is not easy. You need to push yourself to continue going in the face of many different forms of racism and discrimination in order to continue and finish your education" (personal communication, January 15, 2015).

From this initial understanding, the exploration of the most relevant causes of the struggle of Aboriginal youth in postsecondary education becomes necessary to my argument for the

need of a mobile application. In this section, I present the ten most important factors identified by Aboriginal youth. The ten most important factors and causes are:

1) Financial barriers are the most common reason for Aboriginal people not beginning or completing a postsecondary degree (as stated by Hutchinson, Mushquash & Donaldson, 2008, p. 270). The high costs of tuition fees and maintenance in urban areas discourage some Aboriginal students from attending postsecondary institutions, especially Aboriginal youth living on reserve. A member of the Center for Aboriginal Students Services (CASS), who asked to be anonymous, claimed that:

> "I feel you, Alejandro. To be enrolled in a university institution in Canada as an Aboriginal student or an international student without any type of funding is almost impossible. Especially for those who have children. As an Aboriginal student, you have to be brave if you want to pursue your postsecondary degree because you probably are going to get a loan. And to be honest, that it's not fair" (personal communication, March 19, 2015);

2) Cultural Loneliness: Lowery states that most Aboriginal students experience "cultural loneliness" (being caught between two cultures) when they get into postsecondary institutions (as cited in Koleszar-Green, 2008, p. 7). On the same point, Atleo & Fitznor stated that "intercultural marginality [cultural loneliness] is typified by the experience of not feeling at home in any given situation. Aboriginal students often do not feel at home in formal educational experiences, and the outcome can be an apparent lack of motivation to engage in learning" (as cited by Carr-Stewart *et al.,* 2013, p. 30). This loneliness/marginality within the institutions causes a spirit breaking in Aboriginal students. Furthermore, Koleszar-Green added that "in breaking the spirit of Aboriginal peoples there is an emotional and mental connection to the assimilation policies that grounded the residential school legacy, creating

an isolation of Aboriginal peoples within postsecondary education" (2008, p. 7). One student in Koleszar-Green's study (2008) argued that:

> "[…] my family does not follow Aboriginal ways of practice. This is because my grandmother was raised in a residential school. So physically I was exhausted from school, the term before I had had a minor mental breakdown and I had wanted to leave because I was just finding it so difficult to handle, […] Before [an Aboriginal Approaches class] I felt very displaced, very dislocated within the social work program. I felt very isolated. I had one friend that I mainly spoke with and people formed their groups and I wasn't, there wasn't a place for me within those groups" (p. 29).

In this same regard, Elder Philip Cote (2016) expressed that:

> "When a person is feeling disconnected [from her/his/their culture] that means such person has a trauma. To heal, the person should be connected again to [their,] his or her roots. The problem in these [postsecondary] institutions is that there are few spaces where Aboriginal youth can learn about their history and culture" (personal communication, April 6, 2016).

3) Attending university tends to sever young First Nations and Inuit students from their communities as they travel to urban centers to attend university. For First Nations and Inuit students living in northern communities, attending a postsecondary institution involves a relocation of hundreds of miles away from their communities, involving significant costs and often social isolation from friends and family members (Carr-Stewart *et al.,* 2013, p. 29). One of my Indigenous friends and professional colleagues in York University, Jared Visitor, stated that:

> "When I come to school [York University], I am very far from home. For me, it is too difficult to be far from my family and friends. To go home, I have to save around $500 CAD. I cannot go whenever I want" (personal communication, March 10, 2016).

4) There is a lack of support within the Aboriginal communities and families for postsecondary education that contrasts with the encouragement that most non-Aboriginal students receive in their homes (Carr-Stewart *et al.,* 2013, p. 29-30). Similarly, a Métis student and friend in York University, Lisa Stewart, shared with me:

> "When I decided to pursue a university degree, my mom demotivated me because according to her, I was selfish and I should be focusing just on my daughter. How do I suppose to support my daughter without a degree? That's why I decided to fight and start my degree" (personal communication, April 5, 2016).

5) Disadvantages in primary and secondary education: Half of the on-reserve First Nations people have not graduated from high school, the quality of local schools is not balanced in many small northern and remote communities due to the scarcity of resources, and many students of those communities do not have an adequate grounding in core subjects – English, Math, Sciences, or cyber literacy (Carr-Stewart *et al.,* 2013, p. 29). Jared stated that:

> "I remember, when I was in high school in my community up north, we didn't have enough computers with internet. It was a struggle to have a class on those conditions" (J. Visitor, personal communication, March 10, 2016).

6) Rigid postsecondary entrance requirements such as high school marks and prerequisites, as well as strict curriculum inside the programs restrict access by Aboriginal students (Carr-

Stewart *et al.,* 2013, p. 29). As one of the social work students stated in Koleszar-Green (2008):

> "[…] being within an institution with a rigid curriculum, and education policy, I was confronted with how I would foster an academic specific discussion while integrating my oral traditions using metaphors and storytelling. It was difficult to frame my ideas, knowledge and concepts into a style that would communicate to non-Aboriginal students in a clear way" (p. 29).

7) Few Aboriginal people are employed in postsecondary institutions. Therefore, most of the time, university employees do not have any depth understanding of Indigenous culture, values and beliefs. In postsecondary institutions, few Aboriginal people work in support capacities (staff) at the university. Fewer are Faculty members and fewer still hold senior, high profile university administrative positions. According to Bear Spirit Consulting, this absence of a critical mass of Aboriginal people means that most of the aspects that could help to attract and retain Aboriginal students are also absent in the staffing and administering of postsecondary institutions (as cited by Carr-Stewart *et al.,* 2013, p. 30). In this regard two students in Koleszar-Green (2008) stated that:

> "I think being outnumbered in all situations really had an impact on my spirituality, because very few people were open minded about embracing our value/belief systems as something legitimate and as a prerequisite in the field of helping" (p. 30).

8) First Nations and Inuit students are more likely to be female, more likely to have children, tend to be older and suffer from higher rates of disabilities than the typical Canadian non-Aboriginal undergraduate student (Carr-Stewart *et al.,* 2013, p. 31). Seeking full-time postsecondary programs are therefore more difficult and risky when combined with the responsibility of caring for young children. In my personal experience, when I started the

recruitment process for sharing circles of the mobile application, a common answer that I received from many students was that they were not able to attend due to their responsibility for young children.

9) Language barriers in education, specifically English and French: the history of colonization, residential schools and, the federal government's educational policy has privileged standard proper English and marginalized many Aboriginal languages, which existed prior to contact. In this regard one student in Koleskar-Green (2008) argued that:

> "[…] And people come out and use these big fancy words like academic [English] language and you are making me sound like an idiot right now, but I know that you are wrong."

10) Suicide rates among Aboriginal youth are much higher than among Canadian non-Aboriginal youth. In 2009, there were approximately 238,000 deaths in Canada, of which 3,890 were attributed to suicide. This resulted in a suicide rate of 11.5 deaths per 100,000 people (STATCAN, 2016). First Nations youth commit suicide about five to six times more often than non-Aboriginal youth. In the case of Inuit people, suicide rates are among the highest in the world, at 11 times the national average (Health Canada, n.d.). In this particular topic, I want to raise my personal voice about the struggles that many Indigenous colleagues are facing in Toronto, who frequently are depressed for long periods of time and are feeling isolated from their culture. Conversations around depression and sadness are common among Aboriginal students in Canadian institutions. However, it is important to recognize that suicide is complex and is the consequence of several factors beyond postsecondary institutions. Most of my personal motivation to create the mobile app resides in this critical and alarming issue.

These ten examples provide the reader an overall picture of difficulties encountered by Aboriginal members inside postsecondary institutions. And again, it is important to recognize that the causes, relations and, most importantly, the consequences of the previous factors are complex and must be explored in more detail outside of this research. However, the message is clear: being an Aboriginal postsecondary student in Canada is not easy and there are urgent and current challenges to be addressed by academic institutions as soon as possible.

Indeed, postsecondary institutions are trying to support these challenges inside their academic spaces. However, it has not been enough. According to SAY Aboriginal Magazine, of the 160 Canadian universities and colleges that answered a survey in 2015, 74.4% have a Native Centre to support Aboriginal students, 76.9% have Native Scholarships/bursaries to fund Aboriginal students and 54.4% have at least one Native Student Association (SAY Magazine, 2016, p. 51-61).

In the specific case of York University, there is a Native Centre, which is called the Center for Aboriginal Student Services (CASS). In this centre is where the mobile application was designed, created and implemented.

3.5 Centre for Aboriginal Student Services at York University

CASS has the mission to “nourish a diverse and inclusive Aboriginal community within the broader York University community” (Centre for Aboriginal Student Services [CASS], 2014, p. 1). CASS is a centre that offers academic and personal counselling, advocacy and referrals to on- and off-campus resources, liaison with First Nation communities and Aboriginal organizations, information about funding and financial assistance opportunities, as well as education and awareness about topics related to Aboriginal peoples and

communities (CASS, 2015, p. 8). York University has approximately 250 students per year who identify as Aboriginal (personal communication, R. Pitawanakwat, January 22, 2015).

CASS provides “a community space that offers culturally appropriate support services and programs with the desire of empowering Aboriginal students with a sense of belonging that further enables their success throughout their postsecondary studies. The Centre for Aboriginal Student Services supports educational initiatives to encourage the awareness, understanding, acceptance and growth of the Aboriginal community on-campus and, as well, to enrich the overall York University community” (CASS, 2014, p. 1).

Despite this type of effort, the important gap between non-Aboriginal and Aboriginal students is still present and should continue to be addressed by York University and other academic institutions in different albeit different forms, which their further analysis is beyond the scope of this research.

Nevertheless, new opportunities are emerging for Aboriginal peoples in postsecondary institutions to address the issues stated in this section, through the use of new Information and Communication Technologies (ICTs). These possible alternatives are helping students to access cultural and traditional information, and to provide communication services between students and their friends and families across Canada.

3.6 Technology and Aboriginal communities in Canada

According to Aboriginal Affairs and Northern Development Canada (AANDC) in its last study on Internet connectivity in Aboriginal communities (March 2013), the situation of connectivity in First Nations and Inuit communities is at the following level (Table 3).

Table 3 shows the overall picture of Aboriginal peoples' access to the Internet. First, it shows that over 79% of Aboriginal communities (547 of 686) throughout Canada had access to broadband internet (high speed) connections. However, only 46.5% (319) have access to Internet Industrial / Institutional connections (the connection that is required for online businesses).

Additionally, it also shows that 50.3% (65 of 129) of satellite services use takes place in the northern territories of Yukon, Northwest Territories and Nunavut; interestingly, the other 49.7% is spread across the Provinces. This factor could be because many First Nations are still on difficult terrain locations and/or they are extremely isolated from other towns or cities.

Table 3. Aboriginal Connectivity based on broadband in Canada.

Provinces / Region	Low Speed		Broadband to the costumer (High Speed)			Total Aboriginal Communities considered
	Low Speed (Not connected minimum of 1.5Mb/s to the household)	**Consumer Broadband - Satelitemte (Not connected minimum of 1.5Mb/s to the household)**	**Consumer Broadband - Terrestrial (Connected minimum of 1.5Mb/s to the household)**	**Consumer Broadband - Satelitemte (Connected minimum of 1.5Mb/s to the household)**	**Industrial/ Institutional Capable Broadband (Connected)**	
Alberta	0	1	3	1	42	47
British Columbia	19	6	86	3	83	197
Manitoba	6	24	31	0	2	63
New Brunswick	0	0	2	0	13	15
Newfoundland and Labrador	2	0	6	0	1	9
Northwest Territories	0	28	1	0	3	32
Nova Scotia	0	0	0	0	13	13
Nunavut	0	0	0	27	0	27
Ontario	21	11	38	0	70	140
Prince Edward Island	0	0	0	0	2	2
Quebec	4	5	7	13	24	53
Saskatchewan	1	0	9	0	60	70
Yukon	1	10	1	0	6	18
National Level	54	85	184	44	319	686

Note: This table is based on the community profiles of 686 communities (First Nations and Inuit) in AANDC, 2013
Source: AANDC, 2013

In the case of Ontario, 77.1% (108 of 140) of Aboriginal communities have access to high speed internet services (2% lower than the national level). This percentage contrasts with the high percentage of connectivity in the Atlantic Provinces (as a total) and Alberta, where 94.9% (37 of 39) and 97.9% (46 of 47) of the communities, respectively, have access to broadband.

In this regard, the Canadian federal government has implemented the program Digital Canada 150 since 2014 (version 1.0 and 2.0). According to the government, “Digital Canada 150 represents a comprehensive approach to ensure that Canadians, no matter where they live, will have access to high-speed Internet services at the most affordable prices” (Digital Canada, 2016, p. 5). According to the 2017 projections of this program, “over 98% of all Canadians will have access to high-speed Internet at 5 megabits per second (Mbps) —a rate that enables e-commerce, high-resolution video, employment opportunities and distance education—providing rural and remote communities with faster, more reliable online services” (Digital Canada, 2016, p. 7). For Aboriginal people, a potential new measure of connectivity will be derived upon the implementation of this program.

However, despite the potential benefits, this government approach has not taken into consideration some fundamental aspects of control and empowerment principles, which have been developed in the Canadian context around technology and Indigeneity in order to reach self-determination.

The OCAP–Ownership, Control, Access and Possession—principles of Schnarch (2004) to apply self-determination to research and knowledge production have been applied to Information and Communication Technologies (ICTs) through the “First Mile” approaches. “First Mile” is the “development of local infrastructure that benefits local communities, in

contrast to how local infrastructure is often referred to as 'last mile' development that benefits centralized, urban-based telecom corporations and governments" (Beaton *et al.*, 2015, p. 151-152). According to McMahon, the ownership and control of the local technologies are essential to self-determination and local community resilience (as cited in Beaton *et al.*, 2015, p. 152). Some actual examples of this approach are ISUMA TV and Keewaytinook Mobile, which were previously mentioned in Chapter 2.

ISUMA TV is an opportunity for Inuit communities to own, control, access and possess their cultural media contents and equipment, as well as the ability to broadcast their digital creations to the world through the internet (Alexander *et al.*, 2009; Petersen, 2013). Also, Keewaytinook Mobile is an Aboriginal mobile carrier, which provides mobile communication services to the First Nations in the area of Sioux Lookout, Ontario (Beaton *et al.*, 2015).

On the other hand, First Mile and its examples exhibit the importance of mobile technologies in the context of Aboriginal peoples. Therefore, to have a better understanding of mobile technologies, it is important to explore their penetration in Canada.

According to the Canadian Wireless Telecommunication Association [CWAT], in the last quarter of 2015, there were 29,389,553 wireless phone subscribers (prepaid and postpaid) in Canada (CWAT, 2016). This number means that over 97% of the Canadian population aged 14-and-over has a phone subscription.[18]

[18] It is assumed each person has just one wireless phone subscription. Also, this calculation is based on the population aged 14-and-over of July 1, 2015: 30,104,000 (STATCAN, 2016).

In the same way, according to Catalyst, in 2015, 68% of the Canadian population owns a mobile smartphone.[19] Segmenting the data by age group reveals that the share of smartphone owners in the ranges of 25-34 and 45-54 have increased substantially since 2014 (See Figure 4).

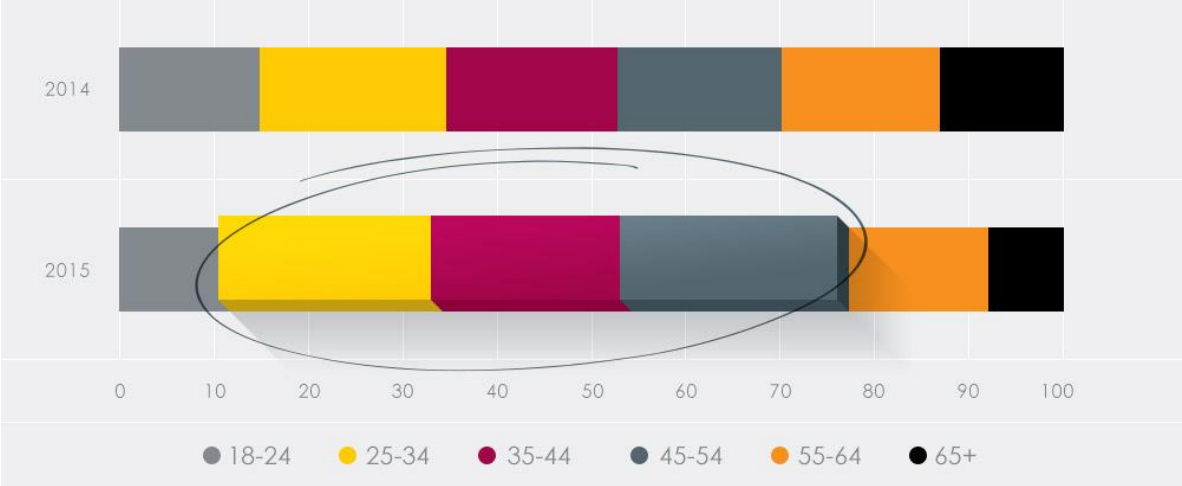

Figure 4. Canadian Smartphone Ownership Share by Age Group, 2014-2015
Reprinted from "With Growth Comes Change: The Evolving Mobile Landscape In 2015" in Canada, by Catalyst, April 4 2016, Retrieved from http://catalyst.ca/2015-canadian-smartphone-market/, Copyright 2016 by Catalyst (circled in original)

As a reminder, the mobile application of this research wants to address the segment between 18 and 34 (the first two sections from left to right of Figure 4). Also, the same study showed that users are becoming more selective with mobile applications.[20] Despite the universality of such applications, the usage is trending down for most activities, while web

[19] Smartphone: A category of mobile device that provides advanced capabilities beyond a typical mobile phone. Smartphones run a complete operating system (OS) software that provides a standardized interface and platform for application developers. In 2015, the main operating systems were: Apple IOS, Google Android, Microsoft Windows Phone and Blackberry OS (Smartphone, n.d.).

