

**DESIGN APPROACH FOR BUILDING TECHNOLOGY WITH
INDIGENOUS COMMUNITIES**

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Abstract

An increase in demand for mobile platforms in the last decade has led to a widespread need for platform development methods. While these standards do work well for a majority of mobile developers, one audience that can be neglected is the urban Indigenous population of youth in Toronto. Through experience, relationships and an understanding of significant cultural practices and teachings, this study proposes a unique mobile development approach. This approach is tailored specifically towards urban Indigenous youth in Toronto, incorporating the Anishinaabe Medicine Wheel, 7 Grandparent Teachings, and Sharing Circles as main influencers. It also features an experience report of how the mobile development approach worked in practice. Two mobile platforms were built using this approach and achieved successful results, with both becoming popular applications within their respective target audiences. This approach places a focus on the users and essentially aims to have the target audience be the main deciding factor in how the developed platform looks and functions. The motivation behind this study is to make technology less exclusive, and more accessible to a diverse population.

Dedication

To my parents, Shan and Subia Rizvi, who were always proud even if they didn't know what I was doing.

To my siblings, Hammad and Ayna, who always let me speak my thoughts out loud.

To my cousin, Kisa, who gave me the space and time to do this work.

To the women of the Rizvi family: Zehra Baji, who went on this journey with me, and Hira Baji and Azka, who never let me forget that I had more research to do or more sentences to write.

And to Ali, of course, who never let me give up.

Acknowledgements

I would like to acknowledge the land on which this work was conducted. While a majority of this thesis was written on Anishinaabe, Haudenosaunee and Mississauga land, it would not have been possible without the sacrifices and suffering endured by generations of Indigenous people who came before me and those who I am surrounded by to this day.

I would like to acknowledge the Indigenous Friends Association (“IFA”), for whom I worked in the past four years. My journey with the charity began in 2018 when I was on the verge of completing my Bachelor’s degree in Information Technology. I was introduced to Alejandro Mayoral Baños, the Executive Director of IFA, through my supervisor Stephen Chen, as a student volunteer who would develop a feature of the Indigenous Friends mobile platform for a course credit. I initially chose to start working with IFA because of personal interest in building technology with/for Indigenous youth but did not have many relationships with Indigenous youth at the time, nor did I know about any cultural traditions.

Once my work as a student volunteer was completed, I was hired by IFA first as an

independent contractor and soon after as a full-time employee. Along with the Indigenous Friends mobile platform, IFA developed a program called INDIGital with the intention to share digital literacy, land-based, and cultural teachings with Indigenous people in what is now called Canada. Before the COVID-19 pandemic, the program was held in person and as a result I had the opportunity to teach in Sagamok First Nations, Regina, Saskatchewan and Toronto, Ontario and work very closely with our program participants for at least two weeks and up to a month, every time. During the pandemic, the program went online and I grew close with Indigenous participants from all over what is now called North America. As a result, I was able to build further relationships with the participants and learn from them while I was teaching them.

As IFA grew, I was able to grow with the organization by building relationships with many individuals who taught me what they knew and practiced. These individuals are McKenzie Toulouse and her family, Ruth Green and her children, Blu Waters, Maria Montejo, Bonnie Rogers, Mitch Gegwetch, Maxwell Abitong, Tsista Kennedy, as well as every INDIGital participant that I met while teaching. It was through these generous and gifted people that I learned how to smudge, how to understand a Medicine Wheel, Indigenous history, decolonization, ceremony, food, laughter, feasting plates, prayer, Sharing Circles, and so much more. Oftentimes in this thesis I will say, “we did this work” or “we noticed this” and the “we” I am referring to is myself and various members of the IFA team.

I also want to acknowledge the fact that I am not Indigenous. I have done this work as a

result of my experiences working alongside the above-mentioned individuals, and only began this work after multiple years of building relationships with Indigenous people, and living and working with Indigenous people. Namely, I have mostly worked with some Anishinaabe (specifically Ojibwe), Haudenosaunee, Oneida, and Métis people. Additionally, I do not have vast knowledge of Indigeneity nor do I claim to be an “expert” in what it is to be Indigenous, as I have worked merely with specific groups of Indigenous people in the last four years, and cannot use my experience to sum up theirs. My work and experiences do not speak for every Indigenous person in Canada.

That being said, I did this work as a result of what I was seeing in the world of digital technology and what I was hearing about through my colleagues at IFA and the INDIGital participants that I taught. I was able to see both sides and understand where there were opportunities for growth. Connecting these experiences came through multiple years of learning, and it is the reason why this development approach was built. It was through consent and privilege that I was able to conduct my research. This approach as it is will not be perfect for everyone, but that is why it has been made to be customizable.

Lastly, an important point that I would like to highlight is that it would not have been possible to do this work without building relationships for multiple years. Building relationships is only the beginning of this work and comes with privilege and consent. It is a long, but extremely necessary and rewarding journey that I had the opportunity to partake in. Thank you.

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Introduction

The demand for the development of digital platforms, such as mobile or web-based applications, has increased in the last decade [13]. Those who design and develop these platforms tend to follow standards and protocols that were laid out with the assumption that they would be culturally neutral; however, this is not the case. Traditional Knowledge, community involvement, visual themes, and oral traditions are a few examples of the practices of Indigenous cultures that are not compatible with these standards and protocols. If we focus particularly on the cultures that exist within the urban Indigenous youth population in Toronto, this is further diversified as the population contains stories and traditions from many different communities and Nations.

Technology that is developed by, with and for Indigenous communities must take into account the culture and teachings of Indigenous peoples through free and prior informed consent, as well as the incorporation of community members as active technical developers.

Successful software projects for Indigenous stakeholders often involve a high level of visual components, storytelling and aspects of Traditional Knowledge. These can look like the uses of and teachings behind community protocols, Indigenous languages and healing stories, which can all be crucial aspects in the software development lifecycle.

This gap that exists will likely not be bridged by adding cultural components on top of an already inaccessible piece of digital technology. That is, including culturally relevant images or phrases may not be enough to solve this problem. If digital technology is created without urban Indigenous communities in mind, it will not serve their purposes. Thus, rather than superficially embellishing technology artifacts with impressions of cultural elements, this gap may be more effectively bridged by building relationships with urban Indigenous communities and reframing with them the framework of software development that leads to such artifacts.

The motivation behind such critical review of established software design practices is to make technology accessible to a more diverse population. Developing software for diverse groups, such as the urban Indigenous youth, but without their voices and opinions we may be subconsciously creating discriminatory software. That is, if we only allow the same kind of people to create the software that we are surrounded by today and in the future, we will neglect to include the experiences of and important considerations for people who do not look, think, feel, or act in that same way.

This study incorporates aspects of Indigenous cultures into the process of digital platform development. This incorporation gives Indigenous people the ownership of technology,

whereby the technology has organically developed around their specific needs, norms and conceptualizations rather than imported as an externally designed object. This, in turn, allows them to create an online space where they, and where people who look, think and act like them can feel like they belong. Their stories would have the potential to change the structure of how things are done (i.e. the industry standards) for the better.

This thesis proposes a preliminary mobile development method, which is tailored specifically towards urban Indigenous youth in Toronto. The development method is also accompanied by an experience report to describe how it worked in practice, with the development of two different mobile applications. This was accomplished through studying the interactions of urban Indigenous youth in Toronto with digital technology. The results of the findings, along with existing knowledge has been formalized into an Indigenous Platform Development Approach. Additionally, the framework was applied for the development of two different platforms, namely the existing Indigenous Friends Mobile Application and the NPAAMB Youth Navigation Application.

This study found that a majority of what urban Indigenous youth wanted was an online space to share thoughts and feelings, while maintaining privacy. The use of the proposed development approach achieved this need and also led to a dramatic increase of users, user engagement, user retention, and many positive user experiences. The suggestions made in the development approach may be used for the development of other mobile applications, provided that it is tailored to the specific audience's needs.

Literature Review

The Digital Divide is a gap that exists between those who have access to and knowledge of information and communication technologies, and those who do not have the access nor the knowledge. There are very specific groups of people that are particularly disadvantaged when it comes to this issue. These groups are affected either because of their age, socio-economic reasons, disabilities, or because of drastic cultural differences from the dominant Western culture [8]. Indigenous people in particular have been identified as requiring programs that target their needs directly in order to increase their digital literacy.

Historically, there has been an erasure in digital media of Indigenous peoples' experience with digital technology. Indigenous communities in Canada were made, by the dominant media, to appear as though they were terrified of digital technology. This media coverage also succeeded in actively removing digital technology from photos of Indigenous people to further support this perspective. The aim of this propaganda was to limit Indigenous communities



Figure 2.1: “In a Piegan Lodge” original photograph by Edward S. Curtis in 1910, showing Little Plume and his son Yellow Kidney sitting together in a lodge. It should be noted that it was mandatory for the subjects of this photograph to have stoic poses and expressions on their faces and to wear traditional dress. [9]

from progressing digitally, erasing their experiences with digital technology, and pushing the concept that Indigenous people are people of the past; stuck in time. Figures 2.1 and 2.2 are examples of this, as one is the original photograph from 1910, and the other is the edited version of that photograph, which was published in 1911.

As a result, the proposed methods of bridging the Divide have focused on the wrong factors [8, 60]. The Digital Divide is not only an issue of not having physical access to technology, it is also the issue of not knowing how to use digital technology. That is to say, simply providing access to the Internet or buying computers for an entire community would hardly be solving the problem. The Internet or computers alone would not teach people how to use the technology, yet it requires a highly developed digital understanding and skills to



Figure 2.2: Published version of “In a Piegan Lodge”, with the clock removed. [10]

be accessible.

There are a few specific issues that must be addressed in order to successfully bridge this gap. These include physical access to digital technology, a lack of ICT skills and support, attitudinal barriers, cultural barriers, and a lack of ownership of digital technology [8, 42]. Under the issue of physical access to ICTs, it is noted that affordable routine access is essential for participation in the information age. Access, in this case, can include what is provided in the workplace, or in public environments such as libraries, community access centres, or Internet cafes. That being said, public environments may limit the type of activities that can be conducted. This is particularly relevant in the context of urban Indigenous youth because it can mean that software development that they conduct may take longer and may

require more resources. Another point to note is that, because it is understood that there is a digital divide, digital platforms designed by, with, and for urban Indigenous youth may also inherently require features that can perform without Internet connectivity, and also be easily understood and used by those who lack digital literacy skills.

The lack of ICT skills and support is a significant factor since the identified groups have low levels of computing and technology skills [8]. This can be a result of cost, limited access to equipment, low educational achievement, and cultural, age, or gender-based exclusions. Here, it is stated that any educators who intend to teach these skills must be aware of the factors affecting their students. This will be further explored in the Personal Narrative section of this thesis as I have specific teaching experience that is relevant to this conversation.

The factor of attitudinal barriers has a major effect on urban Indigenous youth in particular. A prevalent idea in some cultures can be that digital technology or computers in general are intended for a middle-class “white” culture. There is also a concern of security and privacy for particular populations. This is further supported by the First Nations Information Governance Centre, who cite the Report of the Royal Commission on Aboriginal Peoples (1996), which states:

In the past, Aboriginal people have not been consulted about what information should be collected, who should gather that information, who should maintain it, and who should have access to it. The information gathered may or may not have been relevant to the questions, priorities and concerns of Aboriginal peoples.

Because data gathering has frequently been imposed by outside authorities, it has met with resistance in many quarters [12].

While modern digital platforms do not discriminate when it comes to collecting data (i.e. any and all users' data is collected), it plays a particularly significant part, as mentioned above, when it comes to Indigenous people [45, 48].

The aspect of cultural barriers stems from some cultures' (especially that of Indigenous communities) significance on orality and storytelling. The reason why this can be a factor against the adoption of digital technology is because in-person communication can be held to a higher priority than virtual communication [42]. That being said, because of the global pandemic, in-person communication has not been as easily accessible as it once was. Although some practices and ceremonies have not been able to be observed, others that were able to were conducted virtually. Being forced to move to a digital space meant that those who were digitally literate and had access to digital platforms were able to do so with ease. The same cannot be said for those who do not carry these privileges.

