Determining Critical Design Elements That Bridge Virtual And Physical Learning About The Mackenzie River

by

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Abstract

The Mackenzie River system is an important feature of the Northwest Territories (NWT). Students in the NWT schools could benefit from the support of curriculum resources to develop their knowledge about the Mackenzie River. Using the process of Human-Centred Design as a theoretical framework, I interviewed ten NWT teachers as potential end users of an online resource for learning about the Mackenzie River. The data from the teacher interviews was used to create a list of design criteria for a website-based educational resource on the Mackenzie River. In partnership with the Northwest Territories Department of Education, Culture and Employment and the Prince of Wales Northern Heritage Centre (PWNHC), I created a prototype website in which students can make a virtual river journey while meeting the requirements of the Grade 4 curriculum. The teachers who were originally interviewed then reviewed the prototype and made further recommendations for a final version of the website.

Keywords: Mackenzie River System, Dehcho, Education, Digital Media, Grade 4, Curriculum, Northwest Territories, Social Studies, Prince of Wales Northern Heritage Centre, Human-Centered Design.
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Chapter 1: Choosing a River Journey

I am a non-Indigenous woman who was born on the traditional territory of the Tk’emlúpsemc, ‘the people of the confluence,’ now known as the Tk’emlúps te Secwèpemc in the city of Kamloops, British Columbia. My family moved to the North when I was three, and I have lived and worked in the Northwest Territories (NWT) for most of my life. This design study took place across the NWT in Inuvialuit and Gwich’in, Tłı̨chǫ and Sahtu settled land claim areas as well as the unsettled land claim areas of the Dehcho, Akaitcho and NWT Métis\(^1\).

**My story with the Mackenzie River**

In September 2004 I had just been through a rough year. I was recovering from a big battle with Non-Hodgkin’s Lymphoma. Everything had gone well, but I wasn’t feeling prepared to go back to work yet.

“You should paddle the Mackenzie River,” my dad said, “we need a guidebook.”

“Why not,” I thought.

I was feeling healthier and I had always wanted to write. I was up for the adventure and a new challenge, and the saying “You only live once” was front and centre in my mind.

I set off that year paddling from Hay River to Fort Simpson. It was hard. I brought along a paddling partner who was cranky. The water was low and it was cold. We were paddling late in the year and he was anxious to get it over with. But still, despite the headaches, there were beautiful moments, and so the next year I set out again. That second year, with my friend Farah, we paddled from Fort Simpson to Norman Wells. It took us three weeks. It was a wonderful trip making our way down the giant river, stopping along the way and listening to stories, drawing, writing, or napping on the riverbank. It was a third summer before I finished, paddling all the

---

\(^1\) This personal introduction follows the protocols suggested in the article “Unsettling Settler Colonialism: The discourse and politics of settlers, and solidarity with Indigenous nations” (Snelgrove & Corntassel, 2014)
way to Tuktoyaktuk. We danced on pingos\textsuperscript{2} and lay in the tundra popping akpiks\textsuperscript{3} in our mouths and listening to the wind and the ocean.

![Map of the Northwest Territories (NWT).](image)

Figure 1.1 Map of the Northwest Territories (NWT). Map shows the Mackenzie River System route within the NWT, including the Slave River, north to Great Slave Lake and then Northwest along the Mackenzie River (Dehcho) to the Arctic Ocean (PWNHC, 2015). Copyright Prince of Wales Northern Heritage Centre. Reproduced with Permission.

To paddle the Mackenzie River is a practice of meditation. The river is predictable in its size and tempo. As big as an ocean, you can get lost in the sky, the rhythm of the paddle and the daily tasks. Peaceful or hard, the river will take you along. And then, when tired, which can be at

\textsuperscript{2} Pingo means ‘small hill’ in Inuvialuktun. It is a mound of ice covered with earth.

\textsuperscript{3} Akpik is the Inuvialuktun word for a small edible red berry. The latin name is \textit{Rubus chamaemorus}.
any time with a midnight sun, you come back to the land, unpack your canoe, take out your gear, set up your tent, brush your teeth, wash your face in the river and go to sleep. You do this, knowing all along that tomorrow will be the same as today. This rhythm creates a peaceful pattern and a joy for small tasks.

This joy, and celebration and wonder for our world are emotions I have always deeply felt. It is a motivator for me, now more than ten years cancer free, to think of the river with love. To my core, I feel that this river was part of my healing and that I owe a debt of gratitude to the river.

There was a boy I met on the beach near the community of Tsiighetchic. In appearance, he was a typical teenager with a baseball cap. His friends, who were shy, stayed behind him. As we pulled our canoes on shore he came over to us. “Welcome,” he said with open arms, “welcome to my land.” When I think of that moment I well up with pride. It is beautiful to have such a deep sense of place to be able to say, without hesitation or pretence, “welcome to my land.” When considering a topic for my thesis, I knew that I wanted, like the boy I met in Tsiighetchic, to do something to express my pride for the river.

There is a bond between humans and the natural world in which we have evolved, and our disconnection from that bond can cause us suffering (Davis, 2006; Macy & Brown, 1998). As Joanna Macy states in her book, Coming Back to Life (1998), “The tasks [healing the world] proceed more easily and productively from an attitude of thankfulness for life; it links us to our deeper powers and lets us rest in them” (Macy & Brown, 1998). This place of gratitude also plays an important transitioning role as Macy says, “knowing what we treasure triggers the knowing of how threatened it is” (Macy & Brown, 1998).
And this river system is threatened. Downstream from the Alberta Oil Sands, where the tailings ponds are balanced precariously on the edge of the Athabasca River, the leaks, the air pollution, the systemic clearing of forest to dig an ever-widening hole (Kelly, E. N., Schindler, D. W., Hodson, P. V, Short, J. W., Radmanovich, R., & Nielsen, C. C., 2010)Kelly et al., 2010; Nikiforuk, 2010; Wohlberg, 2014). It seems that there is no end to the destruction in that place. The Peace River and the proposed Site C dam also threaten to change water patterns and levels. On the shores of the Mackenzie River itself, hydraulic fracking for oil has been proposed. The sadness and grief that I feel for the river is often overwhelming. So much money is tied to the upstream destruction that it seems hopeless.

As with gratitude, having a collective space to reflect on our pain for the world is critical. “We must be ready and willing to bring to awareness our deep inner responses to the suffering of others in order to see ourselves as interrelated; part of one large body” (Leighton, 2014). This understanding of our interrelatedness or our connections helps us to build communities and to change our organizations and systems that are stuck, moving us out of internal self-pity towards an awareness of collective pain.

Acknowledging our collective grief for the river gives us more energy, because it takes energy to hold onto that pain (Rivers, 2010). This energy allows us to see the connectedness of all things, which Joanna Macy (2012) calls “Seeing with New Eyes”. Sharing in our gratitude and grief for the river will give us the space, collectively, to see with new eyes, and to see how we have all been, metaphorically, “losing our sight”.

As with paddling a river, in life as an environmental educator I must wake up each morning with the intention to get a little further along. To pack up my gear, take down my tent, make breakfast and coffee, brush my teeth and wash my face in the river, to write and draw in
my journal, to stretch, to pack up the boat, to shove off away from the bank and into the river, floating now and, stroke by stroke, to travel through the country.

To go forth in my own small way I wanted to celebrate the river system that has provided so much to me and to many others. In this thesis I have set out to create a community through the creation of a Mackenzie River website, through which by sharing our stories with each other we might move collectively together. The river is always moving and changing. An interactive website can be continually updated and changed as well. A website can contribute to creating a collective space, uniting the people along the river in a forum to share and celebrate stories about the Mackenzie River.

The Mackenzie River System

Importance of the Mackenzie River System

Flowing from Great Slave Lake to the Beaufort Sea, the Mackenzie River is more than 1,800 km long (Government of the Northwest Territories and Government of Canada, 2010). The river is sourced in the meltwater of the Columbia Glacier in Alberta and the snowpacks of the Omineca Mountains in BC. These waters flow into the Athabasca and Peace rivers, combining into one flow in the Slave River and onto the Mackenzie River through Great Slave Lake. This mighty basin covers one-fifth of Canada (1.7 million km$^2$) and drains through Canada’s largest freshwater delta (13,500km$^2$) the Mackenzie Delta (Anielski & Wilson, 2010; GNWT and GC, 2010).

The Northwest Territories has approved seven official names for Canada’s longest river including: Kuukpak (Inuvialuktun), Nagwichoonjik (Gwich’in), Deho (North Slavey), Dehcho (South Slavey), Grande Rivière (Michif), Mackenzie (English) and Rivière Mackenzie (French)
DESIGN ELEMENTS THAT BRIDGE LEARNING ON THE MACKENZIE RIVER

(Lafferty, 2015). All of the names, with the exception of the English and French names, roughly translate to ‘big river’ (PWNHC, n.d.).

It is important to introduce this great river with all of its names up front, because starting with only the English name gives the impression that the history of the river began in 1785, when Sir Alexander Mackenzie completed his journey north. That wouldn’t be at all accurate. The river was (and continues to be) an important travel corridor – a subsistence- and cultural resource for the many Dene, Métis and Inuvialuit whose traditional territories lie along its shores (DCI, 1989; Heine, 1997). Culturally, the big river is a geological reference point for many legends that span the entirety of the river system. For example, Yamoria\(^4\) is a cultural hero who is regarded as having provided the Dene Law, or traditional teachings that guide the Dene people. The Dene Law relates to stories that link to specific sites along the river and other sites in the NWT (Blondin, 1997).

Written text about the river begins with Sir Alexander Mackenzie’s journal (Mackenzie, 1802) in which he records day-by-day, mile-by-mile his journey on the river from Fort Chipewyan to the Arctic Ocean. While his impressions are those of an individual who sees himself as superior to everyone he encounters and the land only for its potential resources, the journal is still a fascinating account of a river whose course has changed little since Mackenzie’s journey in 1785 (Mackenzie, 1802).