[20] *Mobile application* refers to a computer program designed to run on mobile devices. They are independent and they commonly do not require extra software to run. They have their own name and icon. Most of them do not require an internet connection to function. However, when they detect an available internet connection, they frequently consume large amounts of internet data (Summerfield, n.d.).

applications[21] has increased from 2014 to 2015. Furthermore, there is a decline in the average number of applications on Canadian mobile phones. While in 2014 smartphone owners reported having an average of 26 mobile applications on their phones; that number decreased to just 19 in 2015. These two factors indicate a general preference for using browsers over mobile apps. According to the study, this preference of the Canadian population is because of the higher battery consumption by mobile apps and the large amount of internet data that most mobile applications consume over time (Catalyst, 2015).

Specifically, there is no current information available regarding Aboriginal peoples and their usage of mobile phones. However, anecdotally, in the context of CASS at York University, I observed that 34 of 35 Aboriginal users, who interacted with me in different forms, owned and used smartphones.

Nonetheless, it is important to make a difference between the Canadian non-Aboriginal and Aboriginal mobile phone users. Due to different factors (mostly economic variables), the same 35 Aboriginal users who interacted with me, did not tend to have a large amount of data plans contracted with their mobile carriers. In most of the cases, they connected to the internet through Wi-Fi technology in their homes, workplaces or school.

The purpose of providing a brief explanation of the current situation of the mobile and web application market in Canada is to explain to the reader why a mobile application was selected from other technological solutions (a further analysis will be driven in Chapter 5).

[21] *Web application* refers to a computer program designed to run through a browser, such as Microsoft ® Internet Explorer, Android Navigator, Google ™ Chrome, Apple Safari, Mozilla © Firefox, among others. The users need to open a browser on their mobile devices or computer and input a web address to access those applications. They require an internet connection to work, but they commonly consume low amount of data (Summerfield, n.d.).

In conclusion, the situation of Aboriginal youth in postsecondary education is critical, due to the Western standards and forms on which mainstream postsecondary institutions are based. However, there is potential for the high penetration of the internet and mobile devices to provide Indigenous activists and scholars with a new type of solution to empower Aboriginal youth in Canadian postsecondary institutions.

This potentiality is due to different factors such as:

- 31% of the Aboriginal population in Canada is in the age range between 15 and 34, which means that the scope of a mobile application can impact approximately one-third of Indigenous peoples.
- The population in Canada who have subscribed to a wireless phone service is considerable high (97%), which means that even in remote areas, this type of tech is feasible. Although the penetration of smartphones is lower (68%), it is increasing exponentially in short periods of time (17% per year), which means that a high number of the population has access to this type of service.
- The Aboriginal population who is seeking postsecondary qualification is increasing significantly, and especially in cities such as Toronto (57.1%).
- The statistics show a continuous migration pattern from reserves to the cities, e.g. in Ontario just 27% of the Indigenous populations lives on reserve. This phenomenon generates a potential use for the mobile application as a tool of communication.
- In the specific case of York University, most of the CASS members who utilize the space and services of CASS, own a smartphone (34 of 35).

Mobile phones are instruments that Aboriginal youth can use to continue being culturally and spiritually connected with their relatives and families, as well as to access information

about resources and counselling. Also, mobile technologies may encourage the creation of support networks among different Indigenous peoples and groups across the country, who are facing similar struggles. And, most importantly, mobile devices can help to save the lives of thousands of Aboriginal youth through access to traditional counselling during moments of suicidal crisis.

4. Tipi Ceremony as an Indigenous knowledge

The first three chapters of this research offered the reader the elements needed to understand several concepts and contexts of the creative process of the mobile application. This process in the context of the CASS community was innovative in significant ways, including: the incorporation of Indigenous teachings within the design; the modification and "domestication" of software design methodologies; and the assignation of responsibilities (roles) to the partners.[22]

In this chapter, I describe chronologically the procedure in raising the Tipi at York University. The importance of the knowledge embedded within this ceremony frames the overall methodology of creation and design of the Indigenous mobile application. The seven steps described in this chapter are explicated in the next chapter, explaining the detailed procedure and content of the proposed Indigenous software methodology. At the end of this chapter, I explain the importance of the medicine wheel.

4.1 Raising the Tipi at York University.

The process of raising a Tipi has plenty of similarities with the creation of a mobile application.

It was Sunday, October 26, 2014 and I was part of the ceremony to raise the Tipi of York University. The birth ceremony of the Tipi of York University was guided by the Traditional Knowledge Keeper Michael White and Elder Blu Waters. The first aspect, which I learned from them, is that the Tipi has his/her/their own spirit and has to be respected. For this reason, this procedure is not just called "pitching" or "construction," it is an actual Birth ceremony. Furthermore, in order to successfully have a healthy Tipi, there are several

[22] During the following sections, the term *partner* is used frequently instead of *user*. The connotation of *user* does not fit in an Indigenous paradigm.

fundamental instructions/steps to take into consideration when the Tipi is raised. These steps may have small variations, but they cannot have major changes.

For the purpose of explaining this procedure, I describe my experience in the Birth Ceremony of the Tipi, following the teachings of Michael White and Blu Waters (personal communication, October 26, 2014), as well as Reginal and Gladys Laubin (1971, 43-62). The procedure was as follows:

1) Birth Offering and praying to the ancestors: before anything was set in the area, an offering of tobacco was made in the center of the space (Figure 5.c letter A). This offering is typically made by an Elder and/or Knowledge Keeper, who is a person that guides the Ceremony; it is made with the purpose of having the blessing from the ancestors and providing the Tipi a long-term standing.

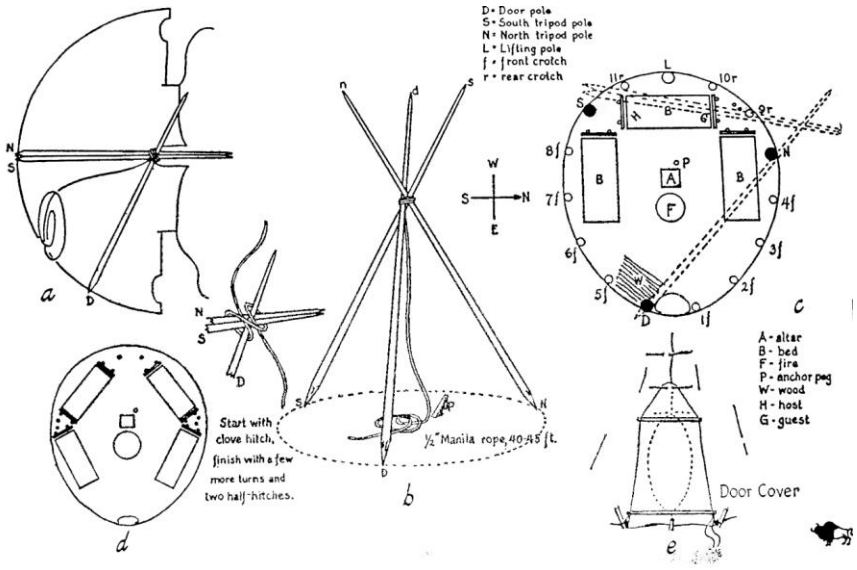

Figure 5: Diagrams of raising a Tipi
Reprinted from *"The Indian tipi: its history, construction, and use"* in United States, by Laubin & Laubin, p. 45, Copyright 1971 by Ballantine Books.

2) Selecting the poles: the three heaviest poles were selected for a tripod. Another heavy pole was laid aside for the lifting pole—the one to which the canvas was tied—and two light

poles for the smoke flaps[23] (Figure 6). In total, six poles were selected. In addition, one white cloth was tied at the extremity of one of the tripod poles–the one facing the North.

Figure 6: Measuring the poles in the area of the Tipi.

3) Placing the tripod: in order to lift the tripod into proper position, the three poles were laid on the ground at the time of tying, including the door pole (D). The poles were wrapped with a rope several times and, afterwards, the poles were raised. The tripod was adjusted in order that the Tipi's door could face the East (Figure 5.b).

Figure 7. Positioning the Tripod of York University

[23] The tipi smoke flaps are attached in a continuous piece to the cured hides that cover the exterior (canvas). (Laubin & Laubin, 1971, p. 110).

4) Putting the poles into position: one by one each of the remaining poles were placed into position. In addition, one black cloth was tied at the extreme of the pole that faces the West and one red cloth to the one that faces the South.

Figure 8. Lifting the poles of the Tipi.

5) The Canvas: the canvas cover was tied along the canvas pole. A yellow cloth was tied at the extremity of this pole that faces the East. The entire bundle was hoisted into the last available position. Then, it was a simple matter to unroll the cover from each side and bring it around to the front in order that the two sides meet between the door pole (D) and pole number 1 (Figure 9). In the case of this Tipi, the canvas was already painted and it was not necessary to decorate it.

Figure 9. The canvas of the Tipi

6) Crossbars and adjustments: above the hole that was going to become the door of the Tipi, a group of crossbars was pinned down across the front poles (Figure 10.a)**.** Then, the smoke flap poles were inserted (Figure 10.b). Next, the poles were pushed out against the canvas cover to make the Tipi's floor plan symmetrical. It was necessary to move the poles several times to adjust the canvas properly (Figure 10.c).

Figure 10. Crossbars, smoke flaps and adjustments of the Tipi

7. The Door and the Lining: to finish the canvas of the Tipi, it was necessary to place the door on the East side between the door pole (D) and the pole number 1 (Figure 11.a). After

the cover was finished, the last fundamental part of the Tipi was the lining. The lining has several purpose, including: keeping away draft and humidity, preventing rain from dripping off the poles, increasing the ventilation, cleaning the atmosphere of smoke, and preventing the castings of shadows from the fire to the outer wall. The lining is commonly three rectangular clothes with several tapes to tie each section to the poles (Figure 11.b).

Figure 11. The doors and lining of the Tipi

After the Tipi was finished, we had a feast as a community to celebrate the birth of the Tipi (Figure 12). Without knowing it, this moment expressed in a beautiful and powerful way what the mobile application was going to become: a place of gathering and sharing among Aboriginal children, youth, Elders, Knowledge Keepers, scholars and allies.

Figure 12. The feast after the Tipi raising ceremony

4.2 The Medicine Wheel

In the following weeks, the Elder Blu Waters explained that the four color cloth that were placed in the extreme of the poles (facing the four cardinal points) represent the dimensions of human beings, which are expressed in the traditional medicine wheel: North-Intellectual-white, West-Physical-black, South-Emotional-red and East-Spiritual-yellow (Figure 13).

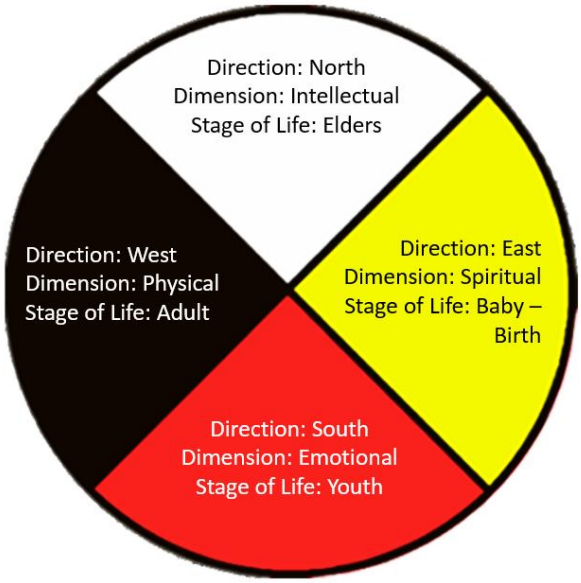

Figure 13. Medicine Wheel (Anishinabe tradition)
Source: Personal communication, Blu Waters, October 26, 2014 – November 26, 2014
Note: This medicine wheel was created accordingly with the Anishinabe tradition

These dimensions should be in balance and the Tipi is a sacred space that helps people to find such equilibrium. Furthermore, each of these directions, dimensions and colors also has a related stage of life, which is attached to it.

At the beginning of our lives as human beings, we are in a spiritual phase because we are connected with the Creator (we do not have complete autonomy of our actions). Then, when we grow up, we become more conscious about our emotions and we belong to the youth's stage. Next, when we reach around 25 years old, we belong to the adult's stage because our physical body reaches fullness. Later, when we are older and wiser, we become more intellectual and we belong to the Elder's stage. Finally, when we are at the end of our days,

we go back to the spiritual phase and typically we become ‘babies’ again because we need help and support from our families to survive. This is the cycle of life and the connection among these stages can usually be seen when people gather inside a Tipi (B. Waters, personal communication, October 26, 2014, November 26, 2014).

Also, the conical form of tipis is compared to the shape of the skirts of women and how they provide shelter for young children when they are scared or threatened (as mentioned in Chapter 2). In the same way, a Tipi gives protection to the people who are inside him/her/them. For this reason, the door and lining are essential elements of a Tipi to keep the environment warm and safe (R. Pitawanakwat, personal communication, October 28, 2014).

For all the previous reasons, the Tipi is a sacred space that should be cared for by the whole community. The well-being of the tipi is typically considered a responsibility of women, but men also have important roles, such as firekeepers and wood providers.

The people who intend to go inside a Tipi should follow an access protocol (Figure 14). In addition, people should be open to listen to the teachings of the Elders and traditional knowledge Keepers, as well as being respectful to the ceremonies and actions done (B. Waters, personal communication, October 26, 2014). Not following these principles can be harmful for the other people who are using the Tipi.

Figure 14. Tipi Protocol of York University

The incorporation of these ways of understanding and all the previous teachings were essential to create a new effective technological approach. During the process of raising the Tipi, I realized that this methodology was quite similar to the methodology necessary to create a mobile application, and moreover, the protocols and ways of understanding the Tipis were fundamental to creating a truly effective mobile application for these particular purposes.

Therefore in the next chapter, I explicate these previous seven steps in the ceremony of creation of the mobile application.

5. Tipi Ceremony as a software methodology

In the last chapter, I described the narrative of one fundamental moment in the design of the mobile application: the Ceremony of the Tipi of York University. The knowledge of the Tipis was used as an essential part in creating the mobile application, from the design to the publication phase in the distribution platforms (i.e. Apple App Store and Google Play). In other words, this knowledge was essential to propose a solution of decolonizing technology.

This methodology, utilizing Tipi knowledge, contrasts with the common Systems Development Life Cycle (SDLC) methodology used by the majority of Information Analysts. The SDLC methodology implements phases where specific analyses and design stages are required, such as Identifying problems and objectives [by the developer], determining human Information requirements, analyzing system needs, designing the recommended system, among others (Kendall & Kendall, 2011, p. 8). The incorporation of any kind of traditional knowledge would be reduced to a simple requirement or objective in the first phase of software development.

To support my methodology, I will now explain how the seven steps of raising a Tipi were taken as a software designing methodology in comparison with the SDLC methodology, as well as how the teachings of the Tipi and his/her/their relation with the medicine wheel were incorporated as part of the functionality of the mobile application. The next seven sections have the same chronological order as the seven steps described in the last chapter.

5.1 Birth Offering and praying to the ancestors

After the construction of the Tipi, I was not sure which direction I was going to take with my research. Many people suggested that I should go back to my previous experiences in Mexico or Nova Scotia, but those possibilities were far from my reality in that moment.

On January 15, 2015, I had an unexpected meeting with Dr. Ruth Koleszar-Green and Elder Blu Waters at CASS.[24] This meeting started as an informal conversation, but it became the birth ceremony of the mobile application.

> "[…] Blu, as I was telling Ruth, I do not have a placement to do my research. My problem is that I want a project, which can drive beyond the academia because I really want to support Indigenous lives. I do not want a research that will be kept in the libraries. I feel desperate because I do not have a community where to go. I was thinking that maybe you can help me to introduce me to an Elder and I can do a website or a survey on a reserve."

After a brief pause, Dr. Koleszar-Green and Elder Blu Waters began to look at each other and they said:

> "Alejandro, you have an Indigenous background. You are Indigenous. Feel the spirit when you are here [at CASS]. Maintain the relations with your 'home.' Why are you looking for a community to support if you are in your community? CASS is your community in this journey. Since day one, you have been open to help to raise the Tipi, support the ceremonies and more important you were open to learn and listen from the Elders. Your project should be here."

[24] Meeting hosted at the Centre for Aboriginal Students Services (CASS) of York University, January 15, 2015.

I was completely astonished by the answer. Everything was making sense in that moment. Next, they briefly explained the challenges of Aboriginal Students at York University (more details are described in section 5.4 of this chapter):

> "[…] Being an Indigenous person in a university environment is not easy. You need to push yourself to continue going in many different forms of racism and discrimination in order to continue and finish your education. "

I got excited about the idea. However, there was an element missing: how was I going to be able to add something new to support the Aboriginal community at York University? CASS had already its website and social media platforms and they did not need any technical support at that time.

After a brief period of proposals and brainstorming, a far-fetched idea came out of that special conversation: the technological approach would be a mobile application with the main purpose of supporting the needs of the CASS community.

The recurrent need for information about available resources and the continuous seeking of guidance were two urgencies that Blu and Ruth highlighted as important factors in the creation of a mobile application (personal communication, January 15, 2015). The potential to create a mobile application by/with/for Aboriginal students seemed highly important and meaningful. Therefore, Blu offered tobacco to the ancestors for my guidance in this new journey.