A lack of culturally relevant content also falls under the factor of cultural barriers. In some cases, records of data about Indigenous people is uploaded non-consensually to the Web (this, of course, raises an issue of ownership and control as mentioned previously regarding the First Nations Information Governance Centre). In most cases, the authenticity of the content that is uploaded is very important. That is, specific people have a deep understanding of what is relevant and needed for their communities; these people also have a deep understanding

of what should and should not be shared in the digital world. This is identified as essential when it comes to having the desire and ability to consume content on the Internet. There is a need and demand for online content that focuses on the language, culture and records of Indigenous communities [8, 42].

There are a few common solutions that can address these issues in a favourable manner. Firstly, in order to provide context and allow community members to make informed decisions, they must be educated on ICTs and given the tools to interact with them. That is, they should not only be handed devices, but taught how to use them. This paves the way for the second proposed solution, which is to give community members the authority to decide what they need. One way to conduct this solution is to use the the First Mile approach, which claims that decision-making in this field must be conducted entirely by addressing specific needs of Indigenous communities [42]. This directly gives the power to Indigenous communities, rather than giving control to centralized governments or service providers. There must be space held for community members to share their concerns and needs before any tangible work is conducted. Any solutions that are aimed towards ending the Digital Divide must be supported by community-based involvement, control and ownership. Indigenous community leaders have argued that there has historically been a lack of support from government leaders concerning access to the Internet, let alone ICTs. Some have mentioned that their voices are excluded, and technology is developed without care or consideration of economic or sustainability factors [42]. Though it was recommended to do so, the Canadian federal government failed to consider consultations of Indigenous community members who were on

and off reserve. Actions like these can strip Indigenous nations of their ability to self-govern. The arguments raised by government policies regarding this lack of support mentioned that an information society would naturally develop, as technological determinism maintained this idea. This idea however was shut down by scholars who stated that it was a passive and unreflexive approach. It failed to assess the contextual elements that play a large role on a local, community level, which in turn could dig communities deeper into the Digital Divide [52].

A third solution is to give community members the chance to create content that is relevant to them. It would be optimal if content was developed in the context that locals could understand, as it would increase interest and decrease the learning curve. When it has been accessible to them, community members of Indigenous communities have been able to develop sustainable networks and technology centres to encourage use and connection of digital technology. It is important to note that not all communities have access to the Internet, but some members have been able to find ways to have access, which means that the demand for access is very high. A study conducted by Sascha Meinrath found that there is a great desire for digital technology that is catered to Indigenous audiences. When the ability to build a project is proposed, community input is always involved, is mostly provided orally, and without formal conversation or practices [43]. Culturally and locally relevant content is popular for, and is invested in, by Indigenous communities. This practice goes beyond rural communities, as the study notes that Indigenous youth living off reserve were also invested in these projects on a personal level.

When put to use, these solutions have already made significant changes, as "tribes are building on their newly-acquired skills to develop content for each Indian nation" [8]. Indigenous communities are able to easily incorporate their values into the digital networks that they are involved in, or are building [46]. They address the needs of their communities on an economic and social scale. Their involvement, therefore, is crucial to the outcomes of digital technology that is built by, with and for them. With better access to Internet and digital literacy skills, Indigenous community members have built projects that have expanded digital inclusion [46]. The existing initiatives that Indigenous people in Canada have launched include digital storytelling, virtual landscapes, and the development of video games and applications both in virtual and augmented reality [60]. One such project is called RezKast and is described as a Native YouTube. Another project involves training youth on how to build computers to be used by their communities. It is clear, therefore, that adequate training and skill building can lead to successful projects. However, when it comes to building digital platforms, there are some additional obstacles to overcome.

There are existing industry standards that have been helpful in the creation of digital platforms for a western audience. In practice, these standards are more suited to this audience as they do not take into consideration the traditions, culture and values of Indigenous communities [51, 5]. When it comes to building digital technology for Indigenous audiences, it is important to take into account the various oral practices, relationship-building, ways of teaching and understanding, as well as Traditional Knowledge. Without the heavy involvement of Indigenous people in the design and development stages, it can be difficult to build products

that are suitable for their needs.

Even within western methods, every mobile development project requires a unique set of strategies and approaches, and are presented alongside a set of common challenges [24]. Among these challenges is high usability and user experience, which are deemed essential when it comes to mobile apps. These applications must demonstrate a seamless integration to the existing systems that users are already familiar with. That is, it must be easy for users to understand how to use the app. If a platform does not adhere to the usability and user experience that is expected by users, the platforms are worthless and are deleted.

Another challenge is clear and limited scope of functionality. Scope creep is an issue that is highly present in mobile app development [36]. Mobile applications exist to allow users the ability to perform tasks quickly and efficiently. Users must be limited in the tasks that they can perform using a particular mobile application, or otherwise risk the user being overwhelmed by the number of options available to them [24].

Performing early usability testing is an additional challenge present in mobile application development [24]. It can be very difficult for some mobile app developers to test their applications with real end users in the same environment as the public, though some scholars find it difficult to describe why [24, 29]. Regardless, this argument in particular promotes the idea of an Indigenous method, as it requires the end user to be a part of the development process from the very beginning.

Another challenging factor is the consistency in terms of look and feel of an application

[24]. This requires mobile applications to present themselves in a similar way to applications that the users are already in touch with. This makes the learning curve much more shallow as it can allow for an easy transition between applications. Further, it is important to keep in mind that users have limited attention. That is, users do not usually pay a lot of attention to the tasks they perform on a mobile device. This means that the content within the mobile application, whether related to visual design or information provided on the application, must adhere to the users' goals [24].

Some organizations that develop mobile applications tend to forgo the proven software engineering methodologies as they are too heavyweight for their purposes. They conclude that software engineering must provide tailored solutions for the types of applications that they want to create (i.e. there is a need for methodologies that do not fall under the current standards).

There is not much related work in this field, but the existing methodologies shift their focus from a general user-centred approach to a more specific one. Some scholars also state that there is a demand for new mobile development methods, as the current standards fall short of encapsulating the challenges faced by the diversity of modern mobile developers and applications [1, 50, 57]. One such approach is the, "Usability Engineering Lifecycle" which divides the mobile application process into three stages which are requirements analysis, design/testing/development, and installation. This approach fails to involve user feedback until after the final stage of installation has taken place, wherein the application is already

published. Once the feedback is collected, it is incorporated into the next version of the application. There are several other approaches similar to this one, but are not specific or involved enough for an Indigenous context, nor do they provide examples, tips or start-to-end methods [50, 19, 22]. For instance, users of an Indigenous application must be involved at each stage of development, rather than brought in for research and feedback at the beginning and end of the development cycle. Additionally, these approaches assume that there is unanimity in the types of users and their goals, which promotes a very general method for application in an Indigenous context.

The mConcAppt method attempts to enforce direct communication between the designers and users of the mobile application [24]. The justification behind this is to create an equal foundation of understanding between the two parties involved in development. This does, however, limit the users in being present for design decisions only. As described in earlier literature, the involvement of Indigenous communities at each stage of the process is vital when it comes to creating a successful project. At the end of this stage, the project manager is final approver of what is within the scope of the project, but only after users have been consulted with and approve. The next stage involves a workshop in which some users are present to participate in the requirements gathering and documentation of the application. The deliverables of this workshop include a single user persona (the most “common” user) that is used for the remainder of the development, as well as the identification of stakeholder groups, current problems and proposed solutions, and identification of system functions. Several workshops follow this one, and each results in deliverables that inform a new part of

the proposed mobile application. The final decisions about the scope of the app are made by the leads, not involving the users.

There are a few limitations, however to this approach, as mentioned directly by the authors. These limitations also cause this method not to be optimal for Indigenous platform development. Firstly, there is a large potential conflict area between designers and architects as the technologies requested by designers cannot always be fulfilled by architects. Project managers are responsible for resolving these conflicts. Second, time is another factor in this case, as it directly affects the experience of the designer. Third, creativity is deemed difficult to estimate, again causing difficulty for the designer. Fourth, the coordination and communication of the development activities requires too much time. Finally, mobile applications have varying scopes and challenges which cannot be easily remedied by general methods. Among these challenges, this method also fails to solve the problem of users having limited attention spans. Despite the useful techniques mentioned in this study, it does fall under the category of a “general” method which cannot be applied in the context of Indigenous platform development [24]. While some techniques can be used, the method does not as a whole represent an optimal development method.

One methodology created by Wasserman et. al. is the most compatible with Indigenous software. It places great emphasis on not just the involvement of users in the development process, but particularly the effective involvement of users. However, it does emphasize user involvement more in the early stages of development, limiting users to decision making only

in the beginning of the process. In some Indigenous communities, participatory democracy takes the lead, meaning that individual thinking, ideas, and unanimity are considered when making decisions that will have an affect on the great community [15, 25]. That is, users must be involved at every stage, not just the early ones.

The User Software Engineering Methodology (“USE”) was created through the consideration of seven factors: functionality, reliability, usability, evolvability, automated support, improved developer productivity and reusability. These factors are echoed in the development approach proposed in this study, but is missing a few more factors that are important in the context of Indigeneity. These factors are the impacts on environment, community, and future generations as well as the involvement of cultural traditions, and protection of traditional knowledge [20, 55, 56].

A traditional methodology uses a top-down approach when refining system functions. This methodology tends to place a focus on the system perspective, and neglects the user [57]. As a remedy, USE opts for an outside in approach, allowing for focus on the user perspective, which in turn results in an easier way to collaborate with the user community. When it comes to displaying the information architecture to users, it was found that diagrams were not enough to communicate what was taking place. The USE methodology recommends sharing mockups or usable prototypes with users to remedy this. However, when a prototype was not available, an approach used in the development of the Indigenous Friends app was to alter the traditional diagrams in a way that made them more consumable by visual learners [33].

While this method of developing software is the most compatible for an Indigenous context, it still lacks some significant factors and considerations which are used in the development approach proposed in this study.

Methodology

3.1 Decolonization

The topic of decolonization is prevalent in this paper as it sets the foundation for what is to be developed. As an Indigenous-based organization, the Indigenous Friends Association grounds itself in creating tools for decolonization. To define the term, one must begin by defining colonization. In this context, it refers to the invasion of the Indigenous communities of Canada by European settlers. This also includes the stripping of land, culture, and community, as well as the violence and abuse that occurred during colonization (and continues to take place today). The effects of colonization can still be felt today as intergenerational trauma continues to harm some Indigenous individuals [7].

Decolonization, then, refers to the reversal of colonization. This is not to say that those who have settled in Canada must return to where their families came from. Rather, this is to

reverse the trauma that has been caused by colonization [34]. As the work of the Indigenous Friends Association is grounded in decolonization, some products created by the organization, such as the IFA app, are decolonization tools [4]. That is, tools that will help reverse the effects of colonization. This can be through providing Indigenous youth with resources to better mental and physical health, to reconnect with their culture, or meet their personal or professional goals.

3.2 Decolonization Through Tipi Protocol

Alejandro Mayoral-Baños conducted a research project in 2016 that explored decolonization through the teachings of a Tipi and resulted in the creation of one of the two mobile applications being explored in this project [4]. His work assessed the possibilities of how information technologies can become a decolonizing tool. In his research project, Mayoral-Baños mapped similarities and differences between the elements of the Software Development Life Cycle and the elements in which the development of his mobile application took place. In particular, he went on to use the processes that are part of a Tipi Ceremony as a software methodology. A Tipi is a conical tent that is easily portable and is used as a dwelling [37]. There are many forms of it, but in this context, the Sioux Tipi is the focus. That is, a Tipi that comprises of three poles as the base; these three poles are the heaviest and are tied together so that other remaining poles can be supported (for a moderately sized Tipi, fifteen poles, including the base three, are used but this can vary greatly [47]).

A Tipi Ceremony involves the process of erecting a Tipi, and it is what follows a birth ceremony. A birth ceremony is conducted in part by placing an offering of tobacco in the centre of the space where the Tipi will eventually stand. The offering is made with the intention of seeking support and blessings from the ancestors for the wellbeing of the Tipi. The resulting structure has historically been used as a shelter and has very specific protocols and teachings surrounding it. Each step of the Tipi raising is calculated, justified, and approved. This is where Mayoral-Baños was able to map similarities with the creation of a mobile application. In this work, the birth ceremony, the poles, and other elements of the Tipi were compared to the Software Development Life Cycle, and the resulting process was used to build the first iterations of the Indigenous Friends app (“IFA app”).