As fur trade posts began to be established along the river, written text came from the journals of the Northwest Trading Company and the Hudson’s Bay Posts. These journals detail the day-to-day workings of a fur trade post: the visitors, the food, the number of furs brought in, and the bickering with other companies (Keith, 2001). Like Alexander Mackenzie’s journal

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\(^4\) Yamoria is his North Slavey name. His other names include Atachûukâjî, Zhamba Déja, Yamǫožha, and Hachoga.
entries, these texts generally tend to be patronizing and to emphasize the perspectives of the traders who felt they were superior to the very people on whom they were relying (Keith, 2001). Missionaries such as Émile Petitot created the first written texts that attempted to incorporate the perspectives and stories of the Dene and Inuit. Petitot published several books in the late 1880s based on his earlier experiences in the Northwest Territories—including several years in the Mackenzie River Valley. While there are language errors in his books and the perspective is, again, that of a European male, these books do provide a more comprehensive historical account through Petitot’s attempts to capture the oral stories he was told by the Dene (Petitot & Fortuné, 1976; Petitot, 2005).

In more recent history, many excellent resources have been written by the ancestors of the people Alexander Mackenzie would have encountered on his journey. Among the key books are an autobiography by Nuligak, who documented the changes to his Inuvialuit community and way of life in the early 1900s at the outlet of the Mackenzie River (Nuligak, 1966), books by storyteller and hunter George Blondin that take place across the Mackenzie River valley (Blondin, 1997) and the accounts of John Tetso, a Dene trapper in the Dehcho, in his book, *Trapping is my Life* (Tetso, 1970).

There have also been many publications by Dene, Métis and Inuvialuit organizations. Oral histories, legends and stories have been captured from elders, transcribed and published through the careful work of the Gwich’in Social and Cultural Institute, the Sahtu Heritage Places and Sites Joint Working Group, the Dene Cultural Institute and the Métis Association of the Northwest Territories (Blondin, 1997; DCI, 1989; Heine, Michael, Alestine Andre, Ingrid Kritsch, 2007; Overvold, 1976; Sahtu Heritage Places and Sites Joint Working Group, 1999).
The book *Mom, We’ve Been Discovered*, (1989), published by the Dene Cultural Institute provides a perspective that is missing in Alexander Mackenzie’s Journal. That is, the perspective of the Dene people on encountering a White man. The report, *The River is Like a Highway to Us*, documents the historic and contemporary importance of the Nagwichoonjik\(^5\) to the Gwich’in people\(^6\). This report was submitted to the Canadian Heritage Rivers Committee and this section of the larger Mackenzie River was designated a National Historic Site of Canada in 1997 (DCI, 1989; Heine, 1997; “Nagwichoonjik (Mackenzie River) National Historic Site of Canada,” 1997).

Today there are 14 communities, many of which are former fur trade posts, which lie directly on the shores of the Mackenzie River system as it flows from Ft. Smith to Tuktoyaktuk\(^7\). These communities range in size from 50 to 4,000 people and cover an expanse of more than 2,500 km\(^2\). The river continues to provide drinking water, as well as a rich environment for important subsistence species (fish, waterfowl, and large mammals, such as moose), a transportation corridor for supplies from the south and a place to teach, learn and practice cultural traditions and skills (GNWT and GC, 2010). Additionally, the river provides non-extractive opportunities for tourism and recreation (GNWT and GC, 2010).

The river is also important for industrial development, particularly south of the NWT where pulp mills, agriculture, hydro dams and the oil sands developments all have an impact on the river (GNWT and GC, 2010). Some of the impacts of these industries, such as the leaking of tailings from oil sands developments on the Athabasca River and the building of hydro dams on

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\(^5\) Nagwichoonjik is the Gwich’in word for the Mackenzie River

\(^6\) The Gwich’in people are a northern Dene First Nation part of the Athapaskan language family. The Gwich’in region is a settled land claim area that encompasses an area north of the Sahtu Region and south of the Inuvialuit Region in the NWT.

\(^7\) These communities include Fort Smith, Fort Resolution, Hay River, Fort Providence, Jean Marie River, Fort Simpson, Wrigley, Tulita, Norman Wells, Fort Good Hope, Tsiigehtchic, Aklavik, Inuvik and Tuktoyaktuk.
the Peace-Athabasca system, are a source of frustration to NWT residents who are concerned about downstream effects (Henton, 2008; Hume, 2009, 2013).

While the river provides resources for industry, it is also critically important for the plants and animals of the NWT and for providing major ecological services to the planet such as clean air and water filtration (Anielski & Wilson, 2010). For example, in a 2009 study, the ecological value of the Mackenzie River system was estimated to be worth $3,426 per hectare (ha) compared with the market value of $245 per ha (Anielski & Wilson, 2010).

The People of the Northwest Territories

The NWT population is estimated at 43,234 people (GNWT, 2015), of which approximately 50% are Aboriginal (Dene, Cree, Inuit and Métis) (GNWT, 2008a). On-the-land activities are important to people in the NWT, both as a source of food (hunting and fishing) and as a place of recreation. Census results in 2013 found that approximately 50% of the NWT population hunts or fishes and approximately 6.1% traps (GNWT, 2013b).

The official languages in the NWT are Dene Suline (Chipewyan), Cree, Tłı̨chǫ, Gwich’in, Inuktitut, Inuvialuktun, Inuinnaqtun, North and South Slavey, French and English (GNWT, 2013c). As of 2014, 38.5% of Aboriginal people in the NWT over the age of 15 were able to speak an Aboriginal language; however, there is variation between communities. In some smaller and more remote communities there is fluency over 90%, whereas larger centers such as Yellowknife (23.9%) tend to have lower rates (GNWT, 2006).

As of 2011, more that 40% of Aboriginal people in the NWT had not completed high school and only 6% had a university degree compared with 35% of non-Aboriginals (GNWT, 2011b). One way that NWT schools have been working to counter these discrepancies is through
initiatives such as the Aboriginal Student Achievement Plan (GNWT, 2011a) and the Education Renewal and Innovation Framework (GNWT, 2013a).

The Prince of Wales Northern Heritage Centre

The Prince of Wales Northern Heritage Centre (PWNHC) is the territorial museum, the home of northern collections, conservation programs, and the NWT Archives. As part of their education program, the PWNHC is developing an education kit about the Mackenzie River. This kit is tailored for the approved Grade 4 NWT Social Studies curricula and currently includes tangible materials such as river charts, photos and historic items. NWT educators are being encouraged to incorporate online materials into their classrooms and the PWNHC is seeking to support this goal.

The PWNHC offered support to me as a sponsor for the development of an interactive website prototype (a ‘work in progress’ 1st model) about the Mackenzie River. They provided advice, background materials and most critically, the time and skills of their website designer Rajiv Rawat. The Department of Education, Culture and Employment Curriculum Coordinator, Mindy Willett, also provided extensive advice and background materials as the project progressed.

Research Question and Objectives

The purpose of this thesis research was to determine what design elements of an interactive and interdisciplinary river-based website might best support teachers and be most engaging for students. This project is focused on the historical transportation corridor of the Mackenzie River system from Fort Smith to Tuktoyaktuk, NWT and seeks to describe the components that make up an effective bridge between virtual and physical experiences with regards to environmental understanding.
My research objectives were the following:

- (1) to gain input from practicing NWT school teachers about the design features that they would find valuable in an online learning environment and resource focused on the Mackenzie River system;
- (2) to develop a prototype of a website for use by teachers and students in learning about the Mackenzie River; and
- (3) to field test the prototype website with representative educators in order to refine the prototype for ultimate full-scale implementation.

The results of this project are intended to provide new possibilities in presenting whole environmental education about the Mackenzie River from a systems perspective while offering multiple perspectives in virtual formats. Given the interest within our territorial education system in incorporating new media and developing an interdisciplinary curriculum (GNWT, 2012) a virtual river system could be an excellent starting place from which to answer the question: “From the perspective of classroom teachers in the NWT, what design elements of a virtual river system will facilitate students’ online learning about the Mackenzie River system?”

In this first chapter I have provided the context of my thesis including the Mackenzie River, the people of the NWT and my interest in the research project. In Chapter 2 I examine some of the literature in environmental education as it relates to rivers, the inclusion of Indigenous knowledge and sense of place, and the use of digital media in education. In addition, I review some literature concerning the principles and processes of Human-Centred Design as a tool for creating new educational resources and briefly discuss the development of the education system in the NWT – past, present and future. In Chapter 3 I describe the application of the concepts of Human Centered Design (HCD) to the design and implementation of my research
and provide details about the procedures used in the conduct of the research. In Chapter 4 I
present the results of using the HCD design process and describe the results of the first
interviews with teachers and the design decisions that were made based on the interviews,
present and illustrate the resulting prototype and offer selections of the feedback received from
the teachers who were able to test the prototype website. Finally, Chapter 5 concludes with the
project’s implications, successes, challenges and recommendations for future work.
Chapter 2: A River of Information

The focus of this study was on the design and development of a website to support the Grade 4 Social Studies curriculum as offered by schools in the Northwest Territories (NWT) of Canada. This literature review has therefore focused on the background and development of the design process and Human-Centred Design (HCD) in particular (IDEO.org, 2012, 2015). As any form of design always occurs within an existing social, political, cultural, and economic context, I also review research related to environmental education, focusing on water, sense of place, children’s programs and the use of rivers as a teaching tool. I then review the incorporation of Indigenous knowledge into curriculum, the use of digital media, the context of the existing education system of the NWT and finally, the research specific to the human-centered design process and the use of digital media as it relates to environmental education.

Environment and Education

Environmental Education and Water.

In 1975, the UNESCO Belgrade Charter stated that the goal of environmental education is:

To develop a world population that is aware of, and concerned about, the environment and its associated problems, and which has the knowledge, skills, attitudes, motivations and commitment to work individually and collectively toward solutions of current problems and the prevention of new ones. (UNESCO, 1975)

The Belgrade Charter further presents a number of principles, which are still relevant to environmental education (EE) in 2015. The principles include:
1. Environmental education should consider the environment in its totality – natural and man-made, ecological, political, economic, technological, social, legislative, cultural and aesthetic.

2. Environmental education should be a continuous life-long process, both in school and out of school.

3. Environmental education should be interdisciplinary in its approach.

4. Environmental education should emphasize active participation in preventing and solving environmental problems.

5. Environmental education should examine major environmental issues from a world point of view, while paying due regard to regional differences.