However, despite my having the approval of two important leaders of the community, the approval of the rest of the members was critical. Subsequent to the meeting, I held individual and group meetings with the four staff members of CASS in order to have their consent. All the staff members agreed to the development of the mobile application (personal

communication, March 12, 2015).[25] After those agreements, I started to talk about it with the CASS community. Different members, such as students and alumni, accepted the development of the mobile application due to the familiarity of the project with their daily lives. All the members who interacted with me were willing to participate and help to develop the mobile application (personal communication, July 16, 2015).

In contrast with this methodology, the SDLC approach proposes that in order to start a software project, the approval from the managers of organizations/enterprises is the only authorization needed to start an IT project. Also, the SDLC methodology recommends that the feasibility analysis of the software system must be done just by the developer or Information Analyst, with the information gathered from several qualitative and quantitative research methods (Kendall & Kendall, 2011, p. 61-62). The high level of power and decision making of the developer over the users would not fit an Indigenous methodology.

5.2 Selecting the poles: method, platforms and development kit

5.2.1 Selecting the first pole of the tripod: Software development method

After the CASS staff meeting, I began to search for methodologies for software development. I needed a simple base method, which would allow me to incorporate changes constantly and efficiently to the software application, while at the same time incorporating Indigenous knowledge about Tipis. This method was going to become the base on which to place the other poles.

In the case of software development models, the *Iterative Enhancement Model* was the best option for this requirement (Figure 15). This approach is simple and consists of two main parts: iterations and a project control list. Each iteration is divided into three phases: design phase (find a need and create a solution), implementation phase (release a prototype and

[25] Meeting hosted at CASS of York University, March 12, 2015.

share with the users), and analysis phase (receive feedback from users and make the required changes). The project control list contains all of the tasks that have to be performed and the needs that must be met to reach the final implementation. The iterations are repeated until the project control list is empty. It should be noted that more tasks and needs can be added to the control list at any moment (Jalote, 2008, p. 19).

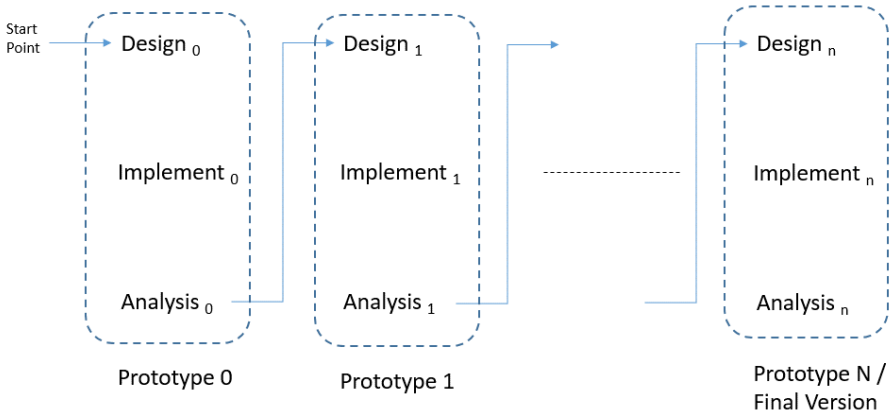

Figure 15. Iterative Enhancement Model
Adapted from "*A concise introduction to software engineering*" in UK, by Pankaj Jalote, p.20, Copyright 2008 by Springer.

The SDLC approach agrees with the three sub-phases of the *Iterative Enhancement Model* (i.e. Design, Implementation and Analysis), but it also proposes timeline diagrams to integrate these stages. In order to successfully design such diagrams, technical expertise and experience are required and modifying one event affects the rest of the diagrams (Kendall & Kendall, 2011, p. 77-88). The inconvenience of this approach in an Indigenous environment is that Indigenous peoples are diverse and dynamic, and therefore, change is frequent and, moreover, is desired. In addition, the outcomes of these diagrams are complex and are difficult to understand for non-technical users who may be participating in the development process and this phenomenon affects the relational accountability in an Indigenous paradigm.

On the other hand, the *Iterative Enhancement Model* allows an analysis at the end of each iteration, and provides an opportunity to construct the mobile app progressively along with the community (Jalote, 2008, p. 31). Specifically, Figure 15 was adapted and enhanced in order to incorporate the Indigenous knowledge of sharing and participation throughout the process (Figure 16). Therefore, an interdisciplinary approach was fundamental in this section because there was a connection between the orality and the storytelling of Indigenous peoples, their needs and the user software functionalities (features).

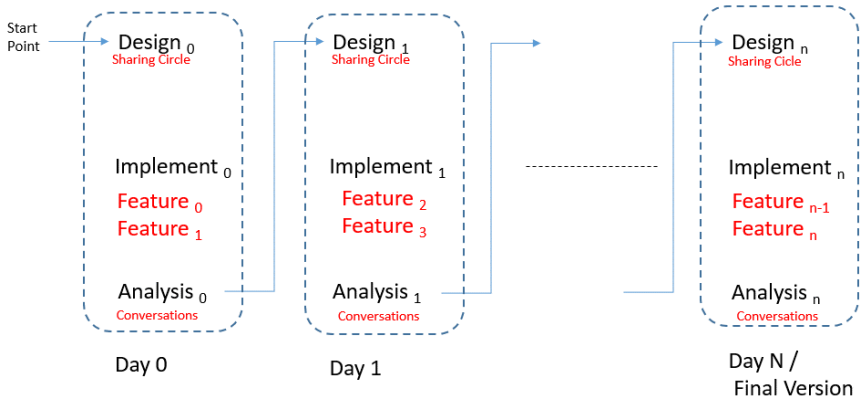

Figure 16. Indigenous Iterative Method
Adapted from "*A concise introduction to software engineering*" in UK, by Pankaj Jalote, p.20, Copyright 2008 by Springer.

During the design phases (one for each iteration), orality and communality were included through Indigenous research methods such as sharing circles.

Sharing circles are used to capture people's experiences. They are comparable to focus groups in qualitative research where researchers gather information on a particular topic through group discussion. However, they differ from focus groups in the sacred meaning they have in many Indigenous cultures and in the growth, healing and transformation bases for the collaborators. All the voices can be heard and they have an equal weight in decision making (Lavallée, 2009, p. 28-29).

In this regard, sharing circles were proposed because they allow *collaborators or partners of study*[26] to discuss together topics of mutual concern. Moreover, sharing circles shift the balance of power away from the developer/researcher, and toward the collaborators.

In the case of the analysis phases, person-to-person conversations were the best tools to improve the performance of the mobile app and to get information from collaborators.

Conversations are comparable with interviews in qualitative research, where researchers engage in a one-way dialogue with the participants. Nonetheless, conversations are a non-structured method of gathering knowledge. This includes a reflection of what the person is expressing, a story on the topic and a dialogue between the two persons (Kovach, 2009, p. 51).

Conversations were selected as the method of gathering the information because they gave me the opportunity to engage with people in trustful and powerful ways. The two persons who were included in each conversation could provide their points of view and values on an equal basis.

In the case of SDLC approaches, they propose structured interviews, where the Information Analyst has complete control of the conversation and the type of data that is expected (Kendall & Kendall, 2011, p. 103-110). They also propose other methods, including structured questionnaires, research sampling, observation methods and case analysis (Kendall & Kendall, 2011, p. 111-149). These methods do not allow a fluent two-way dialogue between the key players in the software development phase, such as the collaborators and the developers. This aspect is a fundamental element that an Indigenous software approach must include in contrast to other technological methodologies.

[26] It is important to mention that instead of using the concept of objects of study or participants, the notion of partners of study or collaborators is used as an Indigenous approach to decolonize forms of knowledge production in Indigenous Research (Absolon, 2011, p. 98; Smith, 1999, p. 10).

Ultimately, with the contribution of different members of CASS in the development process of the mobile app through the sharing circles and conversations, the design of the software was not constructed just by the researcher/developer but by the whole community.

5.2.2 Selecting the second pole of the tripod: software development kit

There are several development options in the global market to create mobile applications. Mobile developers have dozens of options from which to choose depending on skills, budget, infrastructure, goals, deadlines, operating system compatibilities, among other factors. The specifications and evaluation of those development platforms are beyond the scope of this research. However, it is important to identify and describe the software development kit (SDK)[27] that was used to create the mobile application and why this group of tools was chosen.

The chosen platform to develop the mobile application was Ionic Framework. Ionic is a powerful framework that helps to build mobile applications using web technologies such as HTML5, CSS, and Javascript (Bradley, 2013). I decided to use this technology due to simplicity, easy maintenance, compatibility with different mobile devices and most importantly, the possibility to create mobile applications instead of web applications. As stated in Chapter 3, although mobile applications were decreased in 2015 in comparison with web applications, their functionality when used without an internet connection was a key aspect to take into consideration.

The high percentage of Aboriginal communities with access to broadband internet connection (79%) does not mean that the partners/users have Internet data contracted in their cell phone subscriptions. Indeed, anecdotally, Indigenous members of York University

[27] Software development kit (SDK) is typically a set of software development tools that allows the creation of applications for a certain software package, software framework, hardware platform, computer system, video game console, operating system, or similar development platform.

tend to use Wifi technology in their homes, workplaces or school. Therefore, a continuous internet connection was not guaranteed in most cases and Ionic Framework offered a decent development option for mobile applications.

In addition, the final product created with Ionic Framework can be at the same level of quality in design and appearance as other types of development platforms.

It is important to highlight that this type of technology does not have access to high processing power on the mobile phones and the phones lose efficiency as more processes are required to ensure the functionality of the mobile application (sometimes, this phenomenon is called *overhead*) (Morony, n.d., p. 7). In the specific case of this mobile application, a high level of data analysis was not required and therefore this overhead does not significantly affect the overall performance.

5.2.3 Selecting the third pole of the tripod: Backend Database

The final basic pole of the tripod was the backend[28] database. The backend database was also fundamental to choose because it contains all the information about the collaborators who are registered in the mobile application, it can provide live communications among the people, it is extremely significant to the overall performance of the mobile application and most importantly, it will generate the first expenditures in case the mobile application grows. This cost will depend on the amount of data storage and number of simultaneous connections.

Moreover, through the backend database, the developers can monitor the usage of the mobile application (# of collaborators, how frequently they are connecting, when the collaborators are connected, etc.). I consider this element, the door pole (D) because it is

[28] A subordinate processor or program, not directly accessed by the user, which performs a specialized function on behalf of a main processor or software system.

the instrument, which does the authentication of the partners when they want to access the mobile application (i.e. the Tipi).

In the same manner as choosing the SDK, mobile developers have to choose from dozens of options depending on skills, budget, infrastructure, goals, among other factors. And again, the specifications and evaluation of those databases are beyond the scope of this research.

In the case of this mobile application a compatible backend database with live/real-time communications[29] was highly recommended due to the type of the required interactions that the partners/collaborators needed, such as chats and forums.

More specifications of the particular backend database of this mobile application are not provided for security purposes. The data/information of the partners/collaborators and their personal communications could be at risk if more details are given.

5.2.4 Selecting the lift pole: Android and iOS

Another important decision about the mobile application/Tipi was to select the lifting pole with the canvas,[30] which refers to the operating system where such application would be installed and launched.

The operating system has a direct relationship with the graphic appearance and performance of the application; as well, it dictates the mobile devices that are capable of running the application.

The required hardware and software technologies for each operating system are different, as are the development policies and guidelines that need to be followed for each platform.

[29] Real-time communications (RTC) is any mode of telecommunications in which all users can exchange information instantly or with negligible latency. In this context, the term "real-time" is synonymous with "live" (Rouse, 2008b).

[30] The canvas would be the design and the graphic appearance of the mobile application (more details in section 5.5).

Therefore, certain considerations must be taken in order to guarantee the performance of the mobile application and its incorporation into the different distribution platforms (more details are given in section 5.7).

Nowadays, in the smartphone industry, there are four operating systems, which have 99% of the market: Apple iOS, Google Android, Blackberry OS and Microsoft Windows Phone. According to ComScore (2015), in the specific case of Canada the market share is: Apple iOS (38.3%), Google Android (50.5%), Blackberry OS (8.9%) and Microsoft Windows Phone/others (2.3%).

For this reason, the operating systems selected for this mobile application were Apple iOS and Google Android. Moreover, the last versions of Blackberry OS (10.2.1 or later) also accept and run Google Android mobile applications. The total scope within the smartphone market for developing the two mentioned platforms is 97.7%.

One last interesting factor is that, similar to the lifting pole, the operating system was the last pole to be hoisted. In other words, the specific requirements of each operating system are developed after all the features and poles are created.

5.2.5 Selecting the smoke flaps: Push notifications

Finally, two light poles were selected for the smoke flaps: push notifications.

To understand the similarity between the push notifications and the smoke flaps, firstly it is necessary to comprehend the meaning of the fire in the Tipi/mobile application.

The open fire in the center of the Tipi is its central attribute. According to Laubin & Laubin “a tiny fire, properly laid and cared for, is enough to keep the average tipi warm and cozy even in very cold weather” (1971, p. 108). The fire is sacred and has infinite meanings and attributes for Indigenous peoples. The fire was a fundamental and essential part in the life

of Tipis because it allowed people to live in and warm themselves. Indeed, there must always be a person who keeps the fire going: the firekeeper.

In the same manner, the mobile application needs a central attribute to keep it warm. Extending Laubin & Laubin's discussion of the Tipi, a tiny percentage of partners is enough to keep the average mobile application warm and cozy, even in difficult weather. If collaborators continuously visit the app and update content on it, other members are going to find invaluable help and support with their Indigenous peers. The central attribute of the mobile application is the frequency of usage by Indigenous peoples. In other words, the partner/collaborator participation is the fire of the mobile application.

After the meaning of the fire is understood, the purposes of the smoke flaps need to be comprehended: during the summer months the vent, which is controlled by the flaps, may remain open to a view of the night sky and to harmonize with the warm temperatures. In the daylight hours a Tipi owner would hoist the vent open for additional lighting and also at the beginning of a new fire. The Tipi flaps are moved by the firekeeper with two poles (Laubin & Laubin, 1971, p. 2, 8-10, 110).

On the other hand, a push notification, also called server push notification, is the delivery of information from a software application to a computing device without a specific request from the client (Rouse, 2008a). Push notifications let applications notify users of new messages, updates or events, even when the users are not actively using such applications. The push notifications generate constant reminders and messages on the main screen of the phones, which allow users to engage in the different features of the mobile applications, even when those applications are closed. In other words, these push notifications regulate the frequency of usage of mobile applications.

Similar to the smoke flaps, which help to regulate the vent and the temperature of the Tipi, the push notifications regulate how frequently the partners are using the mobile application. Push notifications are used between different operating systems and they can be sent to different partners at the same time. Also, they help partners/collaborators to participate and engage in the different features within the mobile application.

In addition, in the same manner as the firekeeper is the person in charge of controlling the opening of the smoke flaps, certain roles inside the mobile app can send public push notifications (more details in section 5.6).

As I mentioned before, the smoke flaps are part of the canvas/cover of the Tipi and likewise, the push notifications are embedded in the mobile operating system. This aspect can be understood because the push notifications may be received when the mobile application is closed, so they are configured directly with the core of the operating system. In the case of Apple iOS, the configuration is through the Apple Push Notification Service and in the case of Android, through Google Cloud Messaging.

The complexity of the push notification infrastructure is beyond of the scope of this research, however, it is intrinsically linked to the backend database (the door pole – D). This strong relationship is due to the implicated process of authentication that is required for sending and receiving push notifications.

As in the discussion of the backend database, the security of the messages between the partners could be at risk if more details of the push notification system are revealed on this stage. Also, it is important to mention that their implementation in mobile applications is not required (as the smoke flaps are not always required in a Tipi).

Regarding the selection of different software and systems, the SDLC approaches propose analysis of feasibility and business models (Kendall & Kendall, 2011, p. 68-77). These

approximations can underestimate the users' needs because their main focus is on costs and financial benefits. The outcomes of this type of analysis are the estimates of profitability, according to each of the software options (e.g. databases, development frameworks, operating systems, etc.). Although this estimation can be a factor to be considered for the sustainability of the app in a long term, it cannot be a central element in the designing phase.

Even though this analysis was not considered, the selection of the poles/technologies is not an easy task. There are a high number of factors to take into consideration to decide upon the best options, especially because nowadays there are thousands of arrangements and combinations. In the specific case of this mobile application, it required more than 45 days and several difficult decisions to select the poles/technologies.

After the decisions around selecting the poles were made, it was time to place the tripod.

5.3 Placing the Tripod: finding the balance

In raising a Tipi, the most important part of the procedure is to properly place the tripod. This part of the Tipi serves as a base for the whole structure.

Also for the mobile application, the most important part was to place appropriately the tripod, which was made of the three poles previously selected: the Indigenous Iterative Method (software development method), Ionic Framework (software development kit) and the backend database.

The tripod is the relationships among these three poles (integration), which are essential to understand the boundaries and scope of the mobile application and how the voices of Indigenous peoples can be heard from within the software development method.

It may be argued that in this metaphor of the tripod, two groups of software tools, such as the SDKs and databases, are placed at the same level with methodological tools, such as the Indigenous Iterative method.

My argument about software designing methodologies resides on the methods to collect the narratives of the Indigenous members throughout the process has the same level of relevance as the technical software and hardware requirements.

The tripod is a clear need to evaluate whether the forms of gathering the requirements (i.e. the needs and voices) match the technology that is used to create software solutions. The same level of evaluation needed to select the required software tools are necessary for the instruments used to honour the voices by including Aboriginal student narratives.