The mobile application that was created as a result of Mayoral-Banos’s work aimed to centre Indigenous voices, and provide a safer digital space to exist in. It was inspired by the lack of connection and community that Indigenous youth may often feel while attending post-secondary institutions. For some youth, attending a post-secondary institution is their first time away from their families and communities. This mobile application aims to handle the feeling of loneliness and separation by reintroducing community in a virtual sense. The IFA app was thus created to be a virtual Tipi, promoting the sense of cultural connection and safety.

The app’s purpose was a to provide a virtual community to Indigenous post-secondary students through resources and the ability to contact mentors at partner institutions. A

year before the redesign began under my management, the target audience was expanded to include Indigenous youth who were not necessarily attending post-secondary institutions. While it did allow in-app user communication, the app's design was geared more towards consumption of information. That is, while users could communicate with each other through forums and chats, they did not often partake in these features (the forums feature in particular was mostly empty), and instead looked at information such as announcements, campus maps and local events. Only administrative users had the ability to create forums, announcements, send push notifications, and add, edit or remove resources. The number of features and the desire to provide as much information as possible was great, so much so that a page entitled, "More" was created to store features that could not fit in the navigation bar. These features, while useful in theory, were not provoking engagement nor interest from the target users. This is where the need to reassess the entire IFA app began, and this is where the development process that is part of this study comes into play.

3.3 Development Approach

Mi'kmaw Elder, Albert Marshall introduced the concept of Etuaptmunk, two-eyed seeing [23]. This principle guides the ways in which Indigenous people can see the world through both an Indigenous perspective as well as a Western perspective. The idea is that, since Indigenous people exist with both Indigenous and western experiences, they should learn to use them together to benefit both themselves and the world around them. Marshall states,

“The advantage of Two-Eyed Seeing is that you are always fine tuning your mind into different places at once, you are always looking for another perspective and better way of doing things.” This, alone, could be justification for why Indigenous digital spaces must exist, as Indigenous people are able to perceive and create for both worlds. That being said, it can be difficult to get to a place where the concepts of modern digital technology can be taught and understood in an effective manner.

IFA’s INDIGital program aims to teach urban Indigenous youth about digital technology and how to use it. During its first iteration, our team met with urban Indigenous youth who communicated their learning styles to us. Based on this, we curated a curriculum that allowed us to effectively teach them about digital technology in a way that made the most sense to them. However, teaching them was not enough, the goal was for them to build it, but if they couldn’t, we would build it for them. Thus, the IndigiFriends app was completely rebuilt using their feedback. This rebuild allowed users, urban Indigenous youth, to be content creators and allowed them to build communities and connect with each other. This was a goal for the IndigiFriends app originally, but had been difficult to achieve as the team didn’t quite understand how. Because of the heavy youth involvement, not only did the IFA team build an effective mobile application, but also a development approach that would allow others to build digital platforms for Indigenous communities that would be just as successful.

One pivotal difference that can be noted between a western method and the proposed Indigenous-focused method is the use of focus groups versus sharing circles. A focus group

has been defined as a group discussion, which is led by a trained facilitator. The purpose of a focus group, in the context of platform development, is to obtain information regarding a target audience's opinion of a product or service. Focus groups are not and should not be used as a form of collaboration, nor a problem solving session, as the point of the group session is to gather information [14]. Other than this, there are several defining factors of a focus group.

First and foremost is the most important factor of a focus group, which is a trained leader or facilitator. This leader must come prepared with a series of questions (the number of questions is flexible and can depend on the age of the participants) that they will use to guide the discussion that takes place in the group. While the majority of the questions refer to the matter at hand, a few questions are asked in the very beginning of the focus group with the intention of making the participants comfortable. Other than guiding the discussion, the leader is responsible for asking questions to dissect participants' statements, observing important comments, taking note of nonverbal behaviour, and relaying information back to the participants to draw out more refined statements. Another defining characteristic of a good leader is that they are able to create a "non-threatening" environment in which the participants feel comfortable enough to speak their mind, and therefore share as much information as possible [14]. Two additional crucial attributes of a good leader are to "anticipate situations that shift the focus of the group from a general one to one that is personal, and practice responses to such a shift" [35]. At this time, a consensual method of recording the data from the focus group should also be established. This can be either in the

form of an audio or video recording, or a manual transcript, and there should be a person delegated specifically to this task [14].

Next, based on an established target audience, 5 to 12 participants are selected. It is important to ensure that the selected individuals match the demographic of the target audience to ensure that the opinions they bring into the group accurately depict those of an average user's. More often than not, participants are recruited using some incentives which could be monetary. Sometimes, refreshments or a meal are provided, but should be consumed before the focus group begins. Some researchers note that while the participants should be comfortable with each other, they should not know each other [14]. Another limit includes the length of time in which a focus group takes place, which can range from 1 to 2 hours.

There are also some specific advantages of focus groups, namely the fact that they take less time than individual surveys, and allow for participants to query each other and bring about information that could not have been otherwise approximated. That is, participants could initially have a certain opinion about a topic being discussed in the group, but after discussing with other participants who have opposing views, they may change their minds. This sort of information could not be discovered on a survey, making a focus group much more useful in this case. Additionally, they give researchers a chance to get to know their participants. Some disadvantages include the fact that focus groups may require more work than individual surveys, specifically on the part of the facilitator and recorder as they must dissect nearly every statement to ensure that they extract the most important information

out of it. Additionally, it could be difficult to gather information from every individual that is present, as some participants may talk more than others.

Sharing circles are similar to focus groups in that they are sort of a group discussion, however they do not have one specific leader. The importance that is placed on the leader of a focus group is handed off to the participants, or “collaborators” of the sharing circle [4]. That is, every individual who is a part of the circle is seen as equal in the aspects of mentality, physicality, spirituality and emotionality [38]. Further, sharing circles are conducted first and foremost with cultural protocol in mind. Rather than one facilitator or leader guiding the direction of the circle, it is understood that the spirits of the collaborators’ ancestors as well as the Creator are present and guiding it. Collaborators are also sensitive to the energy that is created in the circle, and there is a general understanding of openness and support. Sometimes, the circle begins with a smudging ceremony to clear away negative energy or spirits. When collaborators speak, they can do so in a clockwise or counterclockwise direction, and may hold an object while they speak [38]. While there is a sense of comfort that is established in the circle for collaborators to speak their minds freely, it is not uncommon for collaborators to speak to those conducting the circle privately, once the circle has disbanded [49]. The conversations that take place during the circle are also recorded, with consent, usually through handwritten notes. The use of technology during circles is sometimes prohibited as the energy of the technology can hinder the energy created by the collaborators in the circle [38]. The western idea of sharing is to divulge information that belongs to, or is the property of one particular individual. In this case, however, the act of sharing is done in

a more interdependent sense, where the information shared does not necessarily belong to one individual, rather it is an experience or set of thoughts that are established or common between many. That is, there is a sense of responsibility when collaborators join the circle, and it is known that whatever is shared in the circle is done through the use of knowledge that descends from generations of oral traditions and storytelling. Interlaced within this responsibility is the intention to enhance and support Indigenous communities. Joy Harjo is quoted in Mankiller's *Every Day is a Good Day* for illustrating the idea of this shared responsibility:

I have a home in the world. I feel there is a root community that I have a responsibility to nurture and help move in a good direction. It's very, very precious. It is the central source of meaning, the root, the template [41].

While questions may be prepared in advance for the sharing circle, it is possible that the questions themselves may be broken down and reworded during the discussion. As noted previously, a sharing circle feels more like a conversation and is more open, thus leading to dissection of even the questions that are asked. This, of course, is the reason why a single facilitator cannot take responsibility for the conversations that take place during a circle - the conversations are guided by energy [38]. Additionally, it is difficult to procure an exact time for how long a sharing circle may take to conduct, as the conversations may take far longer than anticipated and it may become true that one or two questions were all that were necessary to gather the information that was needed. It is also common, and encouraged,

in fact, for collaborators to know each other before taking part in the circle. This drives a better conversation during the circle, as it is centred on comfort [28, 38].

The first sharing circle that I was invited to took place at Skennen'kó:wa Gamig, where a few other attendees were students who had also been taking part in the ITEC 4000 course, like myself. One or two collaborators who worked at Indigenous Friends had been responsible for cooking, and had already prepared several dishes for the group. As everyone in the room made plates for themselves and sat into their seats, someone noticed that there were some new faces who were very obviously not Indigenous, myself included. They explained to us that eating a meal together changed the environment from a meeting into a gathering. This was a crucial aspect of the sharing circle, and it had the nearly instant effect of making everyone in the room comfortable. It is also important to note that any time I have taken part in a gathering where food is involved, a feasting plate has been created and placed in the centre of a circle with the spirits of ancestors in mind.

Usually, a prayer signals the end of a sharing circle, however instead of disbanding immediately, collaborators linger to have further conversations relating to the circle, or other personal matters. In my experience, there is leftover food that is distributed to anyone who will accept it and everyone says goodbye before they leave. In the circles that I have been a part of, the collaborators either voluntarily attend, or are offered incentives such as gift cards or honorariums to be present. If required, these are distributed at the end of the circle as well [38, 54].

As outlined in the descriptions of focus groups and sharing circles above, it is easy to map similarities and differences between the two methods of information gathering. The most apparent difference between the two is the aspect of culture, which is absent from focus groups. When conducting work by, with, and/or for Indigenous communities, intentionally employing a method that omits the use of culture is impractical. Cultural traditions are important at every stage of the development process. Additionally, sharing circles hold a spiritual importance in many Indigenous communities and can also lead to personal growth for those who take part in them.

Whereas a focus group is “not an opportunity to collaborate”, a sharing circle definitely is. The space that a sharing circle holds allows for more than just simple answers to questions, rather it is an opportunity for collaborators to be immersed in the platform development process and to share their ideas for changes as simple as colour or as complex as partnering with organizations that they are a part of. What really drives the success of sharing circles is prior relationships, as they allow for a more comfortable space and an open discussion. In focus groups, it is important that participants do not know each other, but this would make the conduction of sharing circles very difficult.

Additionally, while both focus groups and sharing circles are determined to discover as much information as possible through discussion, there is an additional aspect of sharing one’s heart, mind, body and spirit in a sharing circle. This can, therefore, be more valuable than the information shared in a focus group, and the act of giving consent or permission

to the conductor of the sharing circle also becomes more powerful. It also becomes easier in sharing circles to decipher the emotions and nonverbal behaviour that are displayed or expressed by collaborators, whereas in a focus group, a facilitator would be responsible for taking note of these minute occurrences.

This research was conducted using a phenomenological approach adjusted to explore urban Indigenous youth in their natural environment, specifically through observation and Sharing Circles. While Sharing Circles are not formally a method of conducting research, they replaced focus groups for the context of this study.

The participants of the study were urban Indigenous youth in Toronto, who were invited through their relationships to the Indigenous Friends Association to either Sharing Circles or other events that normally took place in the city. For Sharing Circles, once gaining verbal consent, data was collected by writing notes on a large paper pad supported by a stand. This was done so that the participants could also see what was being written down and agree with it before moving forward. This is not normally done in Sharing Circles so the consent of the participants was very important. When it came to the observation of other events, verbal consent was the first step in data collection. Once consent was given, data was collected using a notebook as to avoid any disruptions to the environment.

When it came to the analysis of these transcriptions, the conversations that took place were coded to align common themes with one another. Here, there were discussions of digital technology as being evil, Indigenous futurisms, and the hopes to build digital platforms.

These themes went through a second coding process to further extract clarified concepts with which to build categories. This process of coding the transcripts was difficult as it felt unethical to prioritize or give ranks to the lived experiences, thoughts and feelings of the participants. However, since a majority of the thoughts shared by participants were similar, the data that were not filtered through the coding process were kept in mind for future Sharing Circles to make connections with if possible.

This method of conducting research was iterative. It was through multiple conversations even after the initial data analysis that the development approach was built. This was because each Sharing Circle that took place during the creation of the development approach represented gaining approval of each part of the process.