6. Environmental education should focus on current and future environmental situations.

7. Environmental education should examine all development and growth from an environmental perspective.

8. Environmental education should promote the value and necessity of local, national and international cooperation in the solution of environmental problems.

(UNESCO, 1975, p. 4)

William (Bill) Stapp, who is considered one of the founders of Environmental Education, and who was the Director of UNESCO’s International Environmental Education Program (IEEP) was one of the principal authors of the 1975 Belgrade Charter. Stapp also developed a number of foundational Environmental Education programs in North America. He strongly supported an approach to environmental education that included both scientific and social aspects. As well, Stapp proposed that environmental education should be action oriented and take an approach
where environmental problems within a community were tackled and student learning came through problem solving. In 1989 Stapp founded the Global Rivers Environmental Education Network (GREEN) (Stapp, Cromwell, Schmidt, & Alm, 1996). During 1987-89 GREEN program students from 40 Detroit-area schools were involved in the clean up of the Rouge River. Stapp found that there were many benefits for students who shared information across different schools about a single project, including 1) developing a deeper understanding of complex watershed systems, 2) building a community of learners and sense of community, and 3) cross-cultural sharing and understanding of the different people and cultures that live in the watershed (Stapp et al., 1996). It is significant that the early development of the field of EE was characterized by action projects focused on rivers and watersheds.

Project WET is another example of an action-oriented program focused on water and watersheds. Project WET Canada is the Canadian affiliate of an US program operated by the Board of a Non-Profit Foundation based in the state of Montana. The project WET motto is “Water Education for Teachers”. WET now partners with organizations and projects concerned about aquatic education in 50 US states and has affiliates in a number of countries around the world, including Canada. The Canadian Affiliate is operated by the Canadian Water Resources Association (CWRA) that has as its stated goal “to promote the development, control, conservation, preservation and utilization of the water resources of Western Canada.” The membership of the CWRA includes representatives of corporations involved in water resource management as well as government agencies at various levels. The goal of the US Project WET parent organization goal is to, “promote and facilitate public understanding of atmospheric, surface and ground water resources and related management issues through publications, instruction, and networking” (Project WET, 1995). To do this Project WET has published a
lengthy volume of classroom-ready teaching aids, which provide excellent background, detail, and instructions for teachers of students across a variety of ages (Project WET, 1995).

In a manner similar to Project WET, the document, Water Stewardship: A Guide for Teachers, Students, and Community Groups is a BC resource focused on water and water stewardship resource for teachers. The guide includes information on water stewardship concepts, case studies and a list of teacher resources. Additionally, the guide provides a description of activities that can be tailored to multiple ages and grades. It is an extremely valuable resource not just for environmental educators but for all teachers (McClaren, Fulton, & McMahen, 1995). As of the time of this writing, the Water Stewardship Guide was being considered for incorporation into the revised curriculum for Grades K-9 science in British Columbia schools (Fulton, 2015).

A Canadian charitable organization, Learning for a Sustainable Future (LSF) also provides resources for teachers of environmental education. Rather than tackle a particular theme such as water, LSF provides resources and strategies for transformative learning by linking environmental education, citizenship and sustainability (Kozak & Elliott, 2014). The LSF policy is to be, “actively involved in advancing education policy, standards and good practice toward active, responsible citizenship in all provinces and territories across Canada” (Kozak & Elliott, 2014). The LSF Mission Statement is, “…to promote, through education, the knowledge, skills, values, perspectives, and practices essential to a sustainable future” (LSF, n.d.). In their publication, Connecting the Dots – Key Strategies that Transform Learning for Environmental Education, Citizenship and Sustainability (Kozak & Elliott, 2014), the LSF lists the following strategies that support children in a world that is rapidly changing. The strategies include: local learning, integrated learning, acting on learning, real world connections, considering alternative
perspectives, inquiry, and sharing responsibility for learning. Throughout these strategies LSF calls on teachers to consider a systems thinking approach to their teaching (Kozak & Elliott, 2014).

**Rivers as Teachers**

Rivers provide an excellent starting place for understanding systems thinking (such as learning about others that live upstream or downstream) and for making a broad array of subjects relevant to students (McClaren, 1997). In this study I have looked at the potential for the Mackenzie River to be a teacher and an organizer of content related to the NWT Grade 4 Social Studies Curriculum. Paddling the Mackenzie River is an excellent way to learn the system of the river and the relationships that humans have with it as well as an opportunity for students to learn the stories of their history and culture as they move, like the river, through the landscape of the Northwest Territories (Andrews & Buggey, 2008; Andrews, 2004). However, paddling such a long river is an inaccessible journey for some, and an unappealing challenge for others. A virtual experience provides an opportunity to facilitate learning by giving online users a bridge to the physical river through interactive video and images, along with current and historical information and the stories of adventurers, scientists, industry and First Nations people and other community members who live along the river.

As noted above, through the work of Bill Stapp and Project WET, the study of rivers and watersheds has long been seen as an excellent frame for developing students’ general environmental literacy and as a way of getting students involved in local action projects. In British Columbia this tradition of studying rivers as significant points of focus for environmental education has continued and been developed further, so that the river becomes a direct link to school curriculum.
During the 1995-1996 school year, the project *Networking the Fraser* took a river-specific approach to environmental education (McClaren, 1997). In this project schools in communities along British Columbia’s Fraser River system participated in interdisciplinary teaching and learning to help students create a “portrait” of the river. *Channels of Inquiry*, a teaching aid for participating schools, lists seven themes for investigating rivers. The list includes the following:

- Rivers are parts of larger systems known as watersheds.
- Many forms of life, including humans, depend on rivers.
- Every river has a history. Humans are part of that history.
- Rivers are constantly changing. Humans are often part of those changes.
- Rivers have futures. Humans will help shape those futures.
- Many different forms of knowledge can help us understand and sustain our rivers.
- Rivers have inspired legends, stories, songs, dances and other works of art.

(McClaren, 1997).

These themes were used to structure online conferences and discussions and to link the individual school projects (McClaren, 1997). The teacher’s guide also lists potential research questions for students to help create a portrait of the river (McClaren, 2015). Although developed for the Fraser River, this report is an invaluable resource and could be tailored for any river. It is significant to note that while a number of other river and water resource programs have had a distinctly science, conservation, and resource management orientation, *Networking the Fraser* and *Channels of Inquiry* used an inter- or multi-disciplinary approach and included curricular areas such as science, social studies, language arts, music and graphic arts. Also notable was *Networking the Fraser*’s use of the Internet as a medium through which students and teachers – in schools located at various locations along the Fraser river system – could share their projects
and even engage in real-time online conferencing. At the time, the implementation of the Internet in public school programs was at an early stage, but the potential was becoming apparent.

**The Importance of Place in Environmental Education**

The importance of place has been identified in several studies as essential to both environmental and Indigenous education (Esquire, Cole, & Columbia, 2012; Luig, Freeland Ballantyne, & Kakfiwi Scott, 2011; McKeon, 2012; Simpson, 2014a). “A connection to place that is developed through learning on and about the land, links humans to their non-human physical environment” (Devine-Wright, 2013, p. 61). Place-based learning provides social context, a reflection of history and story, accountability, local and global orientations and opportunities for experiential learning (Colleges and Institutes of Canada, 2014; Gruenewald, 2003; McKeon, 2012; Simpson, 2014b; Sutherland & Swayze, 2012a). As well, researchers believe that learners who explore and develop a relationship to their local history, forests and communities (ecological and human) are more likely to take an interest in and care for those places as these are the places that make people feel stable, connected and rooted (Thomashow, 2002).

David Sobel suggests that teaching geography to children through map making helps to develop their perspectives from those of a young child focused on family and home, to those of a slightly older child who has more ability to see a larger perspective of the landscape (Thomashow, 2002). In the Northwest Territories, teaching geography to children was traditionally a physical and integrated activity where the young would learn about their culture and the land by physically moving through it (Andrews, 2004). For example, when the Tłı̨chǫ Dene would travel the land they wouldn’t learn just about specific cultural sites but about an entire landscape that is embedded with story and knowledge (Andrews & Buggey, 2008). Through the daily activities of moving through these landscapes, stories are brought forward and
remembered, reinforced mnemonically by the features of the land. Through this process the spiritual and cultural connections to the land are strengthened, along with the development of physical geographic knowledge. In this way knowing the land is more than knowing where the river is, or learning facts and figures about it. It is knowing and living your cultural history (Andrews & Buggey, 2008).

In thinking about place-based education and how to incorporate Indigenous Knowledge into lessons, an obvious starting place is with the original name of the place in question. Place names are important because they provide information about the land and the stewardship principles of the original people. Place names can also include important specific information such as when and where fish, moose and important edible plants can be found (Schreyer, Corbett, Gordon, & Larson, 2014). As well, many place names are key in the development of pride in cultural identity and are inseparable from the land (the ecology, features and systems) (Abrams, 1996; Andrews & Buggey, 2008; Andrews, 2004; Colleges and Institutes of Canada, 2014; Mckeon, 2012). While incorporating traditional place names honours and recognizes the language and history of the Indigenous people of the land, using place names can also seen to be honouring the land and as a form of environmental stewardship (Schreyer et al., 2014).

Exploring the Mackenzie River through a computer is not the same experience as paddling the river in a canoe and physically experiencing the wind, sun and waves. And while there are an increasing number of school culture camps and on-the-land opportunities, the reality of the education system for the majority of the school year in the NWT continues to be learning inside a classroom. Across Canada the trend is for people to be more engaged with computers than ever before (Leatherdale & Ahmed, 2011). It is this current reality that makes it incredibly
important to investigate the potential of video games, computers and TV as tools for environmental education (Gough, 2002).

**Including Indigenous Knowledge in Education Curriculum.**

"**Environmental education needs to step outside of its historical roots within the Western worldview and look to the diversity of Indigenous cultures for new directions and visionaries**” (McKeon, 2012, p. 132).

It is of key importance to incorporate into the curriculum traditional ecological knowledge, or Indigenous knowledge, particularly Indigenous culture, languages, and practices. This is not unique to the NWT. Recognizing the land as central to the identity of northern students means going beyond the western worldview-based approach to environmental education, criticized as a white space where the narrative of Canada is that of a land empty, wild and devoid of humans (McLean, 2013) rather than central to the identity of a whole individual (GNWT 2013).