A common practice of Information Technology (IT) professionals is to expend a considerable amount of time (or even money) to evaluate the software and hardware required for the IT needs. However, the methods to collect the needs and the feedback of the community, where these IT solutions are applied, are commonly underestimated or not considered as a priority. Perhaps, in a business environment, it may fulfill the requirements of IT, but in diverse populations such as Indigenous communities, the under-consideration of the voices of the people can result in IT solutions that are significantly far from the needs of the partners. Therefore, the examination of the input methods at the same level as the software infrastructure is primordial in an Indigenous methodology. In this specific case, this aspect is addressed through the particular metaphor of the tripod.

Basically, the tripod articulates how the voices and opinions of Indigenous peoples become technological needs/requirements (Indigenous Iterative method), which are transformed in software functionalities/features and expressed through Ionic Framework Solution. Later, these features generate data, which are stored and shared by the backend database. The

sharing of this data at the end of the process will allow Indigenous peoples to connect between each other (capability).

The absence of equilibrium in these poles means significant negative outcomes in the final version of the mobile application. For example, if a high number of iterations are done during the Indigenous Iterative Method, the quantity of resources and time required could be prohibitive. Therefore, the development of the mobile application would be interminable and the Ionic Framework (SDK) would become complex, and its overhead, excessive. Another example is that if the software development kit is not correctly connected to the backend database, the functionalities of the app (features) will be importantly affected because the overall application's performance would drop significantly. A last explanatory case would be if the Indigenous Iterative Method is not used, the Indigenous voices would not be heard and the outcomes of the development process might not address their needs.

After the poles were positioned, it was the time of tying. The rope that attached these poles together is the ethics and/or the principles of guidance. Without a firm clove hitch, the tripod loses equilibrium and the whole Tipi can lose his/her/their balance (the same can happen with the mobile application). Therefore, with the intention of having a firm rope and systematizing the information collected, I submitted all the documents required to get the approval from the Office of Research Ethics of York University, following the Guidelines for Research Involving Aboriginal/Indigenous Peoples of York University. The Ethics were based on the principles explained in Chapter 1 about Indigenous paradigms and recognizing the approval of the community that I explained in section 5.1 of this chapter. I received Ethics approval on July 10, 2015.

The next part of this section was to raise the poles of the tripod and put them into position. In this same way, I installed the required development software tools and kit in my computer (first pole), I designed and created the basic backend databases (second pole), and I started

to prepare the materials to collect the voices from the Indigenous collaborators of York University (third pole).

One of the most significant materials was the technique of the blocks. This method was used to explain the limitation of resources and the importance of the balance of the Tripod (Figure 17). The development of the mobile application became a common purpose instead of an individual objective. We were generating a collective application and everyone was going to have an active role in the creation process.

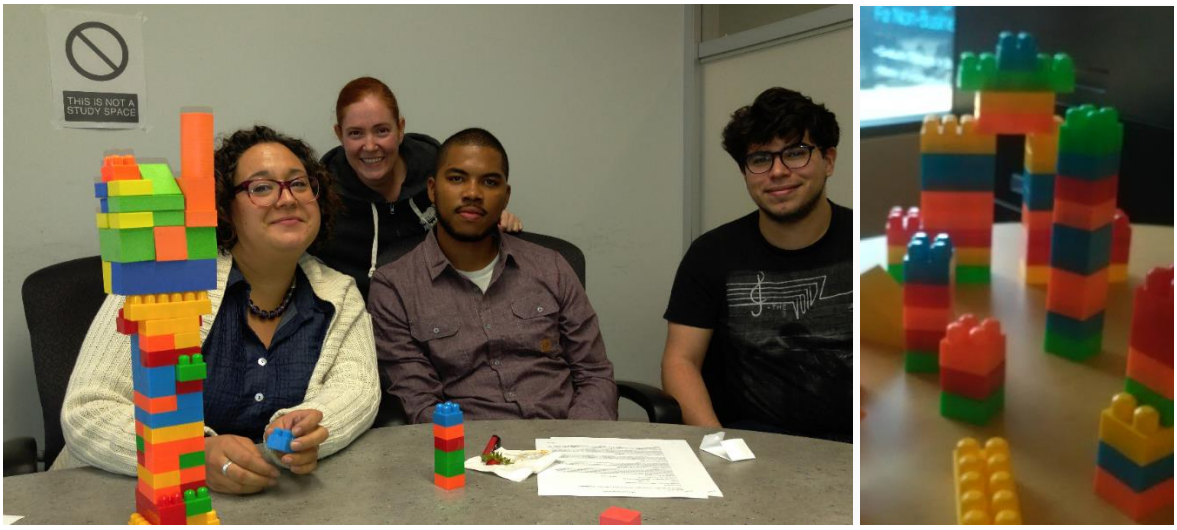

Figure 17. The technique of the blocks

Finally, after clarifying these principles with the collaborators, the structure was adjusted properly and was ready to receive the next poles (i.e. the features of the mobile application, which were created with the Indigenous voices).

In the case of the SDLC, the integration of the software systems with the needs of the users is addressed through prototyping. The opinions of the users are managed through sessions where a list of requirements is generated and the results are presented during subsequent sessions of the programming process (Kendall & Kendall, 2011, p. 159-162). This aspect is

aligned with the relational accountability of Indigenous methodologies because collaborators are involved in the whole design process.

In the next section, I explain each of the needs expressed by the Indigenous members of York University, including how they were transformed to the features of the mobile application through an open dialogue.

5.4 Putting the poles into position: creation of the features of the mobile application

The process of placing the rest of the poles was divided in 4 sharing circles and 20 conversations, which were carried out from August 2015 to April 2016 (Appendix A). In those sessions, 18 CASS members were involved: 2 Elders, 11 students (including me), 4 staff members and 1 faculty member. Of these members, 10 identified as First Nation, 6 as Métis, 1 as Inuit and 1 as an Indigenous person from outside Canada. Also, 7 identified as men, 9 as women, 1 as Two-spirit and 1 did not identify their gender. During all the sessions a two-way dialogue was performed.

The collaborators, who helped with their knowledge to create the mobile application were [listed in alphabetical order]: Billie Allan, Jared Visitor, Jesse Thistle, Jolene John, Joseph Milando, Laureen Blu Waters, Lisa Stewart, Mariah Abotossaway, Nancy Johnson, Randy Pitawanakwat, Rob Lackie, Robyn Grant-Moran, Ruth Koleszar-Green, Samantha Craig-Curnow, Serena Hill, Thane Higgins and Tsitra McKay. I, Alejandro Mayoral-Banos, was the developer of the total code, backend databases, online accounts, website and logo.

Besides these 18 members who were directly involved, there were another 8 people who, although they did not have a major influence, punctually provided knowledge, feedback, support and even financial resources to make this possible (3 identified as Indigenous and

5 identified as non-Indigenous). It should be noted that their contribution was always with the consent of the 18 CASS members.

Many of the concerns and feedbacks were expressed several times and many of the conversations were more than two hours long. Thereby, to simplify the analysis, I decided to organize this section into four major needs. Each of these needs, which are directly related to the challenges inside postsecondary institutions in Chapter 3, was transformed to requirements and then, from these requirements, specific IT solutions were proposed. These solutions are the features/poles of the structure of the mobile application/Tipi.

Moreover, as the poles were placed in a specific order in the structure of the Tipi, the poles of the mobile application were placed based on a side menu arrangement (Figure 18). This type of menu is intuitive and allows the addition of as many features as required. However, for other mobile applications, it may be changed.

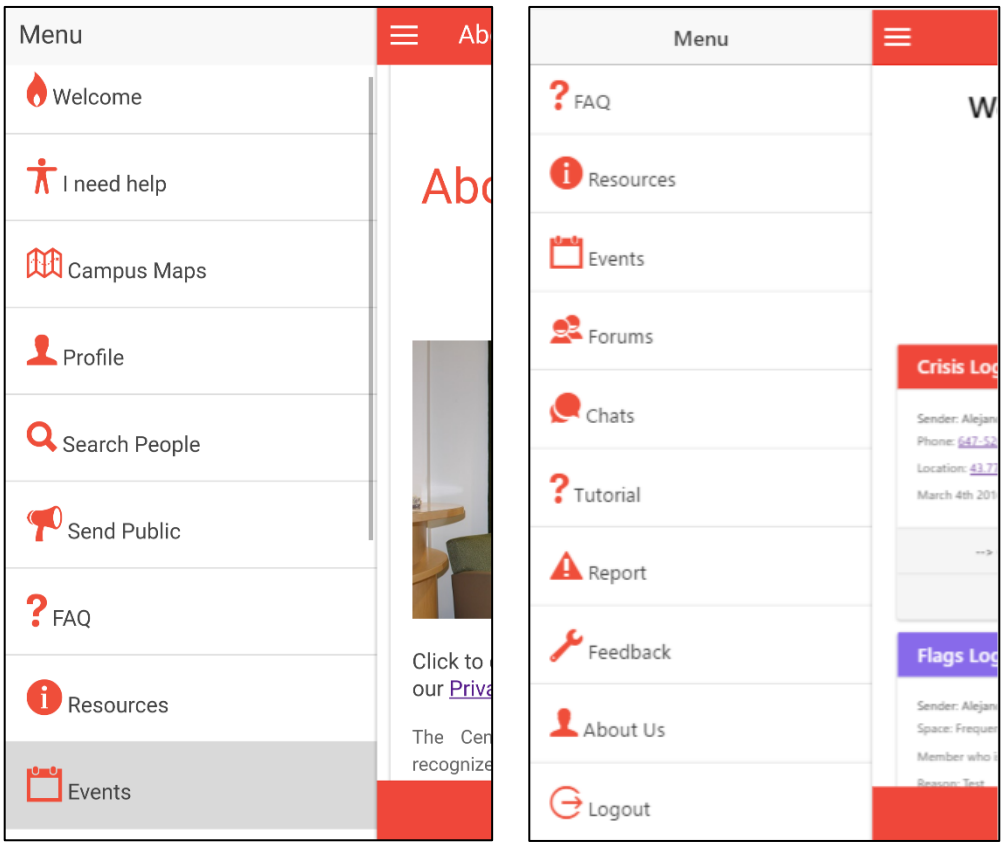

Figure 18. The menu arrangement of the mobile application. Scale 1:1[31]

A related point to consider is that the solutions/features that are introduced in this section are the final versions after all the feedback received from the conversations and sharing circles. In regard to adjustments, the major changes and considerations are explored in detail in section 5.6 of this chapter.

Before I explain the four needs, it is fundamental to state that these needs are related to each other, their complete solutions are complex and the mobile application is not going to totally solve them. The proposed IT solutions are not absolute answers for the difficulties of Aboriginal members in postsecondary institutions and they do not absolve postsecondary institutions of their responsibilities with Indigenous peoples.

[31] The Figures of the mobile application with screenshots want to provide readers a better insight of the user interface. The scale is based on the size of an Apple Iphone 6 / Samsung S6.

The four needs, their multiple requirements and solutions/poles were as follows:

a) Disconnection from their Indigenous identity. In all the conversations and sharing circles, directly and indirectly, there was a common struggle among all the collaborators: being in a Canadian university environment disconnects Indigenous peoples from their identities. Our beliefs, values and cultures differ significantly from the Western academia. This factor is directly related to the cultural loneliness, marginality and spirit breaking, as well as severing students from their communities mentioned in Chapter 3.

Requirement: A form of Identification inside the mobile application.

Proposed mobile IT solutions/poles: An authentication system, which includes a registration form with inclusive fields to identify the members (Figure 19a).

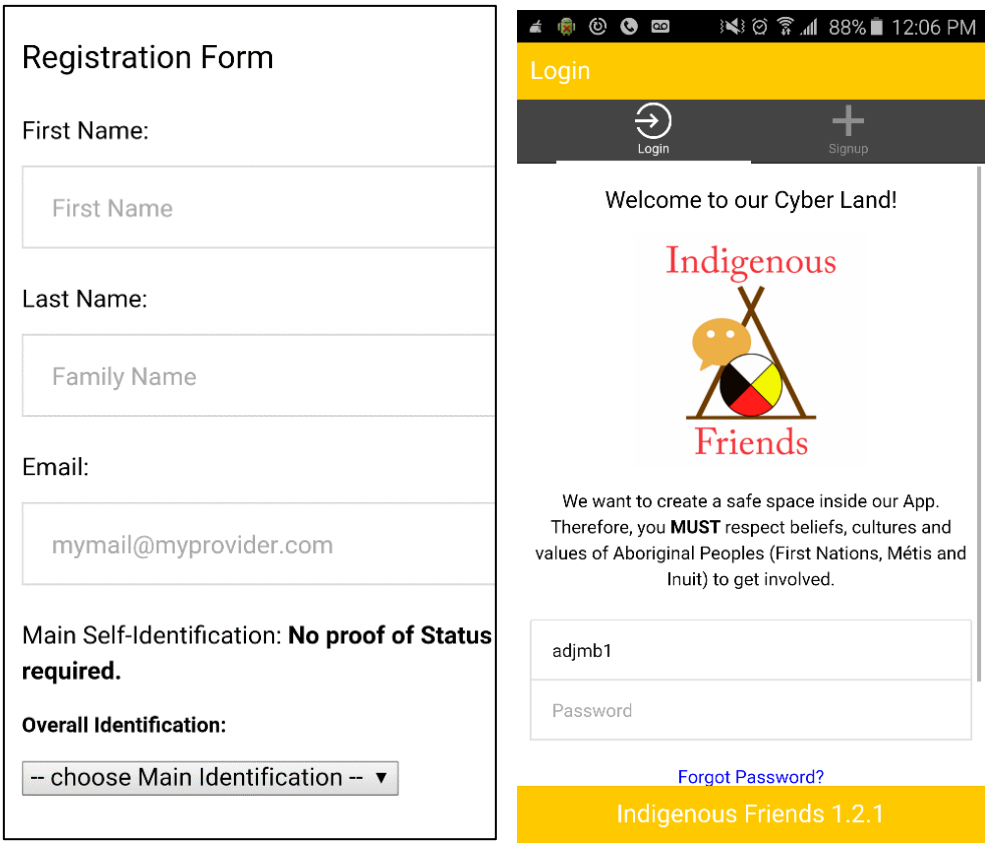

Figure 19. The authentication system
Scale 1:1

The registration form includes the following intuitive and common fields: first name, last name, email, year of birth, username and password. Nonetheless, special fields were included:

i) Main Self-identification (no proof of status is required): in this field the future partners are required to identify themselves in the following six categories: First Nation, Métis, Inuit, Indigenous outside Canada, Non-Indigenous and Unknown/Do not know yet.

ii) Region or province [in Canada]: in this field the future partners can select from among the 10 Canadian provinces, 3 territories or "Unknown/Do not know yet." In the specific case of Inuit peoples, they can select the four regions of Inuit Nunangat: Nunatsiavut (Northern coastal Labrador), Nunavik (Northern Quebec), the territory of Nunavut, and the Inuvialuit (Northwest Territories). This field is not required for people whose main self-identification is "Indigenous outside Canada" and "Unknown/Do not know yet."

iii) Nation or community: in this field the future partners who identify as First Nations can select from among the 636 Nations of Canada depending on the selected province or territory. The future partners who identify as Métis can select from among the 5 provincial Métis Federations. The future partners who identify as Inuit can select from among the 51 communities depending on the selected Nunangat's region. In all cases, the option of "Other" is available with a blank field in which and individual can type any other community name.

In the case of future partners who identify as being Indigenous from another country, there is the option to type directly the name of their tribe, nation or community.

This field is not required for people whose main self-identification is "Non-Indigenous" or "Unknown/Do not know yet"

iv) Institution of belonging: in this field the future partners can select their institution or organization of belonging. This field was required in order to start creating certain specific subgroups in some of the other features (e.g. Campus Maps, Forums, etc.). York University is the first option, but there is the option of "Other" with a blank field to type in the name of any other institution or organization. The option of "Other" was important because there was a common request from the members to include people outside of academia, especially people who are relatives and acquaintances.

v) Gender: in this field the future partners are required to identify themselves in diverse gender categories, such as: man, woman, two-spirit, transgender, LGTBQ, pansexual, asexual or other. This information is important for counselling and networking creation.

When the future partner fills all the fields, they are registered in the mobile application. Their information is kept private from other partners, except first name, last name, email, main self-identification, region or province and community (the privacy policy and security mechanisms of the partners are explained in the section 5.7).

Afterwards, the partners need to input their username and password in the login screen in order to access the mobile application/Tipi (Figure 19b). After they are logged in the first time, the session is saved in the device. This capability means that even if the partner is not connected to the internet, on subsequent occasions, they can access the features inside the app (although most of them may not be functional).

Inside the mobile application, the first screen that the partners see is the welcome screen with all the information they have inputted (Figure 20a). If they want to edit this information, they can go to the profile screen (Figure 20b) where all the information can be changed (except institution of belonging and username).[32] Other optional fields are available in the

[32] These two exceptions are due to the complexity of the design of the backend database.

profile screen such as: mentor/guide (explained in more detail in the last feature/pole of this section), brief personal description (a sentence to describe yourself), Facebook account, Twitter account, phone number and type of role's system (explained in more detail in section 5.6). In all the previous cases, the partners can select if they want to keep this information privately or publicly (more details in section 5.7).