3.3.1 Phase One: Preliminary

It is important to note that in each phase of the development approach, any and all decisions that are made must be agreed upon by the users involved in the design process. In the first phase of the development approach, there are two main tasks to complete. These include creating a proposal of the requests that need to be fulfilled by the clients or the community. This proposal comes after having a conversation with the clients or community to understand what the best solution for their problem is. It also lays out the capabilities or limitations of the digital platform to be created. Once the proposal has been approved, a contract is signed (if needed). The next step is to hold a Birth Ceremony, led by an Elder. For the Indigenous

Friends Association, the tradition of holding a Birth Ceremony began with the first iteration of the IFA app. The idea of this comes from the Tipi Raising, in which the Tipi is believed to have a spirit, and a Birth Ceremony is the term used to signify its raising, as opposed to a term such as construction [4]. During this ceremony, sacred medicine such as tobacco is offered in order to gain blessings from ancestors and to provide long-term standing for the Tipi. In the case of IFA, every digital platform has a spirit. Therefore, a Birth Ceremony takes place in this preliminary stage. The resulting documentation of this stage includes a proposal, a birth ceremony, a signed contract or agreement (in the case of a client), and a requirements document.

3.3.2 Phase Two: Analysis

The second phase of the development approach is where the proposed platform is analyzed to determine the best tools for it. At this stage, the Information Architecture is built first as the foundation for the deliverables to follow. From the Information Architecture, low fidelity wireframes are created, which are then communicated to the client and, perhaps, the end users. The creation of the wireframes can look very different depending on the strength of the client relationship. The clients may be heavily involved in the wireframe creation process, wherein they sit with the development team in a Sharing Circle to hand draw their vision of the proposed platform. Otherwise, if the client has left it to the development team, a Sharing Circle will still take place, allowing for any willing collaborators to share their visions and

Request to fulfill community/client needs
Create proposal: lay out capabilities/
limitations
Understand community/client needs
Help them narrow down optimal solution
Birth Ceremony

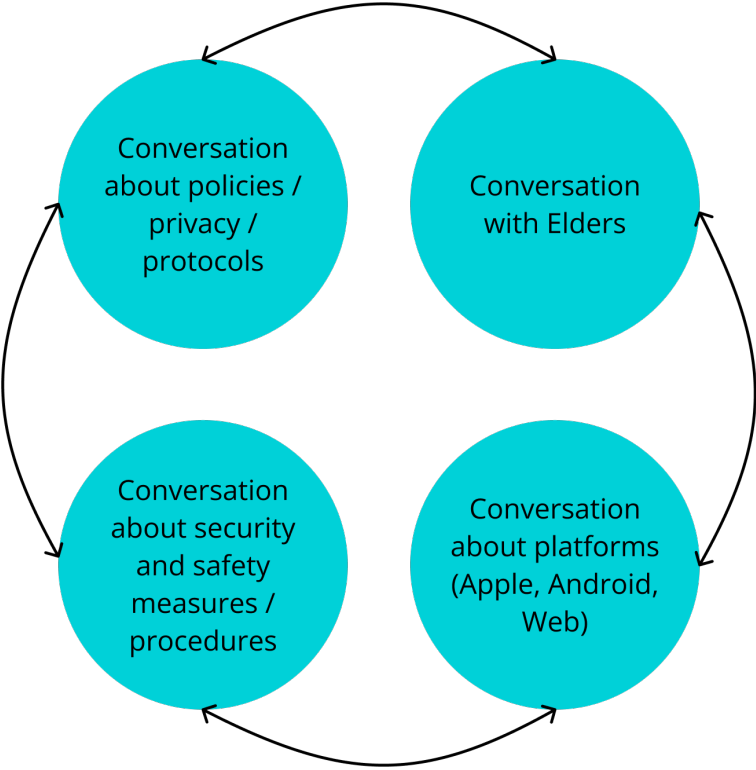


Figure 3.2: Phase One of The Mobile Development Approach

drawings. If these wireframes are approved, the frontend tools are selected. Simultaneously, the Information Architecture leads to determining the roles and responsibilities of users in the app, creating an Entity Relationship Diagram as the backend architecture, which leads to the selection of the backend tools. During this stage, a list of design assets and user stories are compiled, and privacy policy, terms and conditions and cultural policies are also determined. The minimum viable product (“MVP”) is also determined at this stage. Because this is the stage at which the Information Architecture document exists, any changes that are made at later stages must refer back to this stage in order to move forward.

3.3.3 Phase Three: Implementation

In the third phase, implementation and finalization of the design of the platform takes place. The low fidelity wireframes are converted into high fidelity wireframes with the design assets included. Relationship diagrams are created for the frontend and backend, as well as for the backend and the database. These diagrams are then used to determine function specifications in the code. GitHub repositories are created to publish and update the code that is written for the platform. GitHub in particular was chosen with the intention to possibly make the code open source, allowing for users to contribute directly and build on top of the source. Once the platform has achieved the minimum viable product, it is deployed to the app store beta tracks. This allows for specific selected people (i.e. beta testers) to interact with the platform and report any feedback to the development team. At this stage, there cannot

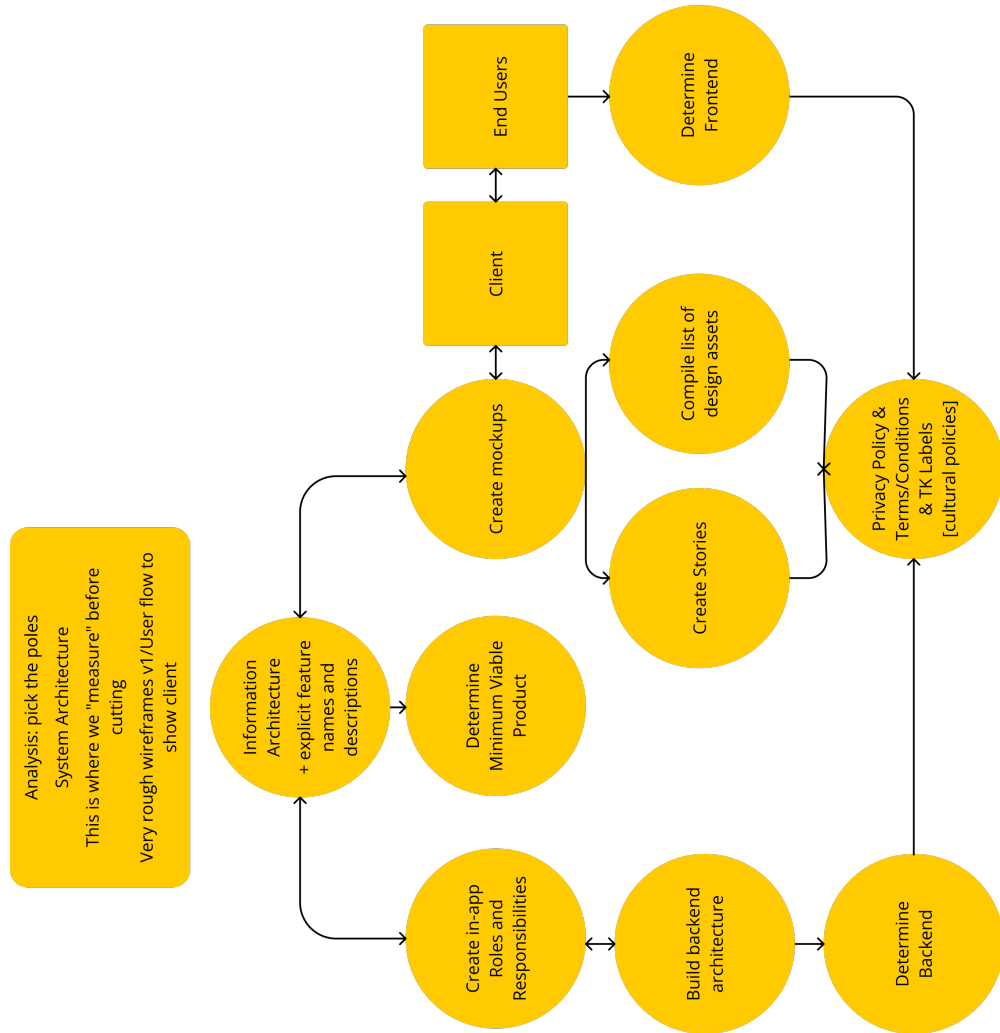


Figure 3.3: Phase Two of The Mobile Development Approach

be changes made to design. That is, beta testers and clients cannot ask to make trivial changes such as colours or fonts. However, if beta testers determine any functional errors, they are reported and changes are made collectively before publishing new updates to the app store beta tracks. Once beta testers are satisfied with the beta version of the platform, it is published to the alpha tracks. Additional testing is done once the platform has been published to the alpha tracks, and this takes place before conducting any marketing for the platform in order to ensure optimal delivery of the platform to the intended end users. Once again, there cannot be any design changes made at this stage, only functional errors are reported and handled.

When the platform is officially ready to be published and marketed, a pre-launch prayer circle takes place to gather, and launch the app with good intentions. This is an essential final step of this phase and of the entire development process.

3.3.4 Phase Four: Maintenance

Once the platform has been published, the developers monitor the app for new errors or enhancements that can be made. Additionally, clients can request new features at this stage, which would then lead back to the second phase so that it can be mapped in the Information Architecture document. Users may also share feedback, which then goes through a filtering process. Firstly, the validity of the feedback is considered, that is, if the feedback is in alignment with the purpose of the app and falls within the values of IFA, then it may move

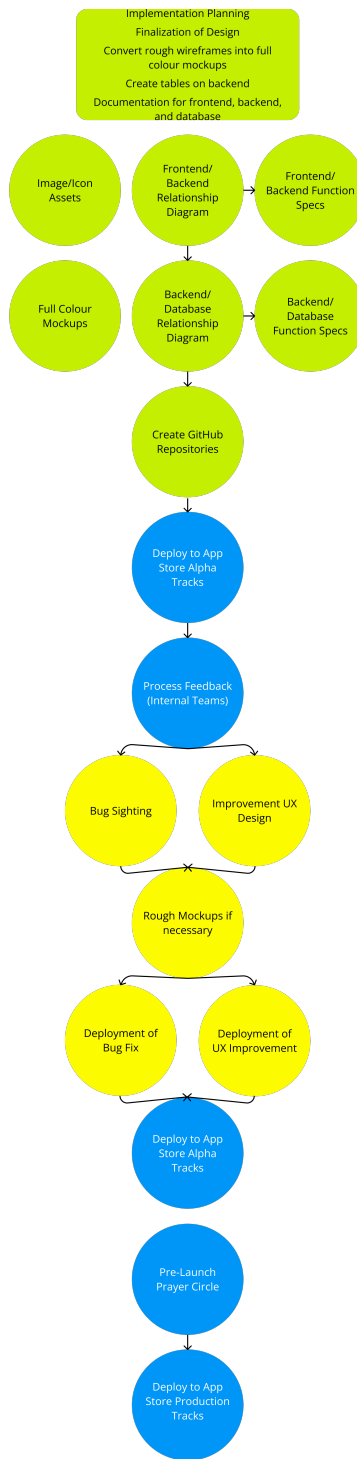


Figure 3.4: Phase Three of The Mobile Development Approach

onto the next step. If the feedback is not within the scope of the app, it may be saved for a later version of the app, or discarded. If the feedback is within the scope of the app, then it moves onto being categorized into one of four groups: optimization issue, new feature idea, bug sighting, or improvement UX design. If the feedback falls under the latter three categories, then wireframes may be created, however the result of all four categories is the same: at least a portion of the Information Architecture will be refactored. If the change to be made is critical, then a special deployment takes place to deliver the changes as soon as possible. However, if there is a minor change, then the changes are published in a regularly scheduled deployment.

At some point in the lifecycle of the platform, it may be necessary to do a complete refactor. That is, major changes would take place and the development approach would restart from the first phase.