The late respected Tłı́chǫ elder and education advocate, Elizabeth Mackenzie, promoted a philosophy of “Strong Like Two People”. This philosophy encouraged students to pursue both Indigenous and Western traditions of education (GNWT, n.d.). This term, “Strong Like Two People”, is similar to another term described as “Two-Eyed Seeing” which is, “learning to see from one eye with the strengths of Indigenous knowledge and ways of knowing, and from the other eye with the strengths of Western knowledge and ways of knowing, and to use both these eyes together, for the benefit of all” [Albert, 2004, cited in (Bartlett, Marshall, & Marshall, 2012)].

The Indigenous Education Protocol for Colleges and Institutes (CICan, 2014) calls for the integration of Indigenous education in curriculum (CICan, 2014). The third principle of this
Environmental education programs, like education curricula in general, are strengthened with the incorporation of an Indigenous worldview. McKeon (2012) states, “... if we in the Western tradition of environmental education are to really know and teach about the places which form our home landscapes, we must create an education that includes the stories of whose lands these are: Indigenous peoples” p.143. In this co-learning journey, “it is not only Indigenous students but all learners who can benefit from the revitalization and incorporation of Indigenous knowledges” (Munroe, Borden, Orr, Toney, & Meader, 2013, p. 332).

Suggestions for incorporating Indigenous knowledge into education include using sensory observations where children learn how to be observers of the land around them through their senses (Cajete, 1994; Thomashow, 2002). Listening to stories is also an important method of learning and teaching lessons of survival, stewardship, understanding relationships with self and with each other, reinforcing the connection of the people to the land that is represented in the stories (Abrams, 1996; Blondin, 1997; Cajete, 1994; Simpson, 2014a) and caretaking, which includes learning responsibilities to care for self, others and non-humans (Cajete, 1994).
Digital Media and Education

While many successes came from the Networking the Fraser project there were also challenges. As noted above, the project took place in 1997 and 1998 when the telecommunications system wasn’t developed or capable enough to support the large multi-school online conferences that had been planned (McClaren, 2015). Today, Internet connections are very pervasive and are much more robust and reliable even in smaller and more isolated communities. As a result, the use of digital media is increasing in almost every academic and professional forum such as sciences, history, geography, Indigenous geography and linguistics (Offen, 2012; Schreyer et al., 2014). Researchers and academics are interested in digital media and GIS mapping as ways to renew interest in their fields as well as methods of deepening understandings (Offen, 2012).

In 2003, the PWNHC created Lessons from the Land: A cultural journey through the Northwest Territories (http://www.lessonsfromtheland.ca) as an interactive website. The website is a virtual journey along a traditional Tłı̨chǫ birchbark canoe route called the Īdaà Trail (PWNHC, 2003). The goal of the website project was to teach Tłı̨chǫ youth about the relationship between culture, education, and the land. The project was a collaboration between the PWNHC and the Tłı̨chǫ Government,8 and it links into the Social Studies and Dene Kede9 Curriculum (PWNHC, 2003). In addition to the social studies links, the website includes a strong language component, as it is available in Tłı̨chǫ10, English and French. In addition, the website has literacy and multimedia components, with text appropriate for both upper and lower grades

8 The Tłı̨chǫ Government is the governing authority within Tłı̨chǫ Lands, as per the Tłı̨chǫ Land Claim Agreement. The Tłı̨chǫ Government has the power to pass laws, enforce its own laws and delegate its powers and authority. See http://www.tlo.ca/government.
9 Dene Kede is the NWT language and culture curriculum for K- Grade 9.
10 Tłı̨chǫ Yatìì is the language of the people who live in the Tłı̨chǫ Region.
DESIGN ELEMENTS THAT BRIDGE LEARNING ON THE MACKENZIE RIVER

(PWNHC, 2003). The website has a downloadable Teacher’s Guide with suggested lesson plans and links to learning objectives (PWNHC, 2003).

In the Northwest Territories where the Indigenous people are of Inuit, Athapaskan, Métis and Cree descent, the primary method of transferring knowledge is through oral stories (Andrews & Zoe, 1998; Cruikshank, 1981). Online media provide a place to house and share the recorded oral stories with students who might not otherwise have access to them. Additionally, digital maps provide opportunities for telling historical stories visually through the use of archival film, audio, photographs and journals. As discussed by Palmer (as cited in Offen, 2012, p. 569), there are opportunities for merging western and Indigenous knowledges in digital media, which can lead to encouraging diversity in the study of geography.

The Taku River Tlingit First Nation has embraced the opportunities present in digital media through a traditional place-name mapping project (Schreyer et al., 2014). The project, titled, “Learning to Talk to the Land: (Re)claiming Taku River Tlingit Place Names” has two goals: 1) helping community members learn more of the Tlingit language and 2) helping community members learn more about being stewards of the land through their online community mapping website (Schreyer et al., 2014). Community members who participated in the project said they were proud to be a part of an online project that incorporated the place names. To support the online mapping tool, the community also developed lesson plans. These are intended to be used alongside the website for British Columbia educators (Schreyer et al., 2014).

Using digital maps to view traditional place names and link to stories is a natural fit in the Northwest Territories, where Yamoria, the Dene hero of the North, is represented in stories that travel from the southern border all the way to the Arctic Ocean. Many geographic features along
the Mackenzie River are reflected and described in the Yamoria stories, making landscape features into living cultural artefacts and landmarks that prompt the telling of an oral history that has been passed on for hundreds of years. While Yamoria’s name changes (Atachùukajj, Zhamba Déja, Yamqožha, Hachoqa) as the stories transition from one dialect to the next, the stories themselves are consistent (Blondin, 1997; Prince of Wales Northern Heritage Centre, n.d.-d).

**Digital Games to Support Education.**

The definition of “game” as proposed by the *Merriam Webster Dictionary* (merriam-webster, n.d.) is “a physical or mental activity or contest that has rules and that people do for pleasure”. Within that definition is an immense, wide range of game possibilities that include card games, military games, sporting games and video games, to name a few. While the topic is too broad to be considered fully within the scope of this review, and while my design project described in this research study is not a game, I do review briefly some digital educational games and in particular the term “gamification” or “game elements” as these are relevant to an interactive online learning environment, such as my design project.

In 2010, video game researcher Jane McGonigal reported that people worldwide were spending more than 3 billion hours per week playing video games (McGonigal, 2010). In Canada, playing digital games has increased in popularity so much that 54% of Canadians are identified as “gamers”, a person who has played a video game in the past 4 weeks (Entertainment Software Association of Canada (ESAC), 2014).

The popularity of digital games makes them culturally comparable to trends in television, movies and literature (Deterding, Dixon, Khaled, & Nacke, 2011). Some researchers see the increase in gaming as a positive trend to be taken advantage of and suggest that games teach people how to collaborate, learn from failure, work hard and trust others with a task (McGonigal,
2010). Because of this trend, practitioners in many areas of endeavor not normally associated with digital games in the traditional sense – including education – have been looking for opportunities to make their products or services more enjoyable (Deterding et al., 2011; Nicholson, 2012b).

There is a wide range of possibilities for using digital games in education from serious games, where the student is immersed in a full computer game, to those in which there is a learning platform with some game elements, such as badges. Digital games can be strictly technology-based while other games, such as geocaching, are a hybrid of technology and the outdoor world (Deterding et al., 2011).

Some examples of digital educational games include fully immersive games such as “Future Delta”, a 3D simulation game which allows users to see the effects of climate change on the Fraser River Delta (Schroth, Angel, Sheppard, & Dulic, 2014), “Never Alone” (Kisima Ingitchuna) (Peckham, 2014; Upper One Games LLC, 2014), a simulation game co-developed with Alaskan First Nation elders and the “Oregon Trail”, a simulation game from the 80s in which players follow the Oregon Trail as American Settlers (Bigelow, 2002; Minnesota Educational Computing Consortium, 1971).

Creating a game of this calibre is a large and expensive undertaking and is not always appropriate for the content, or even possible (Muntean, 2011). In the past decade, there has been an increasing interest by education and other industries in how non-game products can make use of game elements to improve interest without developing a full game (Deterding & Dixon, 2011; Dicheva, Dichev, Agre, & Angelova, 2015; Muntean, 2011; Young et al., 2012). The idea of using some of the design elements of a game in a non-game application or context is called gamification (Deterding et al., 2011). Examples of gamification in educational resources include:
DuoLingo, where a language app includes a point system (Duolingo Inc, n.d.; Garcia, 2013), and PlayBrighter where there are missions instead of assignments (Play Brighter, n.d.).

Some of the design elements that could be used in gamification would include the following: game interface (levels, badges, leaderboards), game mechanics (time constraints, limited resources, number of turns), game principles (clear goals, enduring play) and game models (challenge, fantasy, curiosity) (Deterding et al., 2011). Where some researchers claim that a serious game should use all of the design elements, a non-game activity could be gamified by using just some of the game design elements (Deterding et al., 2011).

Some specific suggestions for gamification features include a clear relationship between action and reward, unpredictable types of time pressures, clear and easy instructions, collaboration with others, diverse badges and leaderboards, creative gifts and points that can be easily accumulated (Hsu, Chang, & Lee, 2013). Other researchers looking at the gamification of web portals suggest game design elements that include focusing on both educational and entertainment needs, as well as aesthetic considerations such as attractive screen designs, use of colour, animation, simple search tools, personalization and cultural elements, such as the use of Indigenous languages (Large, Beheshti, & Rahman, 2002). Broadly, researchers highlight the importance of understanding the user and ensuring that feedback is frequent and helpful (Filsecker & Hickey, 2014; Nicholson, 2012a).

The use of digital games and gamification in education is still relatively recent (Dicheva et al., 2015); however, there has been some research that show success with these products (Dicheva et al., 2015; Filsecker & Hickey, 2014; Hamari, Koivisto, & Sarsa, 2014; Schroth et al., 2014; Watson, Mong, & Harris, 2011). Some of these studies show changes in behaviour (Schroth et al., 2014), improvements in learning and motivation amongst students, and a shift
into more self-directed learning (Filsecker & Hickey, 2014; Watson et al., 2011). Even within research that showed success there are still cautions and challenges. Researchers stress the importance of considering the context of the game, how it is delivered and who the user is (Hamari et al., 2014), ensuring that the game does not direct students to particular cultural biases (Bigelow, 2002), that there is support by administrators and that clear learning objectives are established prior to using the resource (Watson et al., 2011).