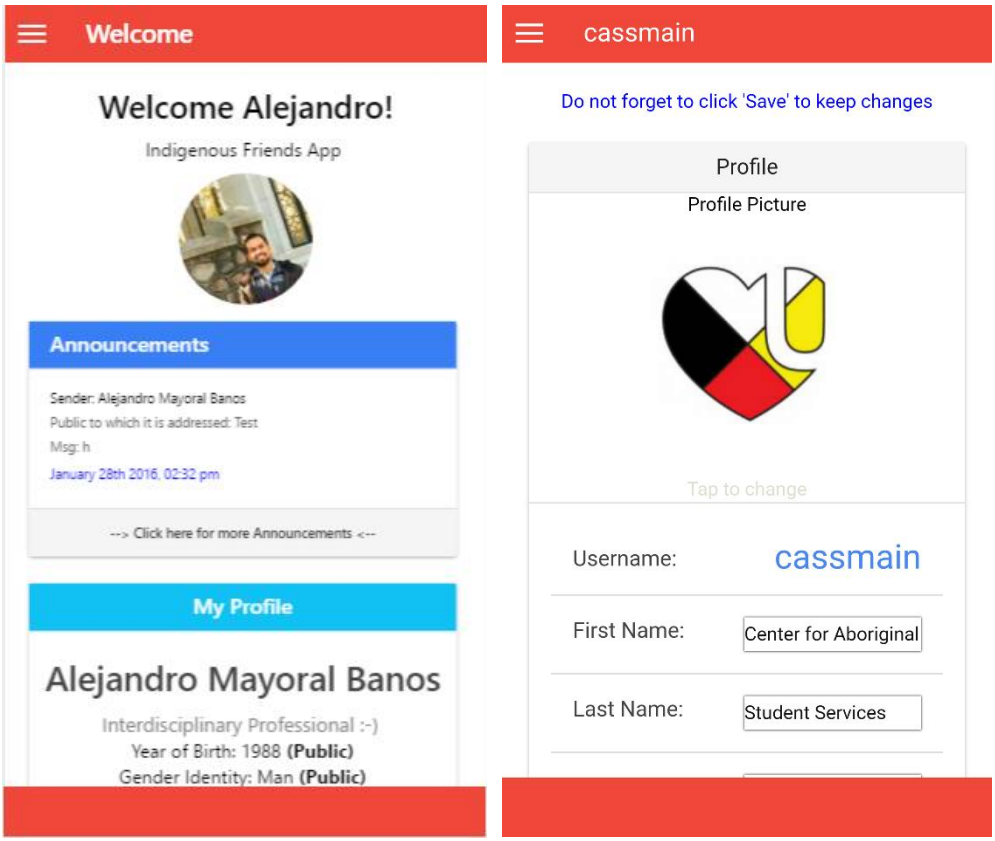

Figure 20. The Welcome and Profile Screens
Scale 1:1

b) Lack of Information: during the conversations, and especially during the sharing circles, the majority of the students said that there was a deficiency of information about available resources for Aboriginal members inside postsecondary institutions. For example, most of the students struggled to find information about funds and bursaries in their first year of university (this issue is related to the financial barriers mentioned in Chapter 3).

In the same manner, finding information about events near their area of residence or related to Indigenous issues was complicated for all of them. Two of the collaborators mentioned that even finding information about the facilities of the university was complicated for them when they began their studies.

Moreover, the students who lived on-reserve or in other provinces before their studies experienced difficulties finding information about housing, groceries and public transportation.

Requirement: Accessible information for all Indigenous members/partners of the mobile application.

Proposed mobile IT solutions/poles: four information screens about resources available for Indigenous members around postsecondary institutional campuses and cities (these screens were developed with the opportunity to include more postsecondary institutions).

The four information screens are the following:

i) Frequently Asked Questions (FAQ) Screen: the first developed information screen was the FAQ feature. On this screen the common questions about, for example, Indigeneity, the city, and postsecondary institutions, can be answered (Figure 21a). This section was developed for the first year students who are new to the institutions and the city. FAQs are ordered in subfolders. Different roles can generate new questions and answers (more detail in section 5.6);

ii) Community Resources Screen: in this feature, information about several Aboriginal centers, shelters, institutions, childcare, and organizations around the cities are available

(Figure 21b). Each resource has a field name, description, website and calendar (optional). Different roles can create new entrances on the resource screen (more detail in section 5.6);

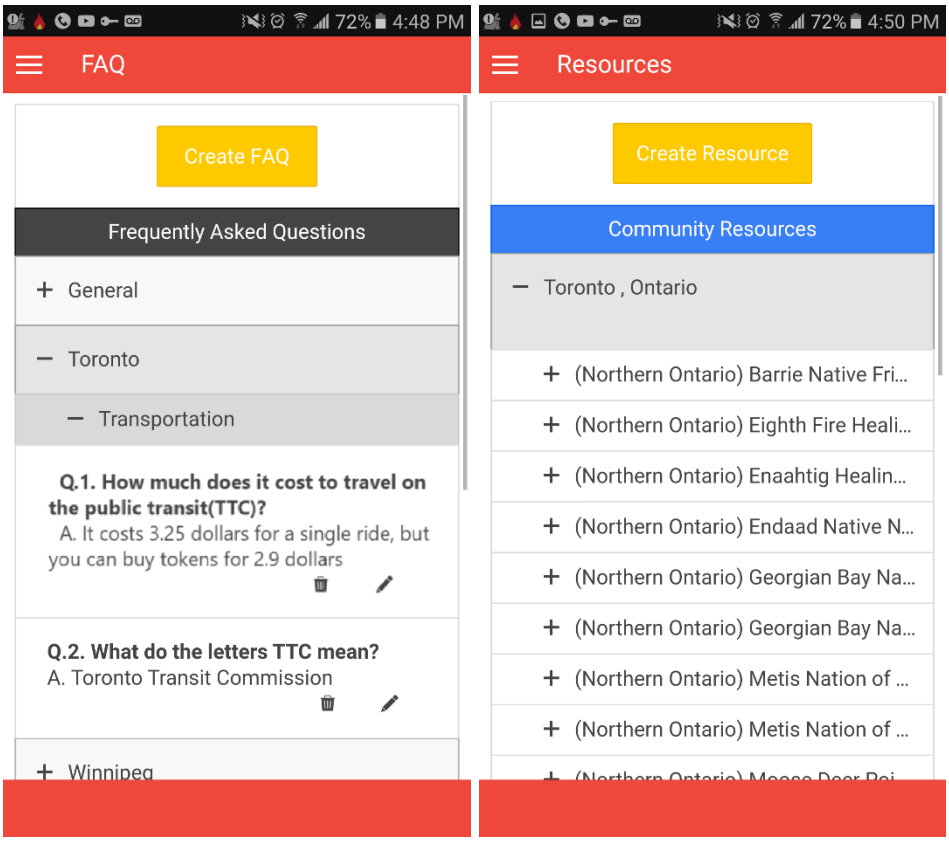

Figure 21. The Campus Maps and Frequently Asked Questions (FAQ) Screens Scale 1:1

iii) Events screen: in this feature, information about events around Indigenous issues, which at the same time are related to each of the institutions, are available (Figure 22a). Each event has the fields of name, description, location and start/end time. People can sign up & out of the event. The organizers of the event can obtain a list of the people who are assisting with the event (with contact information) or they can send a push notification to all the assistants for that particular event. Different roles in the app can generate new events (more detail in section 5.6)

iv) Campus Maps Screen: in this feature, the official public maps of the campuses of particular postsecondary institutions are available, including the regular map, accessibility map, emergency phones map and gender neutral/single stall washrooms map (Figure 22b). The regular map does not require an internet connection to open it. In the case of the other maps, they require internet connection, but they can be downloaded directly to the device after the first access.

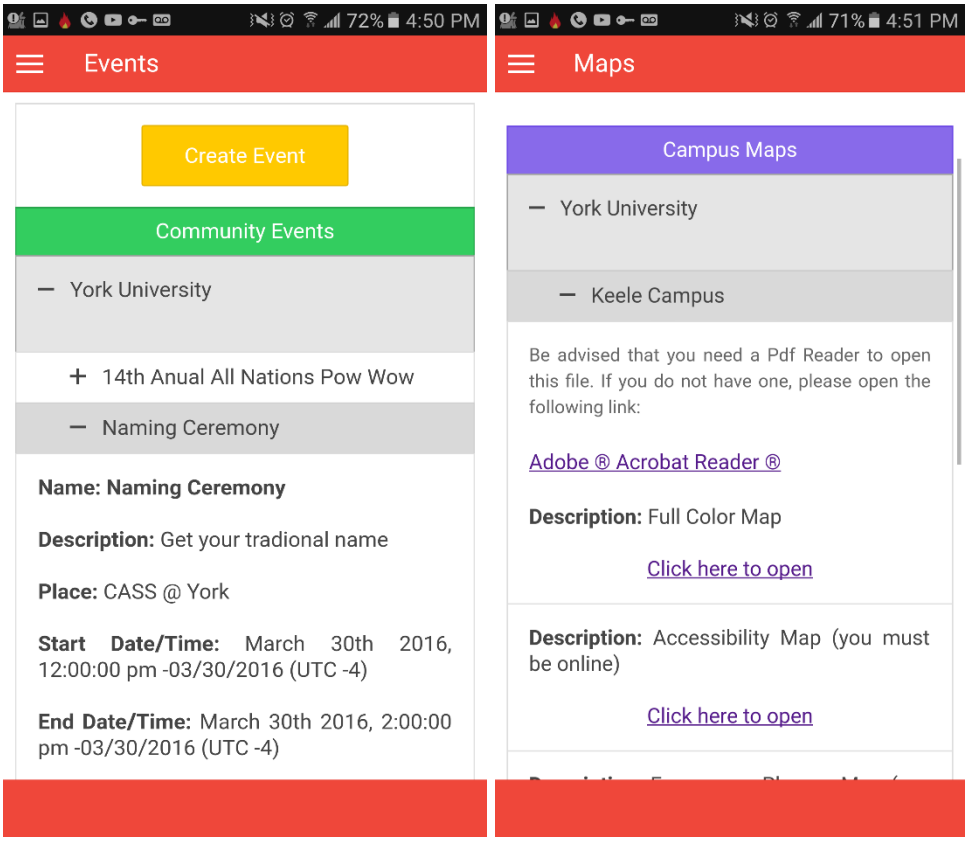

Figure 22. Events and Campus Maps Screen
Scale 1:1

As mentioned before, in order to guarantee the creation of content in the Events, FAQs and Resources screens, special roles were created, which are described in detail in section 5.6.

c) Difficulties in finding other Aboriginal peers for any type of support: a common challenge expressed by all collaborators is the difficulty of finding other Aboriginal members on campus. These struggles have different roots—which were mentioned in Chapter 3—such

as: the few employees who are contracted in postsecondary institutions (e.g. staff and faculty members), the spiritual breaking of Aboriginal students from being isolated in postsecondary institutions, the limited spaces for Aboriginal members inside the university. The support that Aboriginal members are seeking is in the four dimensions that are represented on the medicine wheel, as mentioned at the beginning of this chapter. These dimensions are physical, emotional, intellectual and spiritual.

With limited Aboriginal professionals in postsecondary institutions, the connection among the few Aboriginal members is required for healing and networking purposes.

Requirements: Generate Indigenous Networks inside the cyberspace[33] and create common spaces of discussion and gathering.

Proposed mobile IT solutions/poles: in the case of this requirement, three specific solutions were implemented: a public directory with chat capabilities, forums and public notifications. The development of these three solutions was the most complex and time- consuming tasks of the entire mobile application. Each solution generated privacy issues and security problems (which I address in the section 5.7 of this chapter). Each solution must have an internet connection to be functional.

i) Public directory with chat capabilities: in order to connect different partners of the mobile application with each other, a public directory was created (Figure 23a). In this directory partners have access to Indigenous (and some non-Indigenous)[34] profiles of people who are in postsecondary institutions (Figure 23b). The privacy of the fields can be changed in the

[33] The topic of cyberspace was previously discussed in Chapter 2 section 5 "ICTs: Colonizing or Decolonizing Indigenous People?"

[34] This issue about non-Indigenous members is addressed in section 5.6.

profile screen, as previously explained in Figure 20b. Within the detail view of the profile, there is the capability to start a private chat directly with another person (Figure 23c).

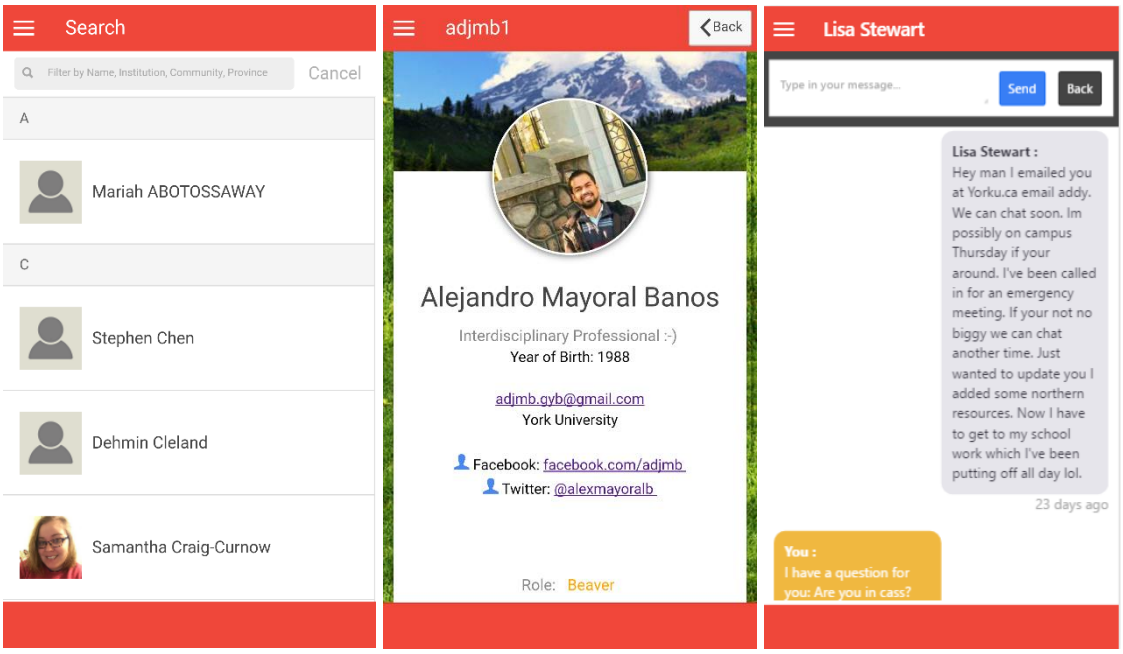

Figure 23. The Public Directory, Detail Profile and Chat Screen
Scale 1:1.3

ii) Forums: in order to create public common spaces where issues around Indigeneity could be addressed, the feature “forums” was created (Figure 24). The forums are basically public chats where people can discuss different topics and generate new ideas. Forums can be created by everyone and all of them are public. People can report harassment or discrimination inside the forums, and they can block people from entering a specific forum. All the forums are personalized and organized in different folders.

Without doubt, this feature/pole was the most difficult, time consuming, and technically challenging of the whole mobile application. Placing this pole into position necessitated moving other poles several times (even the tripod poles), especially because of privacy policies and permissions required.

The overhead caused by this screen is significantly higher than other poles and therefore, the balance of the tripod is especially important on this feature.

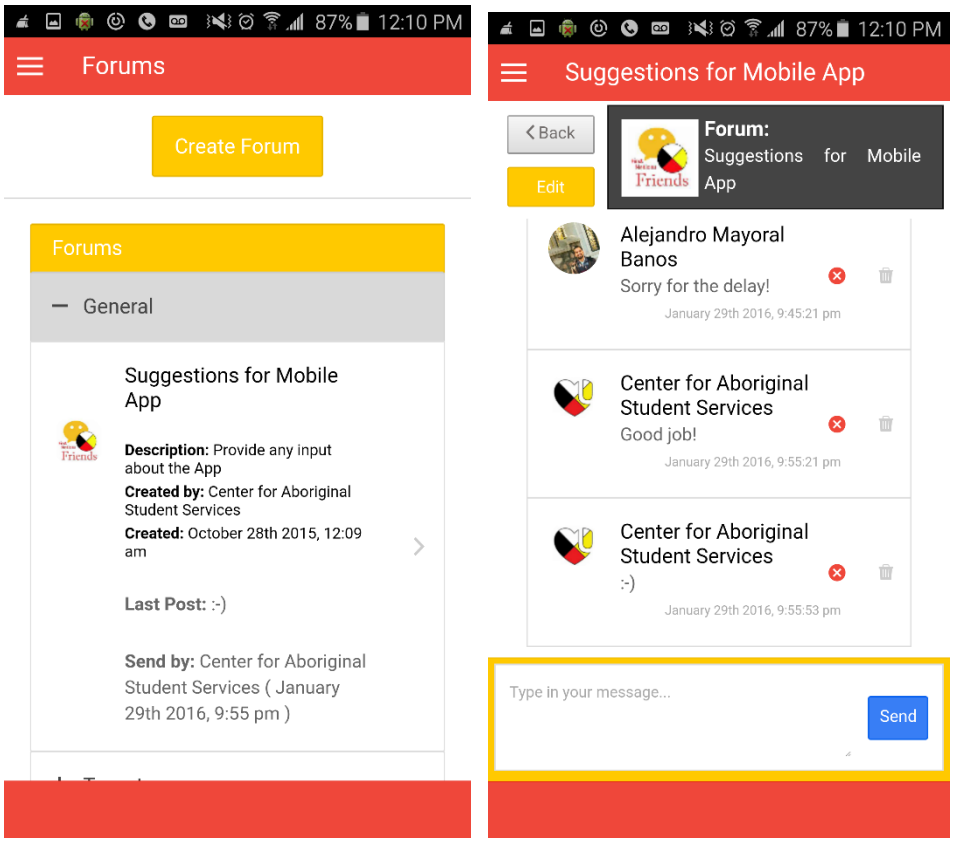

Figure 24. Forums Feature/Pole
Scale 1:1

In order to guarantee good behavior in the forums, the role of the moderator was created; this is described in detail in section 5.6.

iii) Public notifications: in order to engage more people to participate in different features, a screen to send public notifications was created (Figure 25). There are three main channels of distribution through which these public messages can be sent: Downloaded (people who have downloaded the application; they can be either logged in or not), General (people who have downloaded the application and have logged in) and York University (people who have downloaded the application, have logged in and their institution of belonging is York University). This can be very helpful for partners' participation and engagement in different

activities. This feature is related directly to the smoke flaps/push notifications and therefore, there are specific roles assigned to people who are in charge of this pole (more details in section 5.6).