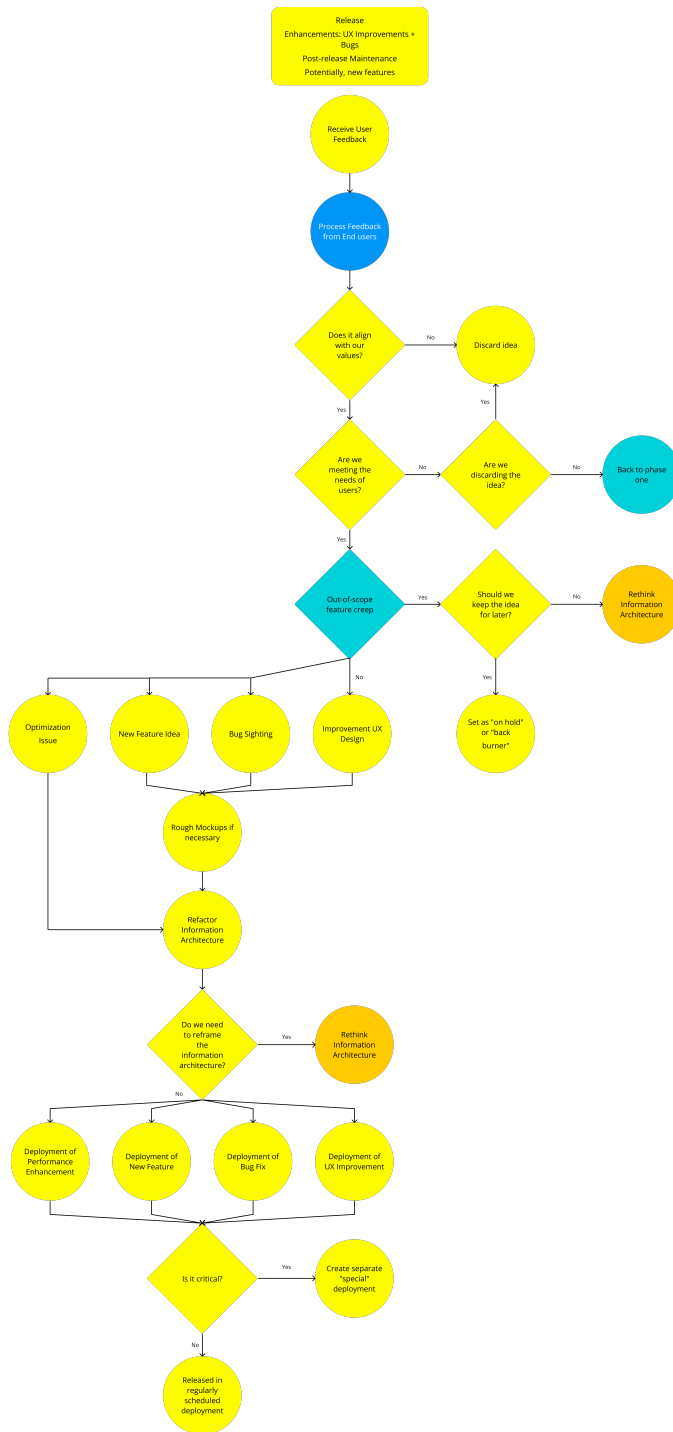


Figure 3.5: Phase Four of The Mobile Development Approach

Experience Report

4.1 Indigenous Friends Mobile Application

The Indigenous Friends mobile application was designed in accordance with the development approach created for this study. This mobile app was redesigned due to a lack of user engagement. In its initial creation, there were several factors (a lack of user involvement being at the core) that led to the low user engagement. Additionally, the app was not an optimal reflection of its initial objective of being a community for Indigenous youth as it limited user interaction. Something to note here is that the redesign of the application consisted of making changes only to the frontend of the application; the backend was not included as part of these changes. Other important considerations such as Software Development Kit, Privacy Policy, Terms and Conditions and target audience also remained the same. When the redesign of this application began, the features that were in place included: Sign Up,

Log in, Events (landing screen), Search/Directory, Forums, Peer Mentors, Institutions, Maps, Create a Student Tag, Trivia, Bingo, Announcement, Feedback, Tutorial, Resources, Report, Block, Ban, FAQ. It should be noted that some of these features were exclusive to users in administrative roles.

The redesign of the app took place in alignment with the development approach. Some steps of the development approach such as the birth ceremony were omitted as they had previously been conducted, assessed or selected when the app was initially created. Nevertheless, the remaining steps in the development approach did take place. Before the redesign of the app began, it was at the maintenance stage, but since there needed to be a complete refactoring, it began in the first phase.

When it was first created, the development of the app followed the Iterative Enhancement Model, as can be seen in Figure 3.1, but this model was adapted to better suit the needs of an Indigenous context, as seen in Figure 3.2. The differences between the models can be noted firstly in the inclusion of Sharing Circles at the beginning of each iteration. As mentioned earlier, Sharing Circles are vital in this development process as they provide an opportunity for collaborators to be fully immersed. The thoughts shared by collaborators in these Circles inform what tasks are to be completed, and how. Secondly, each iteration of the implementation allows for only a couple of developments to take place. Once again this is to incorporate community members as active technical developers as much as possible. Going at this pace allows for differences to be seen and noticed in their entirety, rather than

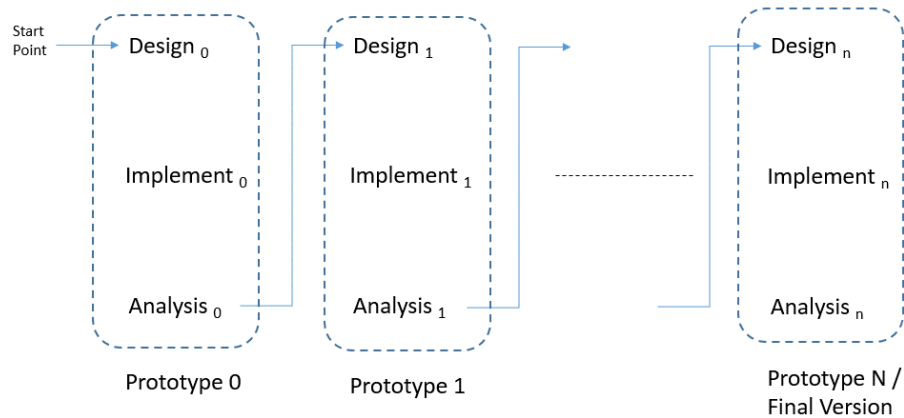


Figure 4.1: Iterative Enhancement Model. Adapted from “A concise introduction to software engineering” in UK, by Pankaj Jalote [30]

being overlooked. As an analysis for each iteration, conversations about the iteration are an excellent form of reflection on the work that has been completed, what went well, and how things can be improved in the next iteration. This constant form of checking in is essential for successful development.

4.1.1 Phase One Tasks

In a non-Indigenous setting, user needs may be gathered through focus groups or interviews. However, the method that was used in this case was sharing circles. Though sharing circles are comparable to focus groups in terms of gathering qualitative information, the difference is that there is sacred significance in the former. That is, sharing circles allow for growth, healing and transformation for those who contribute their thoughts to the group or circle. One element of sharing circles is that all the thoughts shared by those in the circle are heard, and

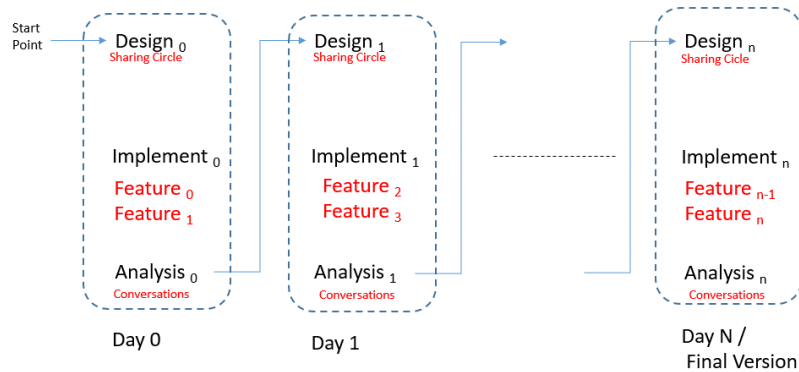


Figure 4.2: Indigenous Iterative Method. Adapted from “Decolonizing Technology Through A Tipi” in Toronto, by Alejandro Mayoral-Baños [4]

carry the same weight when it comes to decision making [39]. This is significant as it changes the dynamic of the group, the users are given more value and importance rather than the developers. This method also allows for a two-way conversation to take place between both parties, which is something that is absent from other methods such as interviews or surveys [32]. Mayoral Baños, in his study, states, “This aspect is a fundamental element that an Indigenous software approach must include in contrast to other technological methodologies.”

It was within these sharing circles that we discovered the need to cut back on certain features, as they were not fulfilling the goals of the application, nor gauging interest from users. Some features that were particularly unpopular included Forums, Peer Mentors, Bingo and Trivia. Further, some features were requested, such as a newsfeed page where users could create posts, comment on others’ posts, and interact in a way that was not possible in the available version. A feature that was suggested by our team was some method of including audio recordings in order to introduce orality into the app, as orality is an important part

of many Indigenous cultures [58, 11, 21, 59, 16]. In fact, during a conversation about this potential feature, it was stated that this would be better than text (i.e. status updates or “posts” in the Newsfeed) because being able to hear someone’s voice would allow for better understanding of their thoughts and emotions. Since Facebook is a popular social media platform among Indigenous communities [18, 6], we decided to make the new version of the app as familiar as possible to platforms which were already being used by youth. Therefore, we incorporated the Stories feature into the IFA app to introduce orality. On Facebook, Instagram, Snapchat and WhatsApp, this feature is one that allows users to share photos and videos on the Newsfeed for up to 24 hours. Stories are unique in that they are constantly visible to all users at the top of their Newsfeed, whereas regular status updates or “posts” make up the Newsfeed. Additionally, after 24 hours, the Story (i.e. the collection of photos and/or videos) is automatically removed from the Newsfeed. When this feature was introduced to the IFA app, due to database capacity issues, we decided to omit the photo and video aspect of the Stories feature, and instead continued just with the audio, to promote the orality of the app. Although this was initially a decision based on capacity rather than user preference, it turned out to be a fairly popular feature on the app.

4.1.2 Phase Two Tasks

In the second phase, an Information Architecture document was built. This stage determined what features would be included in the app when it would be released to the public. Each

feature was connected and any required information was also listed, and this gave the team a better idea of how the app was mapped out. The next step was to select which features would be included in the minimum viable product. This was particularly important as the features needed to be prioritized so that the designers and developers would be able to determine what to work on first. The decisions were made in a Sharing Circle, where each contributor was given the opportunity to speak and share their opinions. By the end of this process, it was decided that the following features would be available in the minimum viable product: Newsfeed, Sharing Circles, Medicines, Collectibles, Communities and Chats. The Communities and Chats features did already exist in the previous version of the app (Communities was named Institutions, but the term was changed to allow for more accessibility to youth beyond the realms of post-secondary institutions) and thus it was not difficult to adapt them to the needs of the new version. Once these were selected, the process of creating wireframes as well as perfecting the in-app roles and responsibilities began.

The creation of wireframes took place in another Circle, where each contributor was first taught about wireframes, then given materials to draw with, and time to draw their depiction of what they wanted each page of the app to look like. It is important to note that although there was a designer on the team, they did not lead this session as it was a Sharing Circle, where each member of the Circle was given the same level of significance. Rather, the role of the designer was to take the interpretations of the Circle and perfect them. Something that was suggested by an Indigenous Friends member was that circles be used exclusively in the app design, and if they could not be used, squares or rectangles should be rounded at

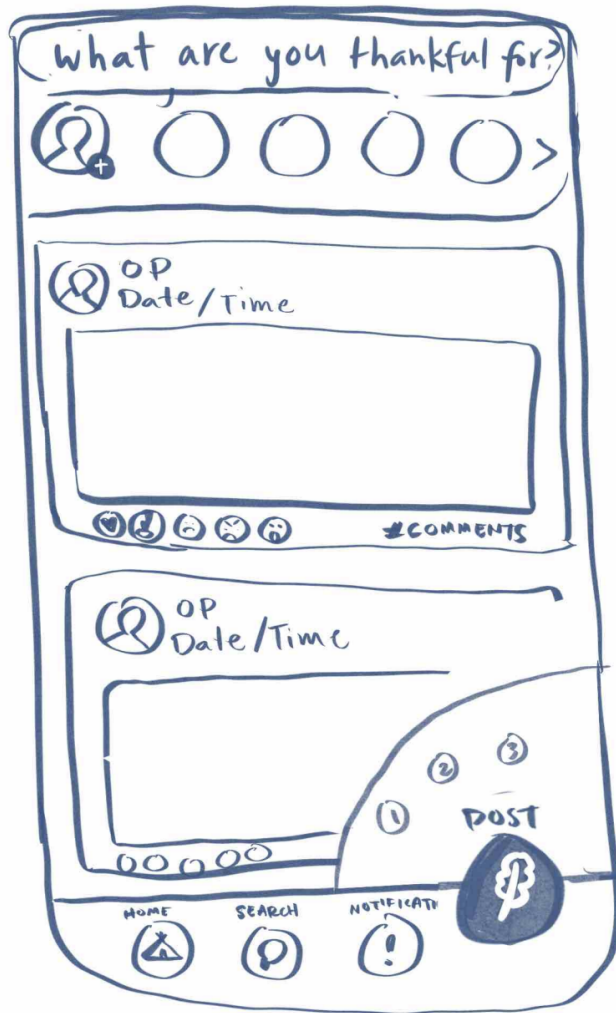


Figure 4.3: IFA App Wireframe

the edges. This simple change to the elements of the app made a drastic difference to the mentality surrounding it. It was obvious then, to all the contributors of the Circle that this truly was an Indigenous-focused app. The wireframes that were created by each individual of the Circle were visually extremely similar to each other, which made it easy to decide what definitely needed to be included, and some visual aspects that could be excluded. One of the resulting wireframes is shown in Figure 3.3.