**Human Centered Design**

A traditional approach to curriculum development is to use an instructional design model called the A.D.D.I.E process, originally developed by the US Military (Branson, Wagner, & Rayner, 1977; McClaren, 2002). The steps in the A.D.D.I.E process are Analysis, Design, Development, Implementation and Evaluation (Control) (Branson et al., 1977). While there are many benefits to the process, such as its flexibility and systematic and logical flow, some weaknesses have also been identified (“ADDIE Model,” n.d.). Among these is a lack of prototyping. This can be problematic because a significant amount of energy may be put into implementing a design that isn’t good, and the process also assumes that design elements can be fully determined prior to development (Tripp & Bichelmeyer, 1990).

In recent years some educators have been looking to a process called Design Thinking or Human (or User) Centred Design (HCD), to find new approaches to old challenges such as curriculum and classroom design (IDEO.org, 2012). In this approach to design, the focus is on the end user of the product. The designers discover up front what the user needs and contexts are. This is unlike processes where the designers create a product based solely on their thinking and expertise, and then ask the end user to adapt to it (Brown, 2009). In Design Thinking, process is not as important as is a set of principles that can be applied broadly to a diverse range of design
challenges (Brown & Katz, 2009). These principles include empathy for the end user, intuition and inspiration (Brown & Katz, 2009). To have this mindset you must believe that “the people who face those problems every day are the ones who hold the key to their answer” (IDEO.org, 2015, p. 9). There are variations on the design-thinking model but they all include empathy for the end user, brainstorming and rapid prototyping (Brown & Katz, 2009; IDEO.org, 2012, 2015; Institute of Design, 2013).

**Mindsets of design thinking**

**Empathy**

In the HCD approach empathy and consideration for the end user is brought to the beginning of the design process before analysis begins (Brown, 2008) and is a constant consideration throughout (IDEO.org, 2015). By adding empathy to the design thinking model researchers put themselves into the end users’ shoes to be more assured that the end users will have a product that meets their needs (Brown & Katz, 2009; IDEO.org, 2015; Kim & Ryu, 2014; Leinonen, T., Durall, 2014). In their paper, “Lessons from Design Firms”, researchers (Meyer & Marion, 2010a) surveyed 44 large and mid-sized design firms in the United States to find out what were the most effective design strategies used by these companies. The number one lesson was that “true innovation emerges from a deep understanding of the user” (Meyer & Marion, 2010b, p.22). As one design firm chief stated, “…We view four intensive hours with ten people as more valuable than one hour with forty people” (Meyer & Marion, 2010b, p.23). By placing value on the deep understanding of the end user before the product is designed, designers are recognizing that a product that is perfect for Kenya may be useless in Las Vegas and vice versa. The early engagement of end users has the additional benefit of creating engagement and collaboration in the process (Brown & Katz, 2009).
Prototyping, Learning from Failure and Collaboration

Another key approach in design thinking is prototyping. Prototyping ensures that the design process is agile and responsive to the user. This means that you don’t get to a finished product or overdesign too early, but instead develop and field test a series of prototypes that are reactive to feedback (Meyer & Marion, 2010b). Prototyping is key to ensuring that you are meeting the needs of the end user (IDEO 2015). The acceptance of failure is an important tool to help in finding an optimal solution (IDEO.org, 2015).

Creative Confidence, Intuition and Optimism

Having creative confidence and optimism is important in the design process. It means trusting your intuition and following through on your ideas without second guessing your abilities. Believing in an idea even though you don’t know how it will work exactly, and being optimistic that a challenging problem has a solution, no matter what the obstacle, allows for an exciting and innovative design process (Brown, 2009; IDEO.org, 2015).

Embracing Ambiguity

Embracing ambiguity means not rushing to a solution too quickly. This is particularly important during the brainstorming or generative phase. Not holding on to any one idea too closely allows for more ideas – ones we hadn’t yet imagined – to come forward and to be innovative (IDEO.org, 2015).

The Design Thinking Process

The Stanford School of Design has a simple process: 1) Empathy (getting to know your end user), 2) Define (clarifying the design challenge), 3) Ideation (generating ideas for the prototype), 4) Prototyping (creating one or more simple and inexpensive prototypes of the
It is through testing that end-users become guides to the best solutions for a problem. In essence, the users are co-designers or active participants rather than recipients of a design developed by experts. Design thinking puts a focus on collaboration in the design process. Collaboration is particularly important when researching a design problem that will result in a collaborative tool (Leinonen, T., Durall, 2014). Particularly influential in my research design were the d-school and HCD concepts of design thinking and collaborating with end users. In Chapter 3 I will describe in detail how I applied these design concepts to my research.

**Education in the Northwest Territories**

The project described in this thesis entailed the development of a resource to support the work of Grade 4 teachers in the NWT. As the website design was shaped in part by this context I briefly review the historical development and current status of the K-12 curriculum in the NWT.

**Early Education**

Pre-contact education amongst the Dene and Inuvialuit was integrated, holistic and focused on children learning the knowledge, skills and values of their elders in order to thrive as adults (Blondin, 1997; GNWT 2013). As with other Indigenous communities around the world, elders held knowledge about how to survive as well as the laws and lessons for how to live on and with the land. These lessons were often passed on from elder to child through stories, and they focused on learning through observational skills such as looking and listening (Blondin 1997 and Neegan 2005).

As the Dene are a people who travelled extensively across the land, the travel routes on both land and water were educational access points, not only to learning about hunting and
fishing areas but also to the cultural history of the people (Andrews & Buggey, 2008; Andrews, 2004). Each trail has geographic features that are linked to stories and cultural protocols. When these trails and waterways were travelled, the stories were repeated and the cultural history of the people strengthened (Andrews & Buggey, 2008; Andrews, 2004). In this way the land can be seen as a living landscape, or as elder Harry Simpson explains, ‘the land is like a book’ (as cited in Andrews, 2004, p. 301).

In 1867, the Grey Nuns in the communities of Fort Resolution and Fort Providence opened the first residential schools in the Northwest Territories (Miller, 1996). Later, several more Anglican and Roman Catholic Schools were started throughout the NWT with limited federal funding (Miller, 1996). In the Northwest Territories, as with the rest of Canada, children were removed from their homes, often with RCMP escorts, put on planes and barges and taken sometimes thousands of kilometres away from their parents (Miller, 1996; TRC of Canada, 2015). In these residential or boarding schools the students’ hair was cut, they were taught a new language and skills that weren’t useful when they returned home (Miller, 1996); “…residential school children lived in a world dominated by fear, loneliness, and lack of affection” (TRC of Canada, 2015, p. 41).

The recent Truth and Reconciliation hearings and report (Truth and Reconciliation Commision of Canada, 2015), have made Canadians more aware of the terrible damage that has been done to the Indigenous education system with the creation of residential schools.

“Canada has experienced such harm for more than 150 years. During that time, Canada enforced a racist policy of assimilation against Indigenous Peoples through the use of boarding schools...The thinking of the day was to “Kill the Indian in the Child” so that within a few generations, Indigenous cultures, beliefs, languages, and distinct identities
would be extinguished. For roughly seven generations nearly every Indigenous child in Canada was sent to a residential school. They were taken from their families, tribes and communities, and forced to live in those institutions of assimilation.” (Sinclair, 2010, p. 3)

In 1955 the Federal Government began to transition from residential schools to an expanded day-school system. The day-homes allowed most students to attend elementary school in the community where they lived. Students who wanted to finish their education would travel to larger communities and live in residential halls. Later in September 1969, the GNWT took over responsibility for education in the NWT and the running of the day schools. By the late 1990s the residential halls were all closed (Prince of Wales Northern Heritage Centre, n.d.-b).

Present Day Education

The GNWT collaborates with the western provinces and the other Canadian territories (WNCP, 2011) on curriculum development for grades K-12. In recent years, the GNWT has been working to renew its education system with an Education Renewal and Innovation Framework (GNWT, 2013a). This work includes following through on some of the recommendations of the TRC Report (2015), through the development of [the first Canadian] residential school curriculum (GNWT, 2013d; Government of Northwest Territories and Nunavut & Nunavut, 2013). The Education Renewal and Innovation Framework (GNWT, 2013a) contains many examples of the work that needs to be done to connect students to their identity and culture. Consider for example, this foundational statement.

A person’s sense of identity is formed and transformed by their relationships and their understandings of the world around them. In the NWT, the land has a great influence on peoples’ identity. Northern languages, cultures, and values must be recognized by the
education system so that learning connects with life experiences, spirituality, and identity, not just to facts and skills. The NWT education system must create opportunities for individuals and groups to express themselves, to feel empowered, and to apply both independence and choice in their learning. (GNWT, 2013a, p. 26)

The Grade 4 Curriculum

The existing NWT curriculum for Grade 4 social studies is intended to teach concepts of citizenship, identity, and diverse cultural perspectives within the Canadian context (GNWT, 2008c). These concepts are taught through six general learning outcomes: The Land: Places and People; Time, Continuity, and Change; Global Connections; Power and Authority; Economics and Resources and Culture and Community (GNWT, 2008c). These concepts are then woven into a number of educational kits or ‘units’ that guide the teacher through the curriculum by offering materials, suggested lessons and resources that can be used throughout the year (GNWT, 2008c). These resources are as follows: “Stories of Our Origins”, “A Dene Way of Life”, “An Inuvialuit Way of Life”, “Fur Trade” and “Resource Development” (GNWT, 2008c).