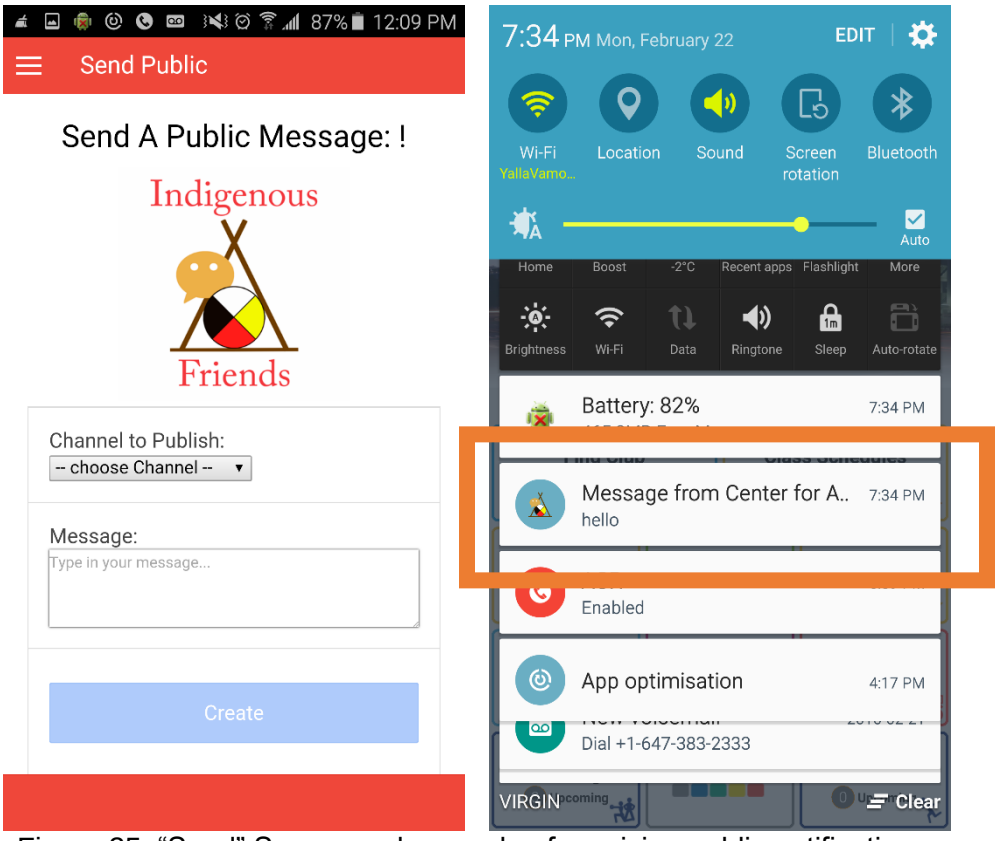

Figure 25. “Send” Screen and example of receiving public notifications. Scale 1:1

A log queue with all the announcements is shown on the welcome screen – Figure 20a (which by default is the first screen that is shown when the app is opened).

d) Depression and isolation: a common topic that was transversal in all the private conversations was the cultural disconnection that Indigenous members suffer in postsecondary institutions. This rupture is caused by several factors previously mentioned in Chapter 3 (i.e. the intergenerational trauma of residential schools, the severing of students from their communities, language barriers, spirit breaking). Nonetheless, the consequences

of this disconnection, such as depression and isolation, are the major concerns and challenges among Indigenous students at York University.

In the specific case of the York University population, these consequences were specifically related to cultural loneliness and spirit breaking. There is an urgency for Indigenous students to connect with traditional counsellors and Knowledge Keepers, especially in moments of high stress or anxiety (e.g. exam periods, couples' breakup). In at least two cases where students migrated from the countryside (including reserves), there was a lack of support from the students' households due to the large distances to the city, resulting in a cultural disconnection from their communities and families. In one of the sharing circles, the collaborators expressed that depression is a common occurrence for Aboriginal students in a university environment and this type of factor leads people to attempt suicide. As stated in Chapter 3, the high rate of suicide among Aboriginal youth is disturbing, and it is not decreasing. Indeed, in one of the conversations, one of the collaborators talked about a personal attempt of suicide.

Requirement: Access to traditional counselling and Knowledge Keepers through the Indigenous Networks.

Proposed mobile IT solutions/poles: creation of a help screen where members/partners will have different buttons that they can tap to access traditional counselling. This communication is through the embedded technologies of the mobile device (i.e. phone calls and SMS text messages). This service does not need an internet connection after the partner/member has logged in the first time (Figure 26a).

The available communication options through these buttons are as follows:

1. Your Mentor by phone call

2. Your Mentor by SMS text message

3. Your Guide by phone call

4. Your Guide by SMS text message

5. Native Youth Crisis Hotline (Emergency): '877-209-1266'

6. Anishnawbe Health Mental Health Crisis Line: '416-891-8606' (Toronto)

7. 911 Emergency line: '911'

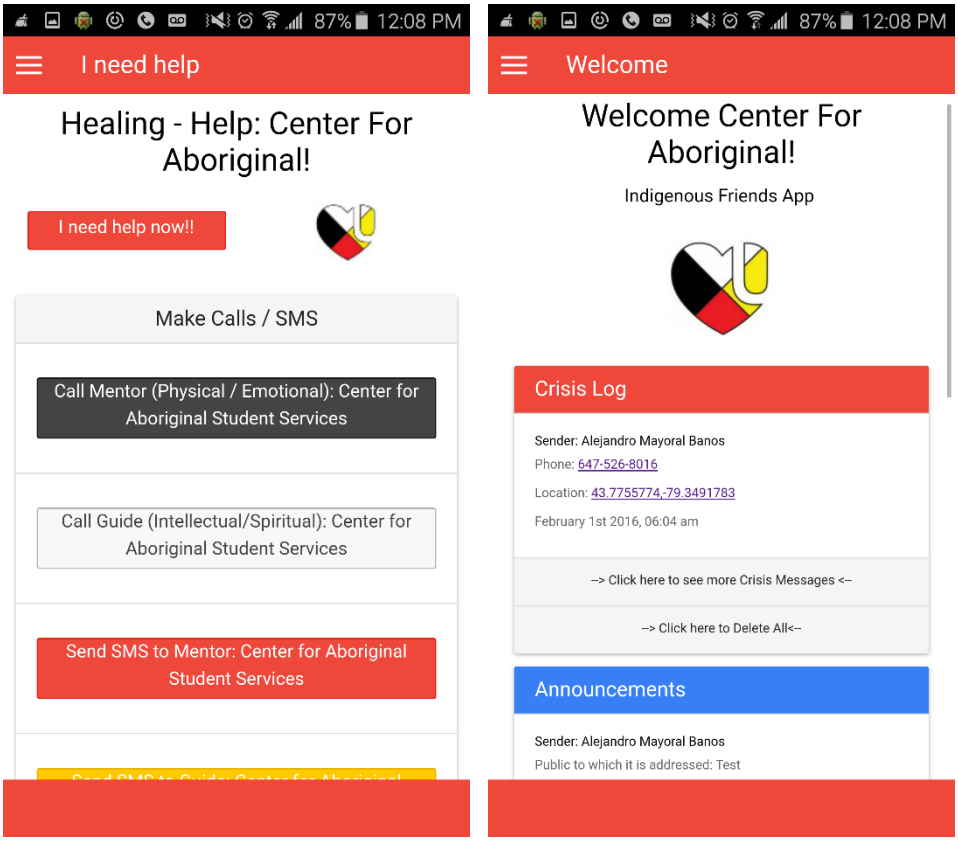

Figure 26. Help Feature and Crisis Log on Mentor/Guide Screens
Scale 1:1

When any of these buttons is tapped, a pop-up screen appears on the device with the contact phone number (the person does not need to type anything), and then, with another simple confirmation tap-on-the-screen, the person will be able to make a standard phone call to the specific support center or person through the phone line subscription service. The reason for this design is because in a moment of personal crisis, the perception of the person

changes and most of the time, he/she is not able to type any phone number or text. Therefore, simplicity is a strong requirement.

In the SMS option, a pop-up screen appears in the default message application on the mobile application with the following text:

> "Call me, please! I'm NAME_OF_THE_PARTNER [Note: It can be an emergency] (delivery through the Indigenous Friends App)"

Again, the person can confirm just with one simple tap and the text will be sent through the standard SMS text service.

In regard to the guide and mentor, they are two Indigenous persons inside the mobile application. The mentor and the guide are people who are part of the community, and who can support other Indigenous peers in their different dimensions. These people are Elders and/or Traditional Knowledge Keepers and/or Aboriginal Faculty members who are capable of providing support and guidance to other people (in the next section 5.6, the roles are explained in more detail).

This support system is based on the four human dimensions of the medicine wheel. The mentor is in charge of the Physical and Emotional dimension and the guide is in charge of the Intellectual and Spiritual dimension. For example, if a partner is depressed because he/she is having a hard time with his/her partner, then he/she would communicate with his/her mentor because the emotional dimension is affected. On the other hand, if this same partner is depressed because of his/her academic performance or cultural isolation, then he/she would communicate with his/her guide because the intellectual dimension is affected.

However, as the medicine wheel teaches, this division is not strict at all. All the dimensions are connected and rely on each other. The partner can talk with either the guider or the mentor.

Indeed, every partner in the mobile app, including mentors and guides, can change their own mentors or guides on the profile tab, as shown in Figure 20b. However, only certain people can be mentors or guides in the mobile application (more details in section 5.6).

The purpose of this separation is to divide responsibilities, provide more options to the partners and to have a better understanding of the type of professional and traditional profiles that are required for guidance and mentorship.

The last aspect of this feature/pole is the top button of “I need help now!,” which is shown in Figure 26a. If this button is tapped, a confirmation screen will pop-up, just in case it was tapped by mistake. If the person confirms that he/she needs help at that particular moment, the following actions will take place:

1) His/her geolocation (i.e. latitude and longitude) and phone number will be sent to his/her mentor and guide. The phone number will be: Not Available, if it was not introduced in the profile screen (Figure 20b). In the case of the geolocation, the feature has to be enabled on the mobile device. If it is disabled, then the values of latitude and longitude will be: Not available. Either way, the values are sent to their mentor and guide with a push notification;

2) A pop-up screen will appear in his/her screen with the phone number of his/her mentor, so then, he/she can confirm to call him/her;

3) The notification will be received by the mentor and guide as a push notification (Figure 26b). When they open the notification, the default map application on their mobile phones will pop-up with the geo-location of the partner (if available) who needs help. At the same time, a second screen will pop-up with the phone number of the person (if available), so they can call her/him;

4) A queue log of reports will be generated, and will appear on the mentor and guide welcome screen (Figure 26b).

In case, the partner does not have an internet connection at that particular moment, he/she can still call his/her mentor (action described in point 2). The other actions will not be performed.

It is fundamental to recognize that this topic is complex, and cannot be addressed simply with an isolated IT solution. However, the collaborators and I believe that this feature/pole can improve dramatically the experiences of Aboriginal youth in postsecondary institutions.

After this long journey of healing and listening, finally all the poles were placed into position. The capabilities of the Tipi/mobile application were ordered and created. The main structure of the mobile application was ready, however, the canvas/cover, the adjustments and the door were still missing.

5.5 The Canvas and the logo of the mobile application

As mentioned in section 5.2, the operating system is the lifting pole with the canvas/cover of the mobile application/Tipi and it has a direct relationship with the graphic appearance and performance of the application.

Before any graphical appearance was designed, it was necessary to prepare the lifting pole with the canvas and place it into position. In other words, it was required to start preparing the particular specifications of each operating system in order to have all the features of the mobile application available on both platforms (Apple iOS and Google Android). The detailed explanation of these technical specifications is not significant for the scope of this research.

However, on the other hand, the canvas/cover needed a graphic component. In the case of the physical Tipi of York University, the canvas was already painted, therefore its decoration was not necessary. But in the case of our mobile application, that canvas was blank, ready to be painted. The first thing to decide for the canvas's design was the name of the Tipi/mobile application. It was a common and recurrent topic in all the conversations and sharing circles. Throughout the sessions, several decisions were made:

a) The name should not be in any specific Indigenous language because it can be ironically misunderstood among different Indigenous groups. Also, there are members/partners who belong to different Nations and to select any language could be problematic.

b) The name should be simple and easy to remember.

c) A word related to Indigeneity should be included and the word 'Aboriginal' should be avoided because it can be misunderstood. Indeed, the term 'Indigenous' was the unanimous choice of the collaborators.

d) The name should be inclusive of all Indigenous groups.

Based on these decisions, the name that was chosen for the Tipi/mobile application was the Indigenous Friends App.

After the name was decided, the graphic logo was required. The logo had different transformations until the final version was approved by all collaborators on November 5, 2015 (Figure 27).

Figure 27. The transformation of the logo of Indigenous Friends App

The Figure 27c shows the final version. Indigenous Friends App is a mobile application that seeks to generate a cyber space for Indigenous youth through a safe environment. It aims to provide access to traditional Counselling and information about spaces, events and general facts around Indigenous topics. Also, it allows young Indigenous students to build networks for sharing information and to support peers in their life journey.

The three elements, which are included in the logo are fundamental to understanding the mobile application. First, the Tipi, as I have already explained, was the fundamental element to create this mobile application. Second, the medicine wheel represents the balance that all the partners are seeking inside the application. Finally the conversation globe represents the partners who are in the Tipi.

One last graphical factor to consider is the red quarter of the medicine wheel. It embodies the emotional dimension of human beings and represents the stage of life of Aboriginal youth and therefore, all the internal menus were decided to be created with a red color.

The operating system, the canvas and its design were ready. The next step was the adjustments and placing the crossbars to close the canvas.

5.6 Crossbars and adjustments: system of roles

After the canvas cover was unfolded and placed correctly on the poles, the adjustment of the poles and canvas was mandatory. In the same way, the placement of all the features/poles and canvas/design within the mobile application required adjustments in the majority of them. Moreover, new needs were generated based on the original solutions mentioned in section 5.4.

The final versions of the features/poles were already shown in that section and, therefore, the explanation of their specific adjustments is irrelevant for the results of this methodology. However, it is just important to state that each pole/feature had numerous adjustments, which were recommended by the collaborators during the sharing circles and conversations. In this regard, the role of the seven external supporters was also essential because they provided feedback and specific comments about certain features.

Nonetheless, there were certain adjustments, which were not related to any specific feature/pole, but were fundamental to comprehend the overall operation of the mobile application. I decided to call those four adjustments “crossbars,” because they are not related to the specific needs of the people (i.e. they are not poles), but they are necessary for the operation of the mobile application/Tipi (i.e. they help to close the canvas to protect the poles). As stated before, these new needs are based on the solutions proposed before in section 5.4. These adjustments were as follows:

a) System of roles: throughout of the explanation of the features/poles, an important issue was exposed. Certain activities inside specific features have a high level of responsibility (e.g. the guide and mentor in the help screen, the moderators in the forums feature, the content generators in events, resources and FAQs, etc.). Furthermore, there were doubts

about whether non-Indigenous peoples were going to be able to sign up and what role they should have inside the mobile application. Therefore, a system of roles was created based on Animal Clans or Color Groups (Table 4). All people have a role in a software application. The roles are the functions and responsibilities assumed by a person in a particular software environment. In the case of the Indigenous Friends App, seven different roles were created.

It is extremely important to understand that these “cyber” Animal Clans or Color Groups do not correspond with the real clans or the color groups’ tradition of the people. For example, if a person belongs to the Turtle Clan in his/her traditional culture, his/her clan inside the mobile application will not necessarily be “Turtle.”

One of the longest arguments during the sharing circles was about which role or person was going to have the responsibility to change or control other roles inside the mobile app. The consent was that Beavers and Wolves can change certain roles without the consent of the Eagles or Owls, such as Turtles, Bears, Wolves and Beavers, but anyone who wants to become an Eagle or Owl (i.e. anyone who wants to be a mentor or guide) must have the consent of at least two Eagles or Owls.

In the same regard, Eagles, Owl and Wolves have the right to block a partner from the application in case they consider that the person has been harmful for the community or a member (the reports are explained later in this section). This procedure has to be through the Beavers, as the block procedure must be done through the backend database.

This kind of system of roles significantly differs from the common IT systems roles based just on administrators and users. Specifically, the SDLC approach proposes to create a decision making analysis trees and process specifications forms to generate different roles and process manuals (Kendall & Kendall, 2011, p. 266-373). This common type of settings in IT would not fit into the traditional forms of thinking of Indigenous peoples because they

would adapt business rules to traditional responsibilities. The system created on the mobile application wants to incorporate the Indigenous roles into the functionality of the application. Furthermore, these roles are trying to balance the levels of power inside mobile application/Tipi. There is not a “superuser” role, which can do all the actions within the app. The responsibilities and duties are distributed among the partners.