The in-app roles and responsibilities had been previously created by Alejandro Mayoral-Baños, and were listed as the seven Clans of the app. They did not necessarily need to be redesigned, but there was some hesitance with members of the team and thus a Sharing Circle was held to discuss this aspect of the app. Some members felt that the Clan system was too complicated and needed to be simplified into at most three Clans, and some felt that it was important to keep all seven because of their individual significance and role towards the functionality of the platform. Through further discussion, it was discovered that those members who wanted to cut down on the number of Clans simply did not understand the roles of the Clans well enough. As a compromise, the seven Clans remained, but the descriptions and privileges were updated to make it easier for all users to understand the significance of each Clan. This differs greatly from the standard of having only three roles on leading social media platforms [62]. When platforms like Facebook apply multiple responsibilities to just a few roles (usually an administrator, a moderator, and general users), it leaves behind the awareness of one's obligations. Placing a distinct emphasis on multiple roles and what they represent leads to better observation of rules and thus, a safer space.

One feature that was discussed in length with an elder, Lauren "Blu" Waters, was Medicines. The feature was to be used for the gamification of the app, in order to give users an incentive to continue using it. The idea was that virtual sacred medicines could be shared among users and they could display their Medicine Bundle on their profile. However, after sharing this idea with Blu, they stated that there were elements to sacred medicines that were not being followed in this feature. Medicines could not be solely virtual as they had

Clan/Colour	Description	Responsibilities
Beaver/Orange	They are the builders of the space. Can be non-Indigenous or Indigenous members with a tech background. Beavers should be familiarized with Indigenous cultures, values and beliefs.	They are in charge of the maintenance of the App, can create content with the approval of the wolves or bears and can change the roles of people, with certain restrictions.
Eagle/Yellow	Eagles can see the 'big' picture from the sky of the user's and are prepared to give guidance if needed.	Eagles are mentors and can share teachings, create sharing circle questions and block users from the entire app.
Owl/Red	They have the wisdom of traditional knowledge.	In charge of healing the Intellectual and Spiritual Dimensions. They can share new available resources with the users 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 and look inside the different spaces of the app in order to guarantee the security of the spaces. Wolves 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 environment where the App is being used.	They are the moderators of the forum. They should visit the forums frequently to see if there are forms of discrimination or harassment. They can block and unblock users from the forums. They can delete the content of any user. They can create events and have access to the information about the users who signed up. They can share new available resources with the users through the feature of "community resources." They can create new frequently asked questions to share with the community such in the sharing virtual sharing circles. They will receive reports of harassment or bad behavior. They can send public notifications to the community.
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 3 rd /4 th years or graduate students or Alumni. They should have previously been in the environment where the App is being used. The Bear shows bravery when protecting what is sacred and what is loved . This aspect is also transformed into courage and not aggression. You are standing up for what you believe in.	They can flag inappropriate posts and should look for misappropriation of TK and message Owls to intervene.
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.	They are to give feedback on the features and resources provided.
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 App 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.

Figure 4.4: Breakdown of Clans

a physical aspect to them, additionally, consent was not being considered when it came to sharing Medicines between users. Therefore, it was decided that Medicines, while still being virtual, would also have a physical connection outside of the app, and would also use consent in the process. That is, if User A wanted to “offer” medicine for User B, they would first ask for consent. If they were given consent, User A would then send a virtual medicine, and also offer that medicine in real life outside of the app for User B. The other feature that works similarly to this is Collectibles, however as the Collectibles used in the app do not have sacred significance, they do not require the same level of physicality as Medicines.

4.1.3 Phase Three Tasks

In the third phase, the low fidelity mockups were converted into full colour mockups, and annotated to reflect the functions of each element on each page. This is also the stage at which the implementation process began, thus the development team began to build the platform. The mockups were created on Figma, and the app was built using the Ionic Framework, with TypeScript, HTML, SCSS, Ruby, Swift, JavaScript, and Java. These tools were selected by the Executive Director for the first iteration and have not changed since then. The backend of the app has also remained the same since the first iteration. At this time in the redevelopment process, the team did not deem it necessary to make any changes to the tools being used.

Something that did require a revision, however, was the logo as well as the icons being

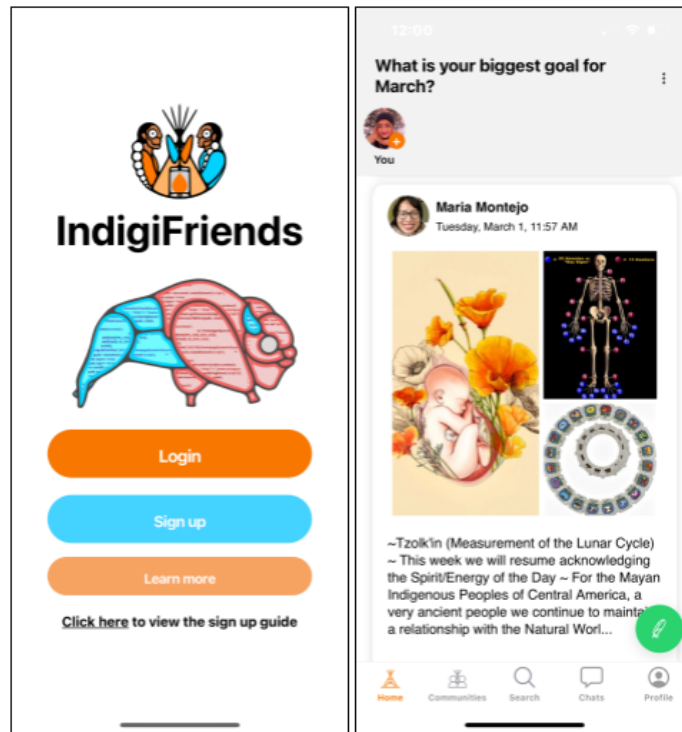


Figure 4.5: Welcome Page and Home Page of the Indigenous Friends Mobile Application. The image on the left displays a running buffalo (the image moves in the app) and is "coloured in" using HTML code. It also features circular buttons to give the user the option to log in, sign up or find out more information. The running buffalo is Tsista Kennedy's artistic representation of connecting culture with digital technology as buffalo are historically significant in some Indigenous cultures [26]. On the right is the Home Page of the platform, featuring the virtual Sharing Circle at the very top, followed by users' posts below. The post displayed in this photo is of a teaching shared by a healer named Maria Montejo who works closely with the Indigenous Friends Association. Note the unique tabs at the bottom of the screen which allow for navigation, as well as the green floating action button on the bottom right of the screen which uses an eagle feather icon to represent the Talking Feather, used in some Sharing Circles to give everyone a chance to speak [3].

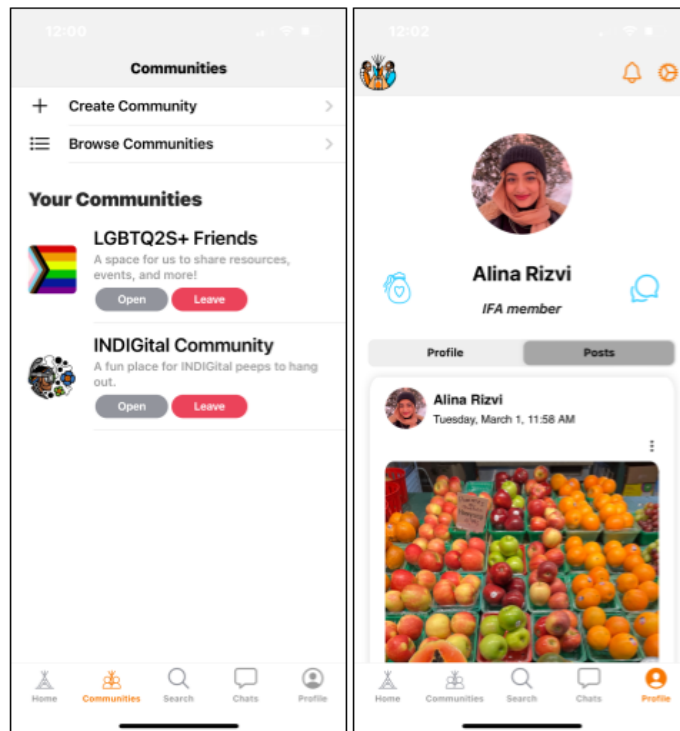


Figure 4.6: Communities Page and Profile Page of the Indigenous Friends Mobile Application. On the left is the Communities page, displaying the communities that a user belongs to as well as the option to browse new communities, open a community, or leave a community. Note the rounded edges of the community photos as well as the action buttons. On the right, a profile page displaying a user's photo in a circular format, along with buttons to access notifications, settings, their Medicine Bundle and the chat feature. On their profile, users can view all the posts that they have published.

used in the app. Firstly, the existing logo was simple and easily understood but required a modernization. Additionally, the team wanted to use culturally relevant icons to depict various pages on the app for a more Indigenous feel. The new image assets, including the logo and various icons used in the app were created by Tsista Kennedy, who used the Woodland artistic style in his images and modified them for use in mobile development [2]. These assets were what made a drastic difference between the previous and current version of the app. Visual elements are incredibly important in Indigenous cultures, and truly helped change the direction of the app from a Western platform into a very obviously Indigenous one [44, 17, 40, 27, 31, 61].

When most of the minimum viable product had been developed, the app was deployed to beta tracks, namely TestFlight on the Apple App Store and Android Beta on the Google Play Store. At this stage, those who contributed to the redevelopment in previous stages were invited as beta testers to use the app and report their feedback. Multiple Sharing Circles took place to give these beta testers/contributors the chance to voice their thoughts. This included suggestions for making the app easier to use and bug sighting. Mostly, these were bugs that testers found, and were handled accordingly. However, one feature stood out in the feedback as something that required some heavy changes. This was the Medicines and Collectibles feature, which testers were unable to understand how to use, leading them to ignore it entirely. The feature was reconfigured multiple times, but due to time constraints, had to be released as is. At the moment, this feature is still being refactored to make it more easy to use.

After several errors were resolved, the app was released on Alpha tracks. Although it was publicly available at this point, it was not advertised yet as the team wanted to slowly allow contributors to get a chance to find any remaining errors. The errors that occurred at this stage were mostly small design errors such as inconsistencies with screen sizes and long loading times. One issue that stood out here was the Sign Up feature, which some devices were not able to display correctly. The development team spent several days attempting to resolve this issue, but as it was a device-based error and only occurred in some devices, it had to be solved in another way. The team made a note to make it easy for users trying to sign up to contact IFA for help if they needed it.

Before the app could be officially launched, a prayer circle was held to release the new version of app into the world in a good way. An Elder was invited to lead this circle, and they helped the team relive and remember the time and effort that it took to reach this stage of completion. It was important for the entire team to reflect and acknowledge both the hardships and the ease with which this version of the app was created. The Elder also prayed for the success of the app and reminded the team that the app had a Spirit which would need to be nurtured on a constant basis. This was an important statement, as it forced the team to reflect back to the Birth Ceremony that took place in the beginning of this process. It was important to remember that the app's Spirit existed and would not be able to survive without everyone's effort.