The existing Grade 4 social studies curriculum education kits provide natural links to the Mackenzie River system (Willet, 2014). For example, the education kit, “Stories of Our Origins” covers the concepts of “The Land and People” and “Continuity and Change” through the use of traditional stories that cover each of the regions through which rivers in the Mackenzie River system flow. As well, this kit includes the nine Dene Laws that were created by the cultural hero Yamoria to teach people about how to behave on the land and with each other. The legends of Yamoria follow the length of the Mackenzie River system from Fort Smith, NWT all the way to Tuktoyaktuk, making the river a natural framework for teaching the existing curriculum. The education kit, “Fur Trade” is also a natural link to the Mackenzie River system as the river was
the main route that brought the voyageurs, missionaries, RCMP, traders, settlers and eventually the federal government system to the Northwest Territories (GNWT - ECE, n.d.-c). The education kits, “A Dene Way of Life” and, “An Inuvialuit Way of Life” include learning outcomes such as, “demonstrate awareness of Aboriginal peoples’ traditional relationships with the land and each other”, “Demonstrate respect for the land”, and “demonstrate an appreciation of how stories both reflect and foster a connection to the land in which one lives” (GNWT - ECE, n.d.-a, n.d.-b).

**Additional Curriculum Support**

The Prince of Wales Northern Heritage Centre opened April 3, 1979 in response to a concern that northern artefacts were being damaged, destroyed or sent to collections outside of the territory. The purpose of the Centre is to be ‘more than a museum’ and while the Centre does “house and display documents and objects that reflect the heritage of the Northwest Territories” (Prince of Wales Northern Heritage Centre [PWNHC], n.d.), it also provides educational programming to support teachers throughout the NWT, support to the arts and culture community, authorizations for archaeological studies and approval for official place names (Prince of Wales Northern Heritage Centre [PWNHC], n.d.).

The educational materials provided by the PWNHC are extensive. Working with museum staff, school programs provide hands on experiences for a range of topics including Dene legends (through puppet shows, gallery tours, and storytellers), history (plays and re-enactments, and voyageur canoe trips), birch syrup making camp, outdoor hikes and mock archaeological digs. “Edukits” are museum resources that are borrowed by a teacher, packaged and shipped to communities throughout the NWT by museum staff. Each edukit is designed for pre-school and kindergarten, primary school or high school and has a specific theme related to the NWT
curriculum. For example, the “Trapping” edukit includes replicas of traps, skin stretchers and a variety of tanned fur pieces, along with videos, photographs and information on “the biology and conservation of fur bearing animals” (Prince of Wales Northern Heritage Centre [PWNHC], n.d.). Other supports provided to communities throughout the NWT include travelling exhibits, artefacts for loan and a number of online resources (Prince of Wales Northern Heritage Centre [PWNHC], n.d.).

Recently, the PWNHC began developing an education kit about the Mackenzie River. This kit is tailored for the approved Grade 4 NWT curriculum and currently includes tangible materials such as river charts and photos, along with historic items such as a replica navigation chart roller. NWT educators are being encouraged to incorporate online materials into their classrooms, and the PWNHC is looking to support this by including an online component to their Mackenzie River edukit (GNWT, 2012). As a result of the work of the PWNHC, and having a sense of the ecological, historical and cultural significance of the Mackenzie River, I focused my design study around the development of an educational resource for Grade 4 Social Studies students learning about the Mackenzie River system. In the next section of my thesis I will describe in detail the methods that I used to structure my research in environmental education design within the framework of the Human-Centred Design (HCD) mindsets and process.
Chapter 3. Planning my Route

To determine what design elements are needed for an interactive online environment to support teaching and learning about the Mackenzie River System, I created a research design for this study based on the steps used by the Institute of Design at Stanford University and the IDEO Field Guide to Human Centered Design (IDEO.org, 2015; Institute of Design, 2013). The methods that I used included interviewing the end users (teachers), developing criteria or design specifications based on the interviews and reviews of existing resources and the advice of experts, building a prototype and eventually testing the prototype resource with a sample of the end users. The process was collaborative, involving teachers, outreach educators, curriculum specialists and a web designer.

Advisory Design Team

Early on in my research I reached out to key experts to ensure that my design study was grounded in the realities of the Northern education system (IDEO.org, 2015). The experts included the Northern and Social Studies Coordinator for Early Childhood and School Services, Mindy Willett; the website designer for the Prince of Wales Northern Heritage Centre, Rajiv Rawat; the Curator of Heritage Education and Public Programs, Mike Mitchell and Outreach Coordinator Brenda Haas, who were also at the Prince of Wales Northern Heritage Centre. All of these key experts work for the Department of Education, Culture and Employment for the Government of the Northwest Territories. Individually they have unique skill sets and knowledge to bring to the project. I explained my thesis and the proposed design study approach and was provided with a letter of support for the research (Appendix A) from Barb Cameron, Director of the Culture and Heritage Division. This support primarily took the form of staff time
particularly from website designer Rajiv Rawat), the review of materials and the loan of existing relevant educational resources.

Mindy Willet provided practical advice on the context of education materials in the NWT as well as access to many curriculum materials, including the four education kits that every Grade 4 teacher in the NWT receives for teaching social studies (GNWT - ECE, n.d.-a, n.d.-b, n.d.-c). These kits became a source for ideas and content in the design process. In addition to the four basic social studies kits I also used materials and ideas from the K-6 cultural curriculum (Dene Kede and Inuuqatigiit). These are culturally based curriculum in which teachers bring Dene and Inuit language, history, and worldviews to the classroom and through on the land experiences (GNWT - ECE, 2005).

As an experienced website designer, Rajiv Rawat helped review the proposed design elements, brainstorm a number of possible directions and options that might work for the website, and eventually built the prototype. Mike Mitchell and Brenda Haas provided additional materials including the Yamoria Education Kit (Prince of Wales Northern Heritage Centre, n.d.-c) and the now out-dated Big River Education Kit (Prince of Wales Northern Heritage Centre, n.d.-a).

**NWT Research Licence, Royal Roads Ethics Approval & Government Support**

As this research was to occur in the NWT, I was required to obtain a research licence under the NWT Scientist Act (Government of Northwest Territories and Nunavut, 1988) in addition to the ethical approval for my research study from Royal Roads University.

The Aurora Research Institute (ARI) is the licensing body under the NWT Scientists Act. As well as providing research licenses, the ARI promotes communication between communities and researchers, ensures that research is culturally sensitive, and promotes information about
research in the NWT (“Aurora Research Institute,” n.d.). Following the process provided by the ARI, my application for an NWT research licence was sent to all of the seven NWT District Education Boards (Beaufort-Delta, Dehcho, South Slave, Sahtu, Tłı̨chǫ, Yellowknife No. 1, and Yellowknife Catholic Schools) for letters of support. I then followed up with both telephone calls and in-person meetings (when possible) to explain the research study. Once the Education Boards provided support, the ARI issued my NWT research license and the Royal Roads Ethics Committee approved my application.

**Recruitment**

Following the process outlined in my Royal Roads ethics application and my application for the research license, I began to recruit participants for my study. I first contacted school principals in communities along the Mackenzie River and across the NWT. I described the project and asked Principals to distribute my information sheet (Appendix B) about the research project to all staff members with a request for interested educators to contact me, as the principal investigator, directly during an NWT Teachers Association Conference in late September 2014.

Every four years the NWT Teachers’ Association holds its annual Teachers’ Association Conference in the city of Yellowknife. All teachers from across the NWT travel to Yellowknife to attend the multi-day workshop sessions, listen to guest speakers and view the conference booths. I used this conference as a chance to provide information about my project to interested teachers and offer an opportunity to participate in the study.

I set up a booth at the conference and had resources that included information sheets, consent forms (Appendix C), a laptop to show examples of other interactive websites, maps and materials from the PWNHC and other relevant literature. A number of teachers approached the booth and either signed up to participate in my research or put me in contact with someone that
they thought would be interested. As a result of my recruitment process at the conference, ten educators who work in communities in the NWT volunteered to be interviewed as part of my design study.

Although essentially the same, there are slight variations in human centered design processes depending on the author (Brown, 2009; IDEO.org, 2012, 2015; Institute of Design, 2013). I decided to combine the Principles of Design Thinking (IDEO.org, 2015) and a process that was developed at the Institute of Design at Stanford (Institute of Design, 2013) as the frameworks for my project. The integrated version includes the following steps: Empathize (interviewing the end user), Define (refining the design challenge), Ideate (brainstorming potential solutions), Prototype (building a simple version of the final vision) and Test (trying the prototype with the end user) (Institute of Design, 2013). In the following sections I provide details of these steps and describe how I adapted them for my study.

A Human-Centred Design Process

Empathize (The Interview Process and Data Collection)

In the first step of the design process, time is taken to understand the perspective, needs, emotions and insights of the product’s end user (IDEO.org, 2015; Institute of Design, 2013). The Empathy stage is critical as it puts the focus on the human context first and emphasises that it is the people who will use the final design who are best able to address and bring insight to the design challenge up front (IDEO.org, 2015).

While starting with the end user is a compassionate and collaborative approach, as a designer it was also practical, as I am neither an expert in digital technology nor am I a teacher in the public education system. Although students are intended to be the ultimate end users of the website, teachers are the students’ entry to the website in the context of the curriculum, so I
focused on teachers. To begin to understand their needs as a designer I set out to interview the
ten teachers who had signed up during my recruitment process. To conduct the interviews I
followed the study’s Research Ethics protocol as approved by Royal Roads University and the
NWT Aurora Research Institute.

I provided Project Information and Consent Forms (Appendix B and C) to the
participants prior to the phone interviews or at the time of the face-to-face interviews. All forms
were signed by the participants and returned to me prior to the interviews. Two interviews were
held onsite at the teacher’s conference in late September. The use of a private room suitable for
the interviews was pre-arranged to ensure teacher anonymity. The remaining eight interviews
took place after the Conference during the month of October. Three interviews took place in
Yellowknife and were conducted face to face in the teachers’ classrooms at the end of the school
day. One interview took place in a coffee shop (at the request of the participant) and the
remaining interviews took place over the telephone. Telephone interviews were a necessity as
the communities where many of these teachers live and work are many kilometers remote from
Yellowknife and there was no travel budget for this project. Phone interviews were arranged to
be private and at a phone number chosen by the participating teacher. I used my office for
telephone interviews as I have an office door that provided privacy for the conversations. The
conversations were held over speakerphone and were recorded digitally with a cell phone with
the permission and knowledge of the participant.