Table 4. The System of Roles of the Indigenous Friends App

Names	Description	Profile	Responsibilities
Eagle / Yellow	They can see the 'big' picture from the sky of the partners and they are professionally prepared to give emergency aid in case it is required (crisis).	-Elder or Traditional Knowledge Keeper. -Experience and/or knowledge in crisis management	- They are mentors who are in charge of healing the Emotional and Physical Dimensions (Help feature). They need to respond to the calls, messages or help notifications. -They must provide their full contact information in order to be reached. -They can send public notifications to the community - They can block users from the entire app.
Owl / Red	They have the wisdom of traditional knowledge and the academia. Commonly, they have an academic background. They are prepared to give emergency aid in case is required.	-Indigenous Faculty members or Traditional Knowledge Keeper. -Experience and/or knowledge in crisis management	-They are guides who are in charge of healing the Intellectual and Spiritual Dimensions (Help feature). They need to respond to the calls, messages or help notifications. -They can share new available resources with the partners through the feature of “community resources.” -They must provide their full contact information in order to be reached. -They can send public notifications to the community -They can block users from the entire app.
Wolf / Black	They are known as protectors. They are looking inside the different spaces of the mobile application in order to guarantee the security of the spaces. They are caretakers of our community.	- Indigenous Faculty members or Indigenous Staff members or Traditional Knowledge Keeper or Alumni. -They should have a form of decision making in the	-They are the moderators of the forum. They should visit the forums frequently to see if there are not forms of discrimination or harassment. They can block and unblock partners from the forums. They can delete the content of any user. -They can create events and have access to the information about the partners who signed up.

Names	Description	Profile	Responsibilities
		environment where the application is being used.	-They can share new available resources with the partners through the feature of “community resources.” -They can create new frequently asked questions to share with the community -They will receive reports of harassment or bad behavior in the case is necessary. -They can send public notifications to the community -They can block users from the entire app.
Bear / Blue	They are traditionally the warriors as well as the healers. They have gained this position through experience and failures.	-Indigenous students of the 3rd/4th years or graduate or Alumni -They should have previously been in the environment where the mobile application is being used.	-They are also the moderators of the forum. They should visit the forums frequently to check for any form of discrimination or harassment. They can block and unblock partners from the forums. -They can share new available resources with the partners through the feature of “community resources.” -They can create new frequently asked questions to share with the community -They will receive reports of harassment or bad behavior.
Turtle / Green	They are strong and powerful to support the adversities. They are swimming and walking to find their life path. They are the main purpose of the application.	-Indigenous student or member	-They have access to all the resources previously explained in section 5.4. -If they see any type of discrimination or harassment, then they should report it.

Names	Description	Profile	Responsibilities
Marten / White	They are agile and adaptive to their environments. This role is the adopted clan /group.	-Non-Indigenous people who are allies of the app. - They should be supporting the mobile application in any form.	-They can use any of the spaces as turtles. -In the case they see any type of discrimination or harassment, they should report it.
Beaver / Orange	They are the constructors of the application. They are the builders of the space.	- Non-Indigenous or Indigenous members with a computer science background. -They should be familiarized with Indigenous cultures, values and beliefs.	-They are in charge of the maintenance of the app. -They can create content with the approval of the wolves or bears. -They can change the roles of people, with certain restrictions.

Notes:

1. The partners can select animals or colors depending on their personal preference. For the majority of First Nations and Métis peoples the system based on Animal Clans has more sense and this is the same for Inuit people with Color Groups. Anyway, the system used is interchangeable in the profile screen (Figure 20b).

2. The animal clan system is not based in any specific cultural tradition. Therefore, the duties or responsibilities of the clans may vary among different traditions. The current responsibilities and duties of the roles were determined in collective agreement among the collaborators whom are from different cultural traditions.

3. All the partners when they finish the registration process previously described in section 5.4, are considered part of the Turtle Clan / Green Group if they identify as Indigenous or Unknown. If they identify as non-Indigenous, they are considered part of the Marten Clan/White Group.

b) Report system: with public and private spaces within the mobile application, where partners can share information with other peers, security, harassment and discrimination issues are likely to occur. Therefore, the need to create mechanisms of reporting to track those cases was compulsory. This system allows partners to send notifications to the Wolves and Bears about any situations of any inappropriate behavior or offensive content. This mechanism has three main parts:

1) The Report Screen: all the partners in the mobile application can report any suspicious activity through this screen (Figure 28a). It can be related to specific features or not. A brief description or explanation is required to send a report.

2) The Report Icon in public spaces: In the case of the public spaces, i.e. the forums, there is an icon to report the comments of partners, which are considered discriminatory or offensive (Figure 28b).

3) The push notifications and the report queue (harassment report): when either action 1 or action 2 is performed, the Bears and Wolves receive a push notification, with the information of the partner who is being harassed, and then they can take specific actions about it. All these reports appear in their welcome screen (Figure 28c).

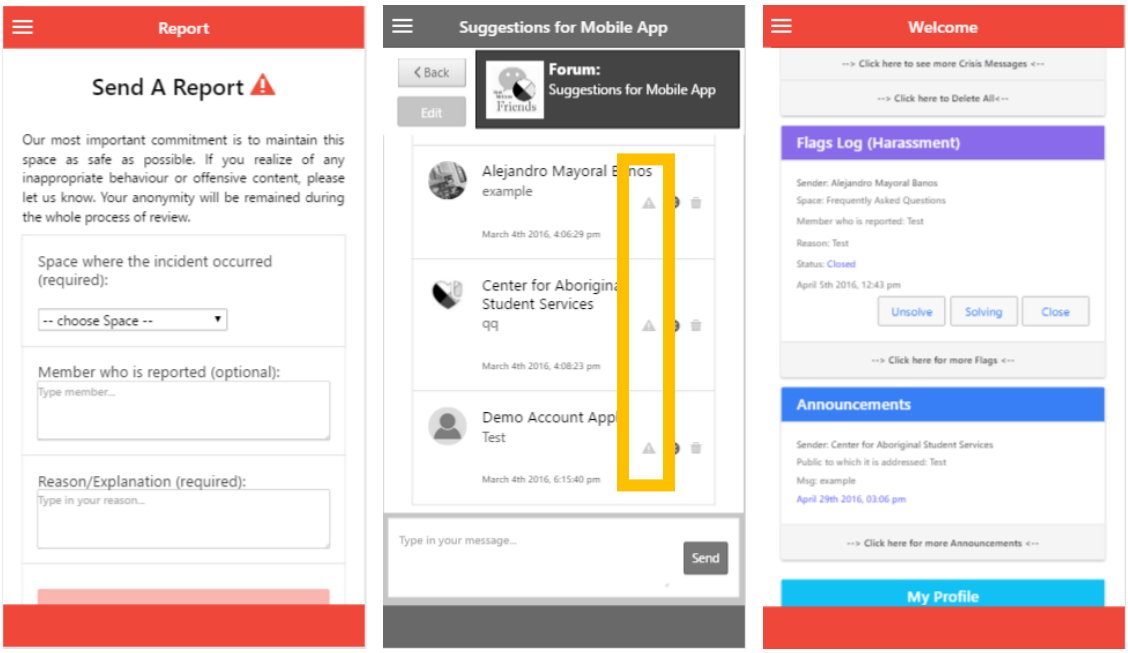

Figure 28. The Report System
Scale 1:1.3

c) Feedback: the service requested during the conversations was a permanent open channel of communication with the Beavers (developers) to send feedback when needed. Therefore a “Feedback” Screen was created (Figure 29a).

d) Tutorial: the complexity of the functionality of the mobile phone, although easy to understand, cannot be taken for granted. Therefore a small tutorial of 10 slides was implemented to help new users to comprehend the roles and the main features/poles inside the mobile application (Figure 29b & 29c).

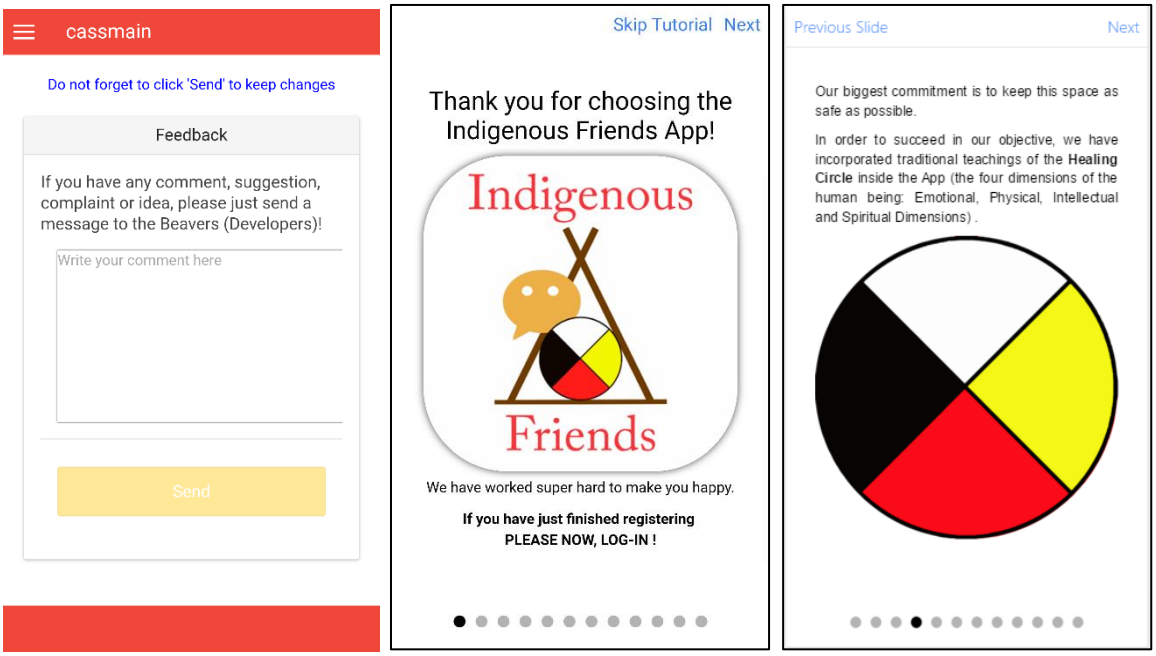

Figure 29. The Feedback Screen and the Tutorial
Scale 1:1:3

With these crossbars/adjustments in the mobile application, the canvas/cover was ready. The only missing elements to finish the ceremony were the door and the lining for the protection of the Tipi's occupants.

5.7 The Door and the Lining: The Access Code and the Privacy Policy

After finishing all the features/poles and adjustments/crossbars of the mobile application, a last set of requirements was needed. As stated in Chapter 2, Tipis are spaces, which provide safety, comfort and privacy. In the same way, the mobile application wants to be a cyberspace with such characteristics.

However, in the previous sections of this chapter, several potential problems around privacy and security were exposed, such as the possible harassment and discrimination inside the forums and chats, and the privacy of the personal information in the public directory, among other factors.

In a Tipi, there are two elements, which help in this regard, which are the door and the internal lining. When a person crosses the door of a Tipi, that human being is accepting the protocols the Tipi's owners have in regard to the behavior, beliefs and values that must be followed inside of such shelter. In the case of the internal lining, it prevents rain from dripping off the poles, cleans the atmosphere of smoke, and prevents the castings of shadows from the fire to the outer wall (privacy), among others. Therefore, in the case of the Indigenous Friends App, the placement of the door and the lining were extremely important.

5.7.1 The Door: Access Code

All the collaborators were worried during the sharing circles about the issue of identifying themselves in public spaces where some troublemakers may access and start harassing people inside the different spaces. Therefore, I decided, along the collaborators, to create an access door to our Tipi/mobile application. This "access door" was a lock screen before the login screen (Figure 19b), where the partners need to type a unique code to start using the mobile application (Figure 30). This ACCESS CODE was "Mississauga."

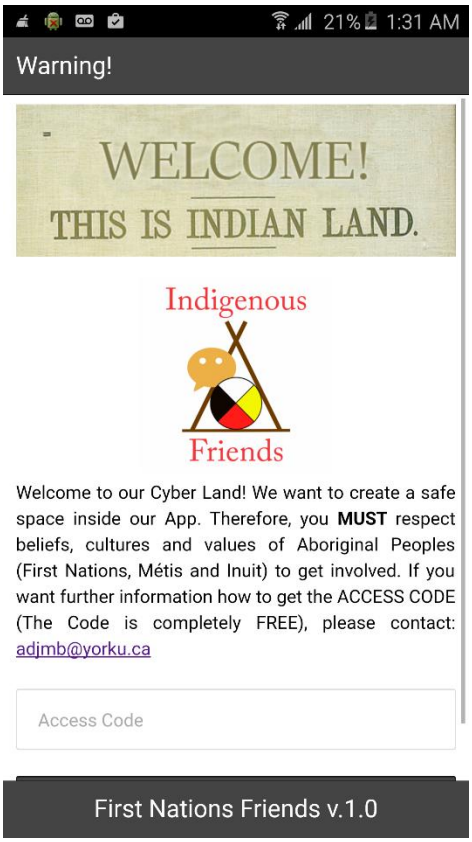

Figure 30. The Door/Access Code Screen of the mobile application
Scale 1:1

This screen was used to create a first filter of the partners who wished to use the application. After the ACCESS CODE was entered the first time, it was saved in the mobile device and did not need to be input again. Moreover, the new partners, who may potentially have entered this code, would have given their consent to follow the protocols and ways of understanding of Indigenous peoples.

Indeed, this unique code also wanted to be a land statement of the place where this Tipi/mobile application was raised and born. It was a recognition of the traditional land on which the software development methodology, conversations and sharing circles were performed (more details in Chapter 2).

This ACCESS CODE was completely free of charge for all partners and was expected to be shared by the Center for Aboriginal Student Services through its emailing list and social media platforms. In the case of non-members of York University interested in joining, a contact email address was provided. However, as I explain in detail later in this section, this specific feature was changed because it was not accepted by Apple Inc.

5.7.2 The Lining: the Privacy Policy

Along with potential accessibility challenge of the mobile application, the privacy and the access to personal information was also a concern. Therefore, their possible solution through the internal lining was an important issue to be addressed. As well as the internal lining is composed of three main rectangles that are directly tied to the poles, three specific elements were created as part of the lining of the mobile application. These components are:

a) A privacy policy was developed in order to guarantee that all the partners understand the implications of being in the mobile application;

b) The option to block other partners. If a partner is blocked by another partner, the blocked partner cannot have a chat conversation with the person who restrained him/her and moreover, the person who is performing the blocking cannot be found through the public directory by the blocked person;

c) In the profile screen (Figure 20b), all partners can select the fields, and whether or not they want to share with other partners, such as phone number, email, Facebook account, twitter account, gender, and day of birth. The options are private or public.

It is important to recognize that these three actions are not infallible. Nonetheless, it will depend on the community and the responsibility of the different roles (which were explained in section 5.6) to maintain this space free of discrimination and harassment. This mobile application is a collaborative space for which everyone must care. Therefore, the responsibility is not just for one person, but it is for the whole community.

On the other hand, the SDLC approach recommends the creation of security policies which are completely centered in the Information Analysts and/or the IT departments. These guidelines usually give all responsibility to the IT professionals and the users are not involved in the process (Kendall & Kendall, 2011, p. 542-546). This contrasts with the Indigenous points of view, where every person within the communities has a function.

Finally, all the parts and elements of the Tipi were collocated and the journey of raising the Tipi/mobile application was expected to be in their last stage. The Birth ceremony, which started in January 2015 was projected to finish at the end of January 2016 with the submission of the mobile application to the two mobile software distribution platforms.[35]

5.7.3 Apple and the acceptance of the Tipi's door

In the case of the operating systems that were used to create this mobile application, the distribution platforms were Google Play in the case of Android, and Apple Store for iOS. To publish in these spaces, the procedure is pretty simple, consisting of paying fees and opening developer accounts in both platforms: Google Developer Program for Android and iTunes Connect for Apple.

[35] In the mobile market, the legal and reliable form of dissemination of mobile software is through distribution platforms. Commonly, these distribution platforms are embedded in the operating system of the mobile device. Basically, these platforms are search engines where users have access to all the software (free or paid) that can be installed in their devices.

An incomplete version of the mobile application was submitted to both platforms on January 15, 2016, in order to check if there were any problems of compatibility or any breaches in Google or Apple guidelines. This unfinished version already had all the poles/features, as well as, the door/access screen and lining/privacy components. The Android version was accepted on the same date (January 15) and the Apple version was accepted on January 21, 2016.

Two weeks after that first acceptance, the final version of the app was finished and submitted on February 1, 2016. The publication of the mobile application on both distribution platforms was going to signify the feast at the end of the ceremony. However, that did not happen as expected.

The same day of submission, the Google Android version was accepted. In the case of the Apple version, I was contacted after four days by email by the Apple Review Team,[36] because they wanted to know more about the purposes of the ACCESS CODE Screen (i.e. the Tipi's Door). I replied with an explanation of the reasons of security (which I have already described above) and finally, they answered me on February 12, 2016 through a first rejection notice of the mobile application.

The Apple Review Team considered that even though, in that screen it was stated the ACCESS CODE was FREE of charge, I was trying to make profit from it[37] and I had to incorporate the Apple purchase system (which redirects 30% of the profit to Apple). This

[36] This group of developers in San Francisco, California, United States is the one in charge of reviewing all the mobile applications for the Apple iOS.
[37] According to Apple, the code can be sold in other markets without their consent.

was a contradiction because in the test version of January 15, the ACCESS CODE was already included. I appealed to the decision and I got a second rejection on February 15, 2016.

On February 16, 2016, I submitted a new version of the app with a change in the ACCESS CODE Screen (i.e. the Tipi's Door). The ACCESS CODE screen was going to be used exclusively for registration purposes (Figure 31), i.e. the first screen would be the login feature instead of the ACCESS CODE screen, but the only way to register/signup into the app (and therefore to have a username and password), was going to be with the ACCESS CODE. Also, with the purpose of avoiding misinterpretations, I changed the name from ACCESS CODE to MEMBERSHIP TAG. This MEMBERSHIP TAG is used by several brands in their mobile applications, where their customers or clients cannot register through the mobile app, but they have particular external procedures to sign up new customers (e.g. retailers, fitness centers, etc.).