Shortly after the deployment, we received a rejection from the Google Play Store, which

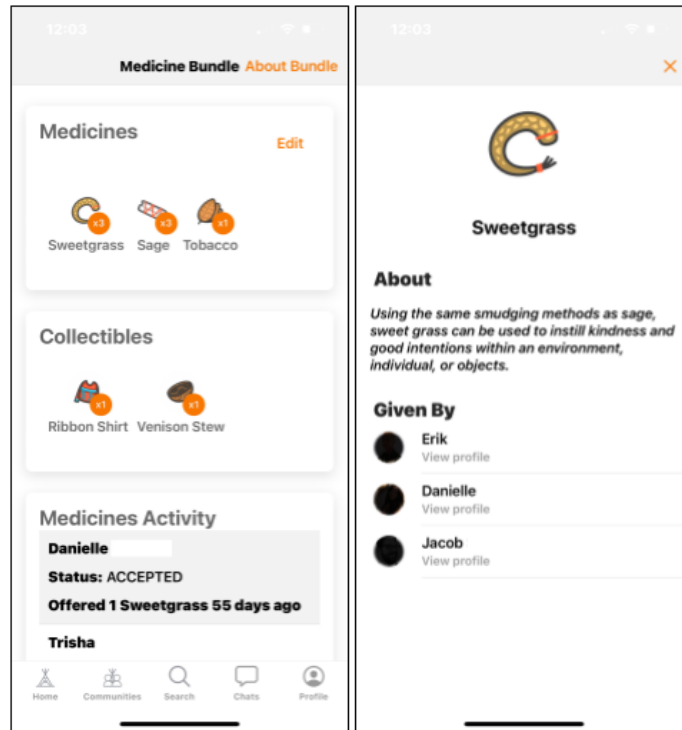


Figure 4.7: Medicine Bundle Page and Medicine Details Page of the Indigenous Friends Mobile Application. On the left is the Medicine Bundle page which showcases all the Medicines and Collectibles that a user has access to in their Bundle. The Medicines represent what the user truly has in their possession outside of the app, and Collectibles represent items that have been earned by the user or shared with the user from another user. Images for both the Medicines and Collectibles were specially illustrated by Tsista Kennedy for use within the app. Every Medicine and Collectible that is displayed is culturally relevant. On the right is the Medicine Details page which shares more information about a specific Sacred Medicine, in this image it is Sweetgrass. Some users' images and full names have been redacted to protect their privacy.

stated that the description of the app needed to be changed. Specifically, the beginning of the description had greetings in various Indigenous languages which Google did not understand. Something to note is that the app had been live in stores with the same description for years prior to this new version being submitted. That is, the description had not been changed in years, and yet this was the time that Google decided to reject it. The team could not understand why this happened, but submitted an appeal to Google three times to resolve the issue. Google refused to read the appeal and decided to reject it each time, likely because an automatic bot was handling the issue. In the end, the team was forced to change the description to avoid delays in publishing the app. This was an important lesson in the reason why Indigenous digital technology needs to exist; so that issues like this can be avoided. If the Google bot were able to recognize Indigenous languages, the app would not have been rejected multiple times.

4.1.4 Phase Four Tasks

When the app was published, it immediately entered the maintenance stage. New users emailed and posted on the app with their feedback, and it was sorted accordingly into categorized based on the type of feedback it was. This feedback included certain features not working for their devices, or bugs that were overlooked in the earlier phases. Overall, the feedback stated that the app was fairly simple to use, and once again the outstanding feature was the Medicines and Collectibles, which some users were unsure of how to use. There were

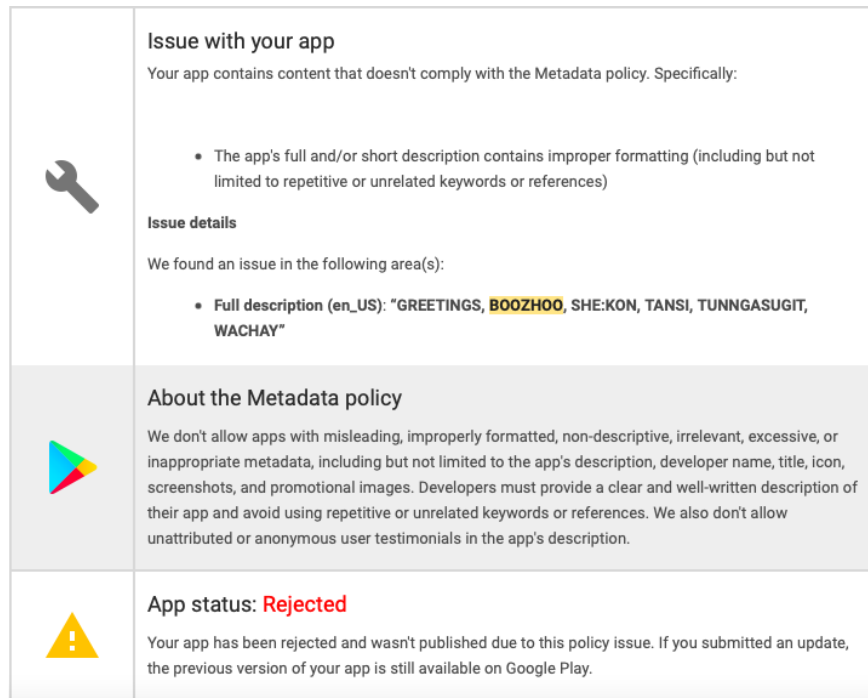


Figure 4.8: Rejection from Google Play Store with regard to Indigenous languages used in app description.

still some issues with users being unable to sign up due to device issues, and new issues surrounding push notifications not being delivered to users' devices. The push notifications issue was resolved, and sign up is in the process of being reconfigured to ensure that users are able to sign up regardless of their device incompatibilities. Medicines and Collectibles are also in the process of being reconfigured, but are lower on the priority list due to their low popularity. It should be noted that the features that are being reconfigured will go through a process that involves user feedback, just as they did during the initial design process.

4.2 NPAAMB Mobile Application

4.2.1 Phase One Tasks

The Niagara Peninsula Aboriginal Area Management Board (“NPAAMB”) is a not-for-profit organization that provides employment and training resources to Indigenous youth. NPAAMB reached out to IFA to build an app for their Youth Navigation Service. The organization listed some expectations and a proposal was built based on what was communicated. The app was to list resources, events, programs, and staff that could be of use for youth who were looking to be employed in the Niagara Peninsula region. The organization also asked to make the app as culturally relevant as possible, and did not require any user interaction, as the app was supposed to be a platform only to consume information. Once the proposal was approved, a contract was signed, and the next step was to hold a Birth Ceremony for the Spirit and success of the app. The contacts at NPAAMB as well as a portion of the IFA team shared an online space where the Ceremony was held. In this space, there was an addition to the prayers that were made for the Spirit of the app. Here, the group also prayed for the success of the partnership that was taking place between NPAAMB and IFA. Once both organizations had come to an agreement, the IFA team started to meet with NPAAMB’s youth, that is, the end users of the app. Sharing Circles took place where IFA, NPAAMB and the youth were present and shared their expectations of the app. These Circles are where the designers and developers of IFA got a better understanding of how to go about shaping

the app.

4.2.2 Phase Two Tasks

The first step in the second phase was to build an Information Architecture. This document led the designers and developers towards selecting a minimum viable product, as well as selecting the correct tools with which to start building the app. It was determined that there would be only two types of users: those who were administrators of the app (i.e. employees of the NPAAMB app) and typical users (i.e. the youth accessing the information on the app). Because of familiarity with the backend that was being used for the IFA app, the same one was used for this app as well. An additional reason to use the same backend is the fact that this app was very basic (i.e. one that users would only consume information from, as opposed to creating content themselves) and would require a basic backend plan as well.

Simultaneously, low fidelity wireframes were created as a result of the Information Architecture document. These first mockups were created on Figma and, in order to get useful feedback from the users, it was turned into a low-fidelity prototype. Another few Sharing Circles with both the youth and NPAAMB took place, where they shared their feedback and concerns. On the whole, both the youth and the NPAAMB team found very few changes that they wanted to make and, once addressed, were ready to move onto the next step. The frontend tools needed to be selected, and particularly for this case, the tools required to build the NPAAMB app in an optimal way needed to be determined. Here, it

was determined that the Ionic Framework would be used to develop the frontend of the app.

4.2.3 Phase Three Tasks

In the third phase, the low-fidelity mockups were translated into high-fidelity and passed on from the designers to the developers. Additionally, there were some design assets (i.e. navigational icons) that were already created for the IFA app that could be used for this app as well, so they were added in. The relationships that were built during the process of development led to contributors in the NPAAMB team to share positive experiences that they had with the platform, issues that they wanted to be solved, and even possible solutions. We believe it is only because the team was sufficiently empowered to contribute that this information was conveyed and adopted. The resulting excitement in the room clearly demonstrated the significance of the seemingly small changes that we had made to make the platform more culturally relevant. It was exclaimed several times, in fact, that our team had gone above and beyond in the cultural aspect of the platform.

This app features a Home page where all the resources can be accessed in a grid form. The resources can also be filtered and searched through using a filter and search feature on the same Home page. When a resource is selected, more information about it are displayed including the name, a description, location, and contact person. Here, users may also tap the heart icon to “like” and save a resource to their Favourites. The next page is a Near Me page which displays the same resources as the Home page, except on an interactive map. This

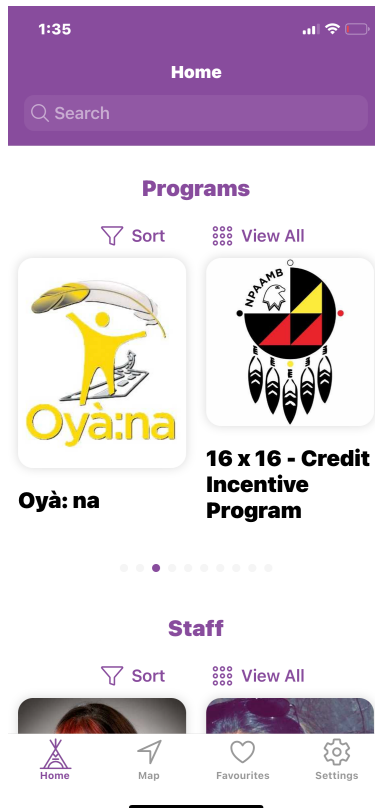


Figure 4.9: Screenshot of NPAAMB App Home Page. Note the rounded edges of the image cards, and the circles used to scroll through them.

was a feature that was specifically requested by the NPAAMB team as it would aid in the visual aspect of locating resources near youth. The Favourites page is located next, and this is where all of a users' "liked" resources are saved. Finally the last page is for Settings, where users can adjust their display and privacy preferences, and administrative users may also use this page to log in and add resources. The app is very similar for administrative users, the only difference is that these users are able to create, edit and delete resources.

To build the app, relationship diagrams were created to connect the front and backend, as well as the backend with the database. As a result of these diagrams, functions were created

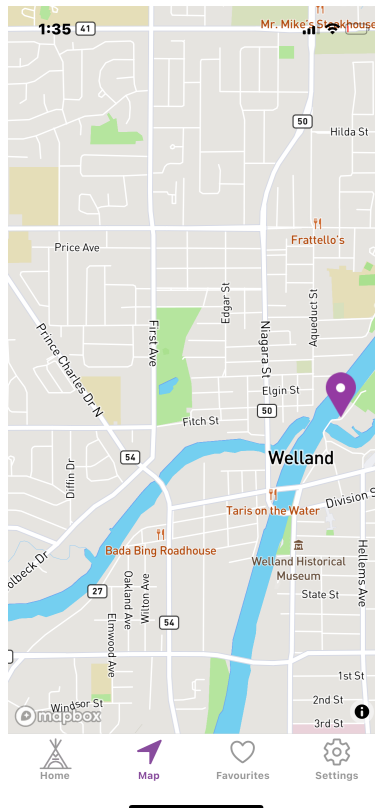


Figure 4.10: Screenshot of NPAAMB App Map Page, displaying a location at which an event hosted by the organization is taking place.

for the code, and the minimum viable product was achieved. Once it was approved to be released on beta tracks, the NPAAMB team and the youth users were invited to download the beta version of the app and share their feedback with the development team. There were only slight functional flaws here, including users being unable to scroll through resources and images not loading fast enough. Once these were resolved, the app was published to both the Apple App Store and the Google Play Store.