*Interview style*

The interviews were semi-structured and included a Review of the project (Appendix B)
and a review of the Consent Form (Appendix C) and were guided by a series of open-ended
topics (See Appendix D).
In order to better understand the teachers’ experiences, thoughts and emotions, I asked open-ended questions, encouraged participants to add their stories, and probed the general interview topics further (e.g., ‘tell me more about that’) (Institute of Design at Stanford, n.d.). I was not overly formal in my interview style and tried to speak in a manner that encouraged conversation, when possible relating to the participant’s stories and allowing lots of room for silences. I tried to keep my comments neutral in order to encourage further dialogue (Institute of Design at Stanford, n.d.).

**Interview topics**

Using the suggestions for interviewing in the *Field Guide for Human-Centred Design* (2015), I began with broad questions about the teachers’ current work, their time living in the north and the types of learning experiences that they offer to students on rivers and specifically on the Mackenzie River. I then introduced the following topics: the needs and constraints experienced by the teachers in using online materials, design features that they have appreciated in other online resources that they have used in their classrooms, online resources that their students have enjoyed, concerns about the use of online media in education and their ideas about a digital or virtual approach to learning about the Mackenzie River system.

Additionally, I discussed examples of websites that had similar topical foci so that they could be familiar with some ways in which other organizations have approached similar projects.

**Interview Recordings**

The average interview was 30 - 40 minutes in duration, though one session was much longer (3 hours) and another much shorter (20 minutes). I recorded all of the interviews digitally with either the recorder on my computer or on my cell phone and also took notes in a notebook. I transcribed all of the recorded interviews by listening to the audio recordings and typing out the
conversations in MS Word®. The resulting transcripts were saved on an external hard drive. I used pseudonyms in the interview transcripts unless interviewees explicitly stated on the Consent Form that they would like their real names to be used. To ensure the accuracy and trustworthiness of the results, I asked all of the interviewees to review copies of the transcribed interviews and to make additions and changes as necessary.

**Step 2 - Define (Data Analysis)**

The goal in this step of the design process is for the designer to develop a point of view that is based on the needs and insights of the teachers who were interviewed in the Empathy step and to focus in on the specific issues of the design challenge (IDEO.org, 2015; Institute of Design, 2013). To develop a composite of the points of view of the 10 teachers who were interviewed I analyzed all of the interviews using a general qualitative methodology (Robson, 2011) and the techniques proposed in the *Field Guide to Human-Centered Design* (IDEO.org, 2015).

First, I reviewed the interviews to develop user profiles of the teachers and the students (as described by the teachers). Developing the user profiles allowed me to better understand the points of view generally shared by the teachers as well as to define the variety of issues that arise from diverse and isolated communities. I then started a coding process by grouping (coding) interesting stories, important and common statements and ideas from the interview transcripts into broad categories: Design Ideas, Caution (what teachers don’t want), Content, Curriculum and Resources (Appendix E). I then used the coding program, MAXQDA® (VERBI, n.d.) to break the broad categories into sub-codes by using colour-coding options. The sub-codes included user needs, look and feel of the website and website platform (Design Ideas), learning
objectives, grade, subject matter, particularly for Grade 4 social studies (Curriculum), online and hardcopy resources, existing resources and potential activities (Resources) (Appendix E).

Next I focused specifically on all of the sub-coded sentences related to design, pulling out sentences that included: User perspectives (how someone would use the website - navigation); platform (software programs – the base of the website) and general look and feel of the website. I then created a table using the summarized results of the coding process. The table had two columns: 1) Key Point, which includes suggestions or insight from teachers related to their needs as a website user and 2) Design Implications which are potential ideas for implementing the teacher’s key points (IDEO.org, 2015; Institute of Design at Stanford, n.d.) (Appendix F). This table became a useful frame for evaluating ideas in the Ideation step, as described in the next section.

**Ideate (Brainstorming Ideas)**

The main goal of the Ideation step in the design process is to brainstorm a wide variety of potential solutions based on everything that I had learnt in Steps 1 and 2 (IDEO.org, 2015; Institute of Design, 2013). During the ideate phase it is important to consider the mindsets of human-centred design, such as creative confidence, optimism and embracing ambiguity. This meant that when I began to brainstorm ideas for the prototype I tried to keep my thinking broad and open. I tried to ensure that I didn’t limit myself or focus only on what I thought was realistic or possible. Instead, I simply tried to generate ideas (IDEO.org, 2015).

To create a list of ideas, I used the insights that I had collected and refined in the Define Step and used these to develop “how might we” statements (IDEO.org, 2015). An example “how might we” statement would be, “How might we create a solution that works even in communities
Rajiv Rawat and I met several times throughout the months of January to May 2015. We reviewed the draft design elements and discussed the key ideas and insights that came from the interviews. After we went through the list of insights and design elements to generate ideas, we then identified which were logistically feasible (budget, staff capacity), those that were fun and innovative, those that were potentially more technically challenging, or ideas that didn’t necessarily meet the design elements. For ideas that were more complex we discussed options such as hiring an external software programmer. The main purpose of our meetings was not to come to a solution immediately but to get “on the same page” about the needs of the end users and the possibilities for the prototype.

Once the broad ideas were narrowed to a few versions of what a prototype website should look like and how it would function, Rajiv Rawat and I discussed how we were imagining the prototype would look. Once we came to an agreement on a rough design, I then created a list of draft icons, curriculum links, and potential activities in a large spreadsheet (example in Appendix G). The spreadsheet became my draft script (example in Appendix H). This script included separate webpages for introductions and set up, community stops, stops between communities and a conclusion.

Prototype

Prototyping is the act of creating a rough draft of the final product. It is intended to be simple, quickly produced and of relatively low cost (IDEO.org, 2015; Institute of Design, 2013). Eventually, the prototype will be tested by the designers and the end users to see how well the ideas and solutions work for the design challenge (Institute of Design at Stanford, n.d.). A key
mindset of the prototyping stage is to accept failures. Rather than seeing failure as a problem, it is viewed in the design process as a necessary factor in determining what won’t work, to get closer to understanding a solution that will work (IDEO.org, 2015).

Once my outline for website content was completed, I was ready to begin creating the prototype. To start, I took the website outline and script (Appendices G and H) and had it reviewed by experts (my thesis committee, the advisory design team and the Conservation Education Coordinator for the GNWT). I then incorporated their changes and ideas. Most changes were made to the text to simplify it and to make it flow in a more logical way (e.g. introducing the Dene and Inuvialuit in the website before the explorers and fur traders).

Then, the prototype was created by working in partnership with Rajiv Rawat, who chose a website template that allowed for an embedded Google map that could be navigated by a graphical canoe animation. We also brainstormed options about how to layout the content in a logical and intuitive manner, and an approach was eventually selected.

In early June 2015 the prototype website was finalized to allow students to take a virtual journey down a section of the Mackenzie River system between Ft. Smith and Tuktoyaktuk. As this was a prototype there was full content available only between Ft. Smith and Ft. Providence with reduced content for the remaining river sections.

**Test the Prototype**

Testing the prototype is the next step in the IDEO/Stanford design process (Institute of Design, 2013). A key aspect of this step is that the designer physically shows the end users what they have created (as opposed to telling about the design). The user is intended to be able to take the prototype, experience it and then react to that experience (Institute of Design at Stanford, n.d.; Institute of Design, 2013).
The prototype website was ready to be tested by users by the second week of June 2015. I sent the 10 teacher interviewees who had participated in the Empathy step the following information: the link to the first version website prototype along with instructions on how to use the website, a Teacher’s Guide with potential additional activities, and screenshots that showed exactly where to click on the website for navigation (Appendix I).

Teachers were given two weeks to review the website and were asked to provide a convenient time and date for a follow-up phone interview. Through correspondence it became clear that the website was not working for several of the teachers to whom it had been sent. Complaints indicated that the videos were blocked or were not loading. Rajiv Rawat quickly moved the website to a new local server and switched the website template to one that loaded faster. Follow up emails were then sent out to all the teachers with the new link

http://www.nwtexhibits.ca/bigriver/ and a list of the questions that I was hoping to ask during the follow-up interview (Appendix J). Topics for the follow up interviews were focused on the teachers’ experiences of using the prototype. Specifically, I asked what the teachers liked about the design, any constructive feedback or criticisms, any new ideas, questions, or any confusions that arose through the testing (Institute of Design at Stanford, n.d.).

Six of the ten teachers originally interviewed agreed to be interviewed in the follow-up. Follow-up interviews were conducted either over the phone, or through email. During these interviews I used a process similar to the first interviews with questions that were open ended and casual and in which I tried to promote a relaxed and conversational experience. The prototype test phone interviews were transcribed digitally and summarized along with the email feedback. The results from the post-test interviews were assembled into a set of revised design elements to be recommended for incorporation into a finalised website. Rajiv continued to add

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11 Map imagery is © 2015 TerraMetrics, a partner of Google Earth.
text from the web script so that by September 2015 there was text from Fort Smith all the way to Tuktoyaktuk on the Arctic Ocean (Appendix H). Changes that could easily be made based on the feedback from the teacher participants were made to the prototype. Other changes which required dedicated time were noted as changes that should be addressed in a final future website should the PWNHC decide to proceed with the project.

**Paddling the River**

As described in Chapter 2, this study was grounded in the theoretical framework of the Human-Centered Design (HCD) process (IDEO.org, 2015). This section of the thesis includes and is divided by the results of each step in the design process. As outlined in Figure 4.1 these steps include 1) Empathize (getting to know your end user), 2) Define (clarifying the design challenge), 3), Ideate (generating ideas for the prototype), 4) Prototype (creating one or more simple and inexpensive prototypes of the product) and 5) Test (where end users try out the prototype and provide feedback) (Institute of Design, 2013).

The objectives of this study were to gain input from practicing NWT school teachers about the design elements for an online learning environment and resource focused on the Mackenzie River and system (Empathy and Definition Steps in Figure 4.1); to develop a prototype for a website for use by teachers and students in learning about the Mackenzie River (Ideation and Prototype Steps) and to field test the prototype website with representative educators in order to refine the prototype for ultimate full scale implementation (Testing Step in Figure 4.1).