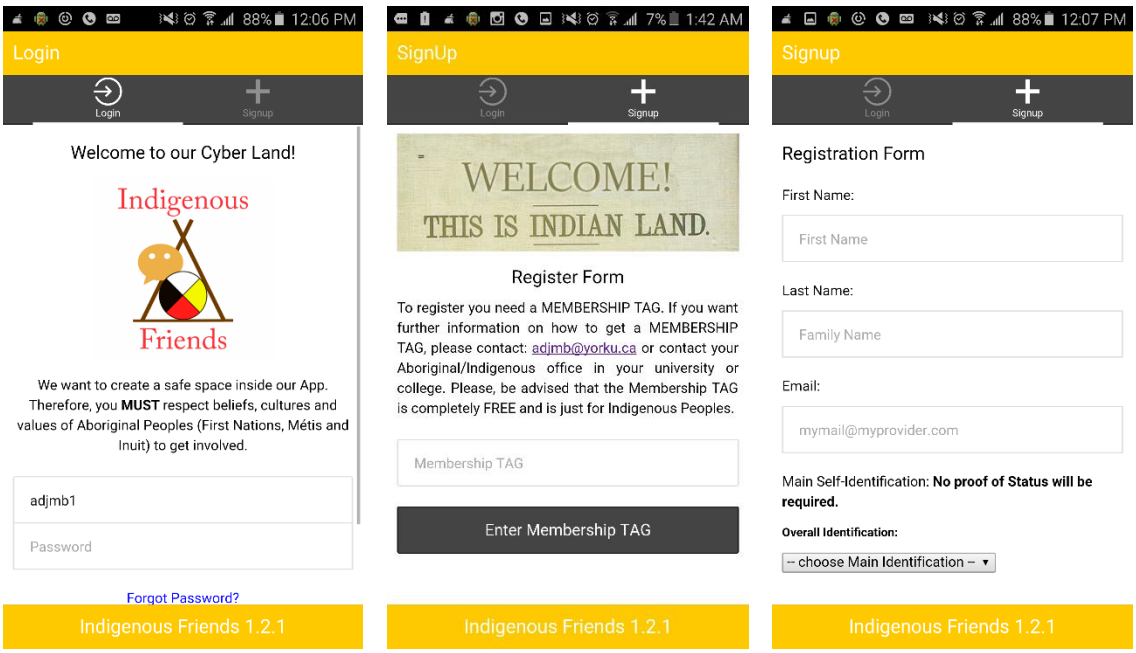

Figure 31. The incorporation of the MEMBERSHIP TAG
Scale 1:1.3

On March 2, 2016, I received a call from Apple Review Team to notify me that the Indigenous Friends App was going to be rejected again. I explained that the purposes of the app were not to create profit, but they were to support Indigenous members inside postsecondary institutions. However, the position was clear during that call: they were not going to accept any type of code or tag inside the mobile application without incorporating Apple purchases system. They told me that if we wanted to maintain the mobile application for free, the signup process should be open for every Apple user or should be outside the mobile application.

In the next days, I decided to go for the second option in order to maintain a safe cyberspace inside the mobile application. Specifically, I created an Internet website to host the registration screen. In this scenario, the signup procedure would be the same as previously described (entering the MEMBERSHIP TAG screen and then completing the registration form), but through a website: www.Indigenousfriends.org (Figure 32). In other words, the registration screen was taken out of the mobile application.

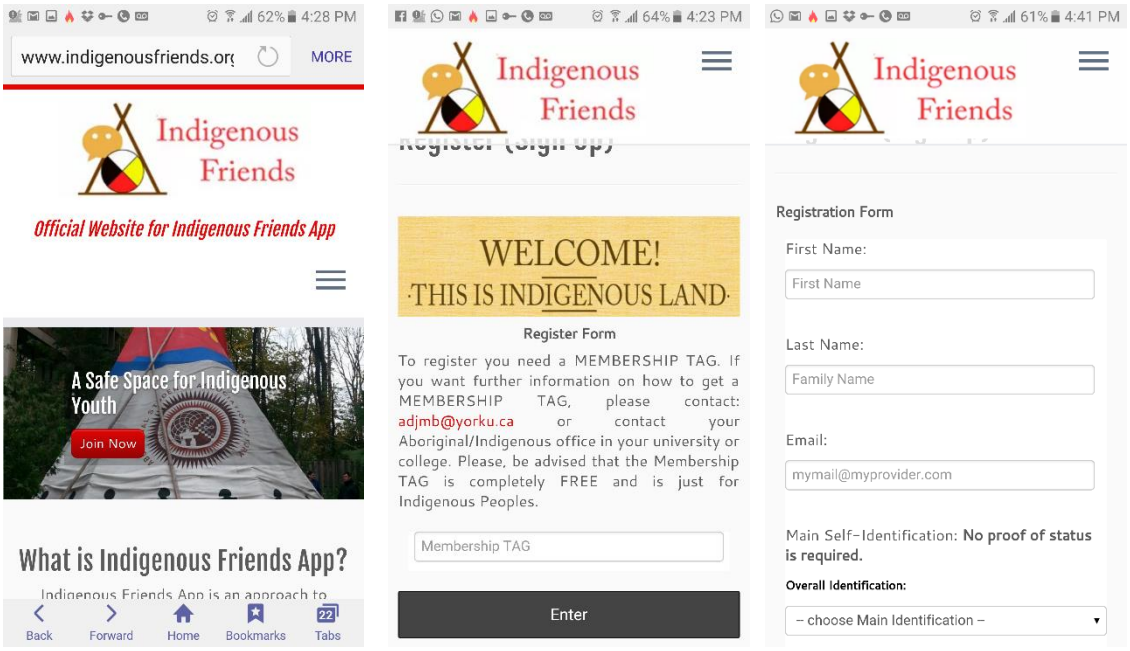

Figure 32. Website for Indigenous Friends App.
Scale 1:1.3

The creation of this website signified that the new partners needed to open a browser (outside of the app) in their devices, enter the MEMBERSHIP TAG, complete the registration form, and then when this is done, go back to the mobile application. This procedure has to be done just once. In order to facilitate the process, I included a link to the website, below the login button on the login screen (Figure 31a). On March 4, 2016, I sent this new version to Apple.

After two weeks of waiting, on March 17, 2016, I received a second call from Apple Review team to notify me that the mobile application was going to be rejected again. They were not going to accept any link to an external website. However, they offered that if the website link was removed, the mobile application was going to be approved and put in a priority waiting list. That same day, I sent the requested change (i.e. deleting the link from the login screen). And finally, the mobile application was approved in the early morning on March 18, 2016.

It is important to state that the average waiting time to receive an answer from the Apple Review Team is between 3.5 to 4.7 days including weekend days (Shiny Development, 2016). However, in the case of the Indigenous Friends App in the second and third submission, we waited 15 and 11 days, respectively. The total time for approval was 47 days.

Finally, the mobile application was finished and it was time for the feast to celebrate the birth of the Tipi. The mobile application became a place of gathering and sharing among Aboriginal children, youth, Elders, knowledge Keepers, scholars and allies. On May 2, 2016 there were already 28 partners enrolled.

Throughout this c*eremony*, to create the Indigenous Friends App, the incorporation of the Indigenous knowledge about Tipis was fundamental. The success of including these teachings in each step of the ceremony was an essential part of the whole creation process. The ways and methods of understanding (e.g. sharing circles and conversations) were included as an elemental part of the software design methodology and the voices of all Indigenous collaborators were heard throughout of this procedure. In contrast with these outcomes, the analysis of the SLDC approach provided an understanding of why this type of software methodology does not fit Indigenous paradigms and how they have difficulties to integrate the vast majority of Indigenous knowledges and cosmologies due to the universal and standards forms that are required.

Therefore, the effort taken to explain each part of the Tipi was to offer the reader an understanding of the importance of the traditional teachings in Indigenous research and the key role they are playing, not just in this thesis as an academic outcome, but as a form of creating new applicable solutions in the new era of information and communication technologies. Traditional teachings are not just historical knowledge of Indigenous people, but they are an essential element to create new knowledge and technological solutions for contemporary Indigenous challenges. The incorporation of the Indigenous knowledge of Tipis throughout the software methodology was a potential decolonizing instrument that empowered the partners in a collaborative process that ensured the incorporation the Indigenous points of views and ways of understanding. This first approach recognizes the importance of exploring technological and methodological principles to create more Indigenous software applications with, and based upon, decolonizing principles.

6 Conclusions and next steps

Throughout the chapters of this research, I have explored a new methodology necessary in the creation of Indigenous software. In the first chapter, I started with the exploration of Indigenous methodologies and their connotations in academic research. Then, I engaged in a discussion of the implications of Indigeneity and technology as argued by different scholars and activists around the world. Next, I provided details about the context in which this research was developed. Finally, I described the epistemology and methodology to create the Indigenous Friends mobile application through the metaphor of the Tipi, including several contrasts of such methodology with the standards of the software industry and academia.

The incorporation of Indigenous knowledge and ways of understanding was a transversal part of the software designing methodology within all its phases, including conceptualization, creation and development. This mobile technology is potentially decolonizing because it was developed by/for/with Indigenous peoples through a process that valorized Indigenous knowledges and emphasized culturally appropriate methods during the whole process of creation of such application.

This software methodology is the outcome of a transdisciplinary analysis of different perspectives, including the circumstances of Indigenous peoples in postsecondary education, Indigenous research methods, the traditional knowledge of Tipis and several methods of software development. The equal integration of this knowledge was fundamental to generate potential decolonizing instruments (instrumentality) as they are the case of the software methodology and the mobile application.

The exploration of diverse approaches of Indigeneity and technology in Chapter 2 provided the principles to create such methodology because it considers most of the empowering

aspects presented throughout the discussion. First, the mobile app includes the Indigenous knowledge and cultural values of the Tipis that allows partners to “domesticate” this type of technology to the needs of the Aboriginal youth within Canadian postsecondary institutions (i.e. Dyson’s concept of “domestication” and Heidegger’s aspect of instrumentality). Second, traditional protocols (especially the Tipi protocols) are considered within the internal functionality of the software, which allows the application to be thoughtfully and respectfully implemented, keeping the needs of the recipients (Oppenneer’s fundamental considerations of ICT for Development). Furthermore, it takes the Pre-Indigenous approach of Richard Heek because it marks innovations around processes and solutions that are devised by Indigenous peoples with reference to their own self-defined needs. And finally, the mobile application creates and integrates spaces of different expressions through several features (e.g, forum, resources, chat, etc.), which embrace interculturality and diversity (Monasterios’ consideration of ICTs).

Furthermore, the particular mobile application of this research is a technological solution, which resides in two of the five usage categories that I adopted to classify the different examples of technology and Indigeneity. First, it is a type of communication between people and their communities through several features, such as forums and chats, as well as a form of accessing public services of traditional counseling (Elders) and resources (e.g. organizations, governmental agencies, Native centers, etc.) for Aboriginal youth.

However, this is a work that is still in progress where the evaluation of usage and impact of the mobile application is required to prove the effectiveness of this software methodology. There are still instruments needed around the world to measure the impact of these technologies within the context of Indigenous peoples. The standard evaluation forms of software applications do not fit with the Indigenous epistemologies and the ways of well-being, and they need to be “domesticated” for the requirements of Indigenous cultures.

Even though the evaluation of usage and impact is beyond this research, diverse inferences were possible to conclude around Indigenous software methodologies throughout the process of creation of the mobile application.

The attitude of the community has been positive and receptive to the idea of incorporating traditional knowledge (i.e. the Tipi) into new forms of technological approaches. The use of traditional Indigenous forms to gather information, including sharing circles and conversations, could compile in a better manner the needs, opinions and voices of Indigenous peoples, which could then be translated into real solutions that would benefit Indigenous peoples' lives. Furthermore, the potential of reaching Aboriginal youth and other sectors of Indigenous populations is high because mobile devices are common nowadays in the lives of the majority of Indigenous peoples in Canada (as stated in Chapter 3). The creation of private and particular spaces for Indigenous peoples is a meaningful aspect for the majority of the partners of the mobile application because other types of technological approaches (e.g. Facebook, Twitter, Whatsapp) do not incorporate Indigenous knowledge and ways of understanding into their functionality. All the partners agree that there is a high level of probability to positively impact the struggles and difficulties of Aboriginal students in postsecondary institutions, and even at the secondary level.

Furthermore, new poles/features, which were beyond the scope of this first approach can be developed to improve the services that are offered to Aboriginal youth through the mobile application. These include: first, the inclusion of Indigenous orality through the integration of different type of media, such as images, sounds and videos; second, the possibility to have Newsfeed channels to subscribe to different organizations and groups; and finally, the possibility to import and export certain content to other social media platforms such as Facebook or Instagram.

It is important to highlight that despite all the considerations of other types of knowledge to create software applications, there will be always a dependency on other software technologies. As it was explained through the tripod in Chapter 5, the mobile application relies on other technologies, which belong to different organizations or enterprises. This factor means that even though Indigenous peoples include their teachings and ways of understanding, there will be a dependency on the policies established by different organizations or enterprises. In other words, the Indigenous Friends App relies on different operating systems, such as Apple iOS and Google Android, in order to function, and will therefore always be dependant upon them.

Nevertheless, this dependency does not mean that Indigenous voices and knowledge should be adapted to, or underestimated by, these entities. The incomprehension and unwillingness of the Apple Review Team in order to accept the protocols of the Tipi/mobile application within the final review process was a factor, which put at risk one of the main purposes of this technological approach: the safety within the Tipi/mobile application.

The technological approaches created by/for/with Indigenous peoples cannot be led by entities, which are not part of Indigenous lives or communities. Software applications must be adapted to the requirements of Indigenous peoples. The software solutions for this type of problems should prioritize the Indigenous knowledge over the technical requirements in order to avoid changing or modifying the Indigenous ways of understanding. Indeed, the modifications of the mobile application, which were mentioned at the end of Chapter 5, rely on the technical aspect, but not on the Indigenous knowledge. Despite the long delay and negotiation, the membership tag is still an important part of the functionality of the mobile application and the technology was adapted to it and not otherwise.

In order to sustain the mobile application and to measure the impact of this type of approach, the mobile application will continue to be developed through the MAMOW SHA-WAY-GI-

KAY-WIN: North-South Partnership for Children. This Indigenous organization is a dynamic and evolving partnership that began in 2006 as the coming together of First Nation Chiefs, Elders and youth living in remote communities in northwest Ontario with caring individuals and volunteer organizations based in southern Ontario. This partnership responds to the identified needs of children, youth, families and communities in remote First Nations of Ontario. The mobile application will continue to serve in the CASS community of York University, but it will expand to other communities and institutions through this organization. Since April 2016, I have been an active member of this organization and I expect to measure the impact of this application during my doctoral studies in York University.

In order to evaluate the impact, the continuous participation of the partners (i.e. the fire of the Tipi/mobile application) is vital, as is the integration of more Elders and traditional Knowledge Keepers to the project. The promotion through different channels (e.g. social media, Native centres, person to person, etc.) is required to have an active community. Then, when a constant level of frequently active partners is reached, the design and implementation of Indigenous social indicators will be necessary to measure the impact of the mobile application within different Indigenous populations.

Finally, it is important to mention that the outcomes of this type of methodological approach to create software can potentially mobilize other overlapped sectors of Indigenous populations, such as the missing and murdered Aboriginal women[38], as well as Urban Aboriginal populations. The correct implementation of features such as geo-location, push notifications and live communications of mobile devices can have significant positive impacts in the support of many other Indigenous lives.

[38] For example, a mobile application that can benefit sex workers through the services of geo-localization and instant messaging.

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Appendices

Appendix A: List of Sharing Circles / Conversations

Collaborators (alphabetical order): Alejandro Mayoral Banos, Billie Allan, Jared Visitor, Jesse Thistle, Jolene John, Joseph Milando, Laureen Blu Waters, Lisa Stewart, Mariah Abotossaway, Nancy Johnson, Randy Pitawanakwat, Rob Lackie, Robyn Grant-Moran, Ruth Koleszar-Green, Samantha Craig-Curnow, Serena Hill, Thane Higgins and Tsitra McKay.

Sharing Circles

Assistants	Date
Jolene John, Joseph Milando, Lisa Stewart, Thane Higgins, Ruth Koleszar-Green (5)	September 29, 2015
Jared Visitor, Mariah Abotossaway (2)	October 6, 2015
Robyn Grant-Moran, Ruth Koleszar-Green, Tsitra McKay (3)	November 5, 2015
Jared Visitor, Joseph Milando, Lisa Stewart, Robyn Grant-Moran, Serena Hill, Thane Higgins (6)	January 21, 2016

Conversations

Name of the person	Date
1. Laureen Blu Waters	August 19, 2015
2. Laureen Blu Waters	September 28, 2015
3. Robyn Grant-Moran	September 28, 2015
4. Randy Pitawanakwat	October 6, 2015
5. Nancy Johnson	October 7, 2015
6. Billie Allan	October 8, 2015
7. Rob Lackie	October 9, 2015
8. Thane Higgins	November 3, 2015
9. Jesse Thistle	November 5, 2015
10. Samantha Craig-Curnow / Lisa Stewart[39]	November 10, 2015
11. Serena Hill	November 10, 2015
12. Joseph Milando	November 19, 2015
13. Mariah Abotossaway	November 27, 2015
14. Laureen Blu Waters	December 11, 2015
15. Laureen Blu Waters	January 23, 2016
16. Jared Visitor	January 28, 2016
17. Ruth Koleszar-Green	January 29, 2016
18. Randy Pitawanakwat	February 5, 2016
19. Nancy Johnson	February 18, 2016
20. Lisa Stewart	April 5, 2016

[39] This conversation is not considered a sharing circle because the protocols of a sharing circle were not followed.