Once launched, a Sharing Circle was held with both the IFA and NPAAMB teams to gather some feedback on the process of the partnership as well as understand what the

next steps would look like. In this case, NPAAMB would receive six months of support in app maintenance and any requests would be made directly to the development team. This included only maintenance requests such as bugs and upkeep of the server, and did not include any new features. If new features were required, those would be handled on a case by case basis.

4.2.4 Phase Four Tasks

In the maintenance phase, the general tasks of keeping the database on track and finding and handling bugs took place on a biweekly basis. During the six month support period, the NPAAMB team hired a new employee to handle the app. Because this employee was new to the app, they noted some bugs but also wanted to make changes that went beyond the limitations of “maintenance” and so these requests were handled individually. The changes that needed to be made included adding a background image for the app, adding more information to the Near Me feature, and changing the way that the resources were categorized. These changes also came with their own sets of bugs, but each were handled as they came up.

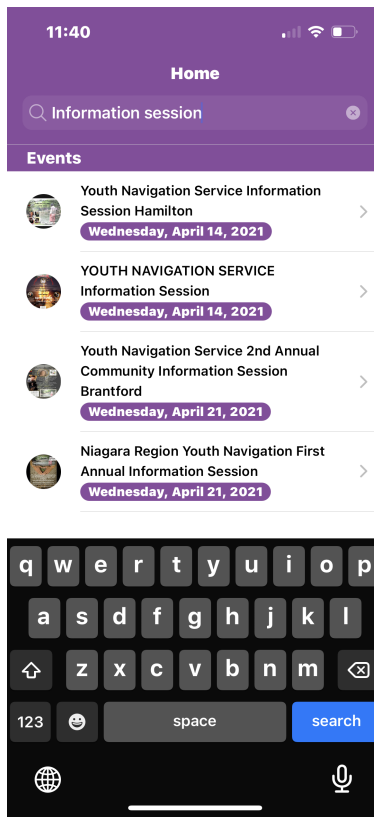


Figure 4.11: Screenshot of NPAAMB App Search Page. Take note of the circular images displayed to reflect the results of the search query. Also note the rounded edges of the displayed dates, and Search bar.

4.3 Creating an Ideal Digital Platform for Indigenous Youth

One part of the research conducted for this thesis focused on discovering what it was that urban Indigenous youth in Toronto wanted to see in a mobile application. Through multiple Sharing Circles, and conversations with collaborators, it was discovered that at its core, the most important thing that was sought after was a safer online space on which to share thoughts and feelings. As previously mentioned, Facebook has been a popular application used by urban Indigenous youth for years, however, it comes with the disadvantage that users' data is not very private, and is sold to advertisers [53]. Additionally, it was important that the online space could be one that was related to culture, and could feel like an exclusive community. The IFA application and the NPAAMB Youth Navigation application, therefore, catered to these needs. For both the applications, privacy and distribution of user data was not an issue, as IFA only ever tracked anonymous user data (for analytics), and never sold user data to begin with. Initially, the IFA app asked users for a lot of information including their education status and gender. The new version only asks for users' names, pronouns, and email addresses - this also helped users feel comfortable in choosing the app. The NPAAMB app did not collect any user data (aside from usage) as it did not require users to create accounts or interact with each other.

For the IFA app, the issue of creating a sense of community using culture became easier as

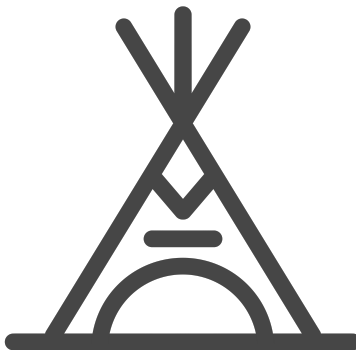


Figure 4.12: Indigenous Friends Mobile Application Tipi icon. This was illustrated by Tsista Kennedy and is used as the new standard to replace the icon of a House for the home page of any platform that is created. It should be noted that this icon is used for both the Indigenous Friends Mobile Application as well as the NPAAMB Mobile Application. The seemingly small shift from an image of a house to an image of a Tipi has made a large impact on how users view and interact with the space.

more conversations took place with collaborators. This meant that we created the concept of virtual medicines and collectibles which were very particular to cultural items, such as beaded earrings, ribbon skirts, and bannock. We also created new icons to replace the standard ones, including a Tipi for the Home screen, as opposed to a house. Finally, every shape used in the app was either purposely turned into a circle, or was styled to have rounded edges to maintain the circular theme. As mentioned earlier, circles are important in Indigenous cultures, and this detail made a large difference in the final design.

Communities were also created as a feature on the app to facilitate conversations between users about particular interests. This includes users who are participants in the INDIGital program, as well as a group for 2SLGBTQ+ users, and those who attend specific post-secondary institutions. However, there is more work to be done in these areas. Both the



Figure 4.13: Indigenous Friends Mobile Application user icon. This was illustrated by Tsista Kennedy and is used as the default profile photo for any users who do not want to upload a photo of their own.

medicines and collectibles, and the communities features are not popular and require further development through the use of Sharing Circles with collaborators. While this feature lacks popularity, this is actually a strength of the development approach as it allows for the continuous building of dialogue. The fourth phase of the development approach is dedicated to maintenance, which includes taking a look at different features to assess their significance and whether any changes need to be made to them.

For the NPAAMB app, the same icons were used as a sort of "new" standard, and the rounded edges and circular shapes were also included. The sense of community was naturally created as the organization, NPAAMB, caters to youth looking for employment and engagement opportunities. Additionally, since the organization is established in the Niagara region, there was little that IFA had to do from the perspective of application development.

4.4 Impact on Users

The application of the development approach led to major changes in terms of the impact on the mobile applications. Since the NPAAMB Youth Navigation Application was a newly created platform with no reference regarding the user impact, only the Indigenous Friends Mobile Application will be considered for this section. Previously, while the mobile application was still in its second version, there was an average of 2 users, aside from the employees of IFA, that were actively engaged on a weekly basis. These users only used the application to play games that are no longer in use in the new version. Additionally, it should be noted that gift cards were used as incentives to keep these users engaged.

When the development of version 3 began, multiple people were involved in the process. This meant that every individual who saw or heard about the application being built, or those who were actively involved in the development knew that an application that they had helped to build was going to be released. This played a large part in the user engagement, as these individuals wanted to see what they had, in part, created, and also told their friends and/or families about it. In terms of numbers, the application had 139 users in January 2021, with a daily average of 7 active users, and the organization had an aim of 200 users at the time. As of January 2022, the app has above 500 users, with a daily average of 55 active users. That is, the IFA mobile application saw an increase of over 360 users, and an increase of over 680 percent of user engagement.



Figure 4.14: Indigenous Friends Mobile Application average monthly users in January 2021



Figure 4.15: Indigenous Friends Mobile Application average monthly users in January 2022

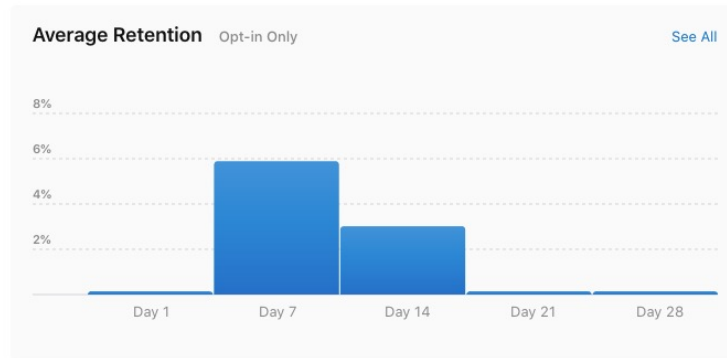


Figure 4.16: Indigenous Friends Mobile Application user retention rates in January 2021

Retention rates are defined as the percentage of users that return to the mobile application after initially downloading it. In January 2021, the retention rates fell dramatically after the first two weeks of installation. That is, users were mostly only active in the first two weeks, and stop returning to the application after the 14 day mark. In January 2022, however, users commonly returned to the application on a biweekly basis, leading to numbers fluctuating between two to six percent of users returning to the application. Upon further inspection, this was probably caused by the Traditional Teachings and virtual Sharing Circles that were shared on a similar basis. These two features were not previously present in January 2021.



Figure 4.17: Indigenous Friends Mobile Application user retention rates in January 2022

4.5 Positive Outcomes

- Created an exclusive, virtual space in which people can comfortably express themselves.
- Helped some urban Indigenous youth in Toronto change their outlook on digital technology.
- Built a mobile development framework that is easy to use and adapt.
- Increased user engagement, user retention and number of users for the Indigenous Friends mobile application.
- Gained perspective of what users want through positive user experiences and anecdotes.

- Built long lasting relationships with a diverse group of people with similar values.
- Gained a better understanding of what factors are important to urban Indigenous youth in Toronto when it comes to building digital technology.
- Was invited to learn more about traditional knowledge, teachings, and cultural practices.
- Created a space in which inclusive technology can become a part of a larger conversation.

4.6 Negative Outcomes

- Inability to connect with multiple people due to time and pandemic-related constraints.
- Lack of technical skill led to inability to control exactly what the platforms looked like.
- Unless supervised, teams can forget or skip steps of the mobile development approach.
- Difficult to accommodate all of users' wants, especially when trying to avoid scope creep.
- The development approach requires a very good project manager to ensure that all needs are met and all steps and documentation are completed.
- App stores would not allow for certain features or language to be published, and therefore changes needed to be made to make the applications eligible.

Conclusion

This study found that a safer online community was the most sought after digital platform for urban Indigenous youth in Toronto. The newest version of the Indigenous Friends Mobile Application was directly informed by the feedback from Indigenous youth. This, along with following the mobile development approach, led to an increase in user engagement, number of users, user retention, and positive user experiences as a result. The approach was built to aid urban Indigenous youth in learning to build digital platforms, and also as a standard to help others in the industry to create technology for Indigenous youth.

The current standard of digital platform development tends to be an exclusive, inaccessible environment, especially for urban Indigenous youth in Toronto. Organizations that create these standards seem to assume that they are useful in every context, given their success. However, this success can be a result of a lack of availability of other standards, and the consumers of these standards might be using them out of obligation or powerlessness. That

is to say, there is nothing better for Indigenous youth to use, and they may not know how to create better solutions. This is where the Mobile Development Approach comes in, as the thoughts and experiences of this population have the potential to change the standard of platform development for the better. The approach takes into account the existence and importance of cultural practices. It gives contributors a platform to describe what cultural practices are significant and how they can compose the final platform. That is, the stories shared by contributors should not be appended to an existing platform, rather used as the foundation to build it. This is where the difference lies between designing a platform for a target audience and the target audience designing a platform.

That said, this method can truly only be successful if combined with relationship building through frequent, comfortable conversation. While focus groups create a sense of order through the use of identifying a "leader" and "participants," a Sharing Circle differs greatly. Sharing Circles remove the idea that any one person has higher authority than others and instead places importance onto every individual that is present. This allows for ease to be built directly into the foundation of the conversations that take place. The awareness of a present Spirit as well as the acknowledgements made to ancestors before and/or after each Sharing Circle provide context and remind contributors in the Circle of why they are there and why their participation is important. It is through these Sharing Circles that contributors get a chance to find out more about each other and therefore start to build relationships, naturally leading to more conversations. More conversations lead to more ideas being built, even outside of the Circles, thus extracting rich contributions of knowledge, stories and

suggestions for the platform. These contributions are at the very core of the digital platform.

The Mobile Development Approach has provided the steps on how to build a digital platform that can be truly successful in the context of urban Indigenous youth in Toronto. However, it may also be applicable to other audiences with some simple tweaks based on cultural differences. If we focus only on the cultures that exist just within the urban Indigenous youth population in Toronto, it is evident that the approach can be applied in the context of stories and traditions from many different communities and Nations. Some core elements such as reflection and the focus on end users should not be altered, however elements such as which images are used, or different types of ceremonies may change. While the aim of this approach is to create inclusivity in the tech industry, it cannot be the sole standard, as any one document cannot encompass every issue that every culture faces. Rather than being a quintessential approach, this is a starting point upon which to build inclusive technology. It is through accessibility and ownership that digital technology can become a powerful tool in the hands of many intelligent people.

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Appendices

Appendix A: Mobile Development Approach Document