To determine the needs of the intended users of a Mackenzie River website (primarily students and teachers), I conducted ten interviews with teachers from across the NWT. I framed these interviews with an explanation of the process for a human-centred design study, the importance of their feedback to the design of the product and a review of the objectives for the research. I received a wealth of information from the interviews with the teachers about who their students are and what needs they have in a website resource to help students succeed in their learning. In the text below italicized font represents comments made by participants during the 1\textsuperscript{st} Interviews (Empathy Step) and the 2\textsuperscript{nd} Interviews (Testing Step).

\textbf{Empathy – The 1\textsuperscript{st} Interviews with Teachers}

Below is a description of the questions that were asked during the first set of teacher interviews along with a summary of the discussions and a selection of quotes that represent some of the insights that came from the conversations with the teachers.

\textsuperscript{12} A Creative Commons License covers this process. For details see http://dschool.stanford.edu/use-our-methods/.
To begin the interviews, I asked participants, “Let's start with what you are doing now. Tell me about your current role and the work you do.”

The teachers often described their work with a focus on teaching Grade 4 social studies students since the information that they had been provided about the purposes of my research indicated that as a focus. In Grade Four students are expected to learn about the geography of the NWT and Canada, the fur trade, northern legends, the Dene and Inuvialuit pre-contact and post contact lifestyles as well as information on renewable and non-renewable resource development. All of these curriculum topics are well suited for connection to the Mackenzie River, which in addition to being a major Canadian geographic feature is also a key aspect of fur trading history, development, Aboriginal history and stories. In the following passages participants described their current work in the Grade 4 Social Studies curriculum and discussed the connections between the curriculum and the Mackenzie River.

We've just started on the unit on Dene lifestyle, pre-contact. We were just over at the museum today with Mike Mitchell doing a program with him where he has the artefacts lined up and the kids try to figure out what it was used for…. And the kids here really seemed to enjoy that. The legends and the artefacts, the lifestyle and issues. Many of them don't have a lifestyle now that is similar to that, but there is still a very strong connection to that type of material. (Participant T05)

Well as part of the map of the NWT we looked at the major lakes and rivers. So you know, looking at the watershed, at the drainage, Slave River, Slave Lake, Mackenzie River, Bear River… We are encouraged to keep things culturally relevant at the school. (Participant T05)
Dene Kede, which is where we teach about Dene culture and so we teach about legends and Dene culture. So that would tie into the river use as well. So I think it has a lot of potential for curriculum development… Dene legends, Yamoria... takes place along the river, so there are sites that are talked about in the legends, like where Yamoria killed the giant beavers.... And that as well would tie into the Mackenzie River. (Participant T02)

*We study the source, the location, the formation of deltas and this is where we would use the river as an example for any of the Social Studies curriculum.* (Participant T03)

In the Beaufort delta we focused on Inuit and Gwich'in culture and Dene culture… the waterways are an important area for the students to learn about because the explorers came up and down the waterway. And I also liked to remind kids that it's not just our area, there were lots of people travelling up and down the river from different areas.

( Participant T07)

I then turned the conversations towards the teachers’ needs for, and use of, particular resources by asking, “Do you have particular printed or hard copy resources that you use in your classes (posters, curriculum kits, books, DVDs, etc.)?” Many of the teachers referenced the importance of maps as being a key resource for Grade 4 Social Studies. The maps mentioned included watersheds, river systems, maps showing traditional place names and maps showing language groups.

They were looking at the different Athapaskan dialects down the river and locating each of those groups down the river with a map. So we looked at a map of the NWT, we put some place names on it. We put the major rivers on it, the major lakes and then we came back another time and we used the same map and we put the linguist groups on there as
well…It’s a social studies kit and it’s put together for the grade 4 program and I think the one that deals with the legends is the Dene life ways and its got some good material already prepared for the grade 4 program…One of the neat things in that kit is a CD of the French songs of voyageurs singing and we've used that. (Participant T05)

I used big maps of the river and had them up on my wall, this was in Fort Simpson, and just having the visuals brought out stories. (Participant T08)

Mackenzie River Basin Watershed map... I can't remember exactly the title, but it is a big map with the Mackenzie River Basin and then all of the sub basins and communities. And when we are doing work with that we also get the community drinking water basin maps and do a bit of mapping water and how it relates to community drinking water…I'd try to find out information about their water bodies in their area, it took a little while to track that down.” (Participant T09)

I also asked teachers what online materials they had used in the past that had been a pleasure to use. The teachers noted that they enjoyed resources that are simple to access and use, and that are fun for students. In particular, teachers said that students like games, stories and resources that connect in some way to the student’s culture and family.

A woman in Ft. Simpson developed a Slavey language app…that is really interactive. It is pleasant looking it's got a nice design and layout. She's got lots of videos and lots of audio. I'd say hers borders almost on being too much, like hers does take a bit of time to load. But, not so much so that you lose kids because it's so slow. (Participant T06)

I have a program I have been using for years called Knowledge Forum. And it's a database, it’s a very simple program. So simple and it does everything…. there is some
leading authorities in brain research who were on the ground floor of creating this computer program, Knowledge Forum. (Participant T10)

Some teachers talked about the importance of praise in an online activity, referring in this to the small positive feedback that keeps a student motivated to improve their performance and continue to make progress.

“... they like if they are being praised. Every time they have a question [in IEexcel math] it goes, 'awesome'. Or, 'great job' or, 'your doing fine'. And it is immediate gratification if they get it right.” (Participant T03)

Raz Kids [an online reading game] is a great literacy tool. It's for reading A-Z kids… it can be used for a broad range of ages and ability levels because it's a levelled reading system and having such a range in my classroom, it's a tool that I can use with all of the students. And it's just an intuitive website. It's got rewards for accomplishing tasks and that sort of thing. (Participant T06)

“If it [web resource] gives a lot of praise that is very helpful, especially for this grade.” (Participant T01)

I extended the discussion to students by asking, “What sorts of education materials are enjoyed the most by students? Games, videos, etc?” With this question many teachers spoke about how much their students enjoy hands-on interactive activities as well as taking lessons outside.

“I asked them, 'just go outside and list as many sounds as you can hear'. So they liked that. And they were coming back in and we shared what they heard.” (Participant T01)
“A lot of them really like being on the land and we do a trapping program and they are always excited to go out on the land. Like, traditional activities are pretty popular.” (Participant T06)

I get kids to dress up like them. Like mosquito larvae have a breathing tube on their feet and they hang upside down... Pretending to be a mosquito larvae and it’s a fun opportunity for them to learn the names of different insects and also learn about the life cycle of different aquatic insects because most have a few different life stages.

(Participant T09)

The teachers described including interactive activities in a variety of ways, such as taking students to places that are engaging, bringing in elders and story tellers to the classroom and asking students to incorporate their own histories into their assignments.

…Oh and this is the one that is the most fun! Looking at aquatic insects… That one, by far, kids love the most…More and more water scientists are looking at aquatic insects as an indicator of stream health… And it is really, really fun for kids…I find a bunch of insects and go through the adaptations that insects in the water have. And I get them to act out different ones. Like a caddis fly larvae builds their own house out of whatever they can find…(Participant T09)

…we'd take the boys down and pull in the nets every day and walk from the river back to our classroom, where they'd have a Home Economics area [and] spill all the fish out…. [We would] make 'em into dry fish or just distribute them amongst the community members. And my task was to turn it into hard lessons… So all of a sudden it became about the math, because we tracked how many fish: how many whitefish, how many
conies, how many loche, how many pike, how many jackfish. Then it became about the biology of the fish. (Participant T10)

Teachers also noted the value of online activities that are engaging and are also fun for the students, though some teachers said there aren’t many online resources for social studies.

“I don’t know of any directly related social studies games or links... well you can take the immigration test online... And we've done that. But no, there is a need for it [social studies games].” (Participant T04)

Another teacher extended the idea of using an online website for interactions among students, such as using social media.

I think for the older ones it is sharing and being able to communicate with peers… Like have an activity on the website and then they have to do something and report back to each other about what they have done or what they have accomplished. (Participant T06)

Another teacher’s comments suggested that an effective website might also have aspects of online gaming. “If you keep them entertained and you grasp their interest. And they like games where they can build and manipulate. Then its more than a website, you have to be a game master”. (Participant T03)

I then asked teachers about their opinions about how well informed the students were now about the Mackenzie River System. I asked, “What are your feelings now about how informed or interested your students are about the river, and how do you think an online resource could be helpful to improve or develop their interests?” The teacher’s remarks suggested that students in smaller communities near or on the Mackenzie River are more likely to have a connection with the river if their families have camps or use the river for transportation or for hunting.
... students usually like to say that they've gone hunting. So for some, they go hunting with their parents or even out on the lake (Great Slave Lake- Tucho). And for some even go on the Slave River. So I would see how the students would make a connection to their whole lifestyle. (Participant T01)

“...those communities are more traditional so find they have way more connection to places and camping and hunting areas. And all the legends that go with it and the connections to that island or this rock and all of that.” (Participant T08)

However, other teachers felt that regardless of how active a student’s parents might be outdoors, the students might not be aware of the river or its importance.

“We are close to the source of the Mackenzie but to be honest with you, I think a lot of kids that I’ve taught have never seen the Mackenzie River before.” (Participant T10)….some of them [students] said, ‘Why is the Mackenzie River important?’ So the big idea for this grade is 'why is it so important?', ‘Why do we have to learn about it.’ That was some of the questions that they came up with. (Participant T01)

“I have eight students right now and we haven't done a whole lot on learning about the Mackenzie River... I don't feel really that there is a whole lot of material at the school about those specific rivers.” (Participant T06)

“So it would be good for them to know that Mackenzie is a main waterway, transport, fishing for sustaining the Aboriginal populations around there, and maybe knowing its impact on the ecosystems.” (Participant T04)

I also wanted to find out something about the teachers’ general attitudes about students’ response to online resources. I asked, “How do you like to work with online materials?”

Teacher’s are tasked with introducing the Internet to students to help them become more
computer literate and to learn how to communicate using technology in a critical, ethical and creative way (GNWT, 2012). Teachers can do this by introducing their students to computer applications and tools such as creating digital stories or using games that support learning.

Teachers commented on the responses of students to online resources.

We've done some stuff where we've added on Wikipedia. We've added a picture of the school on the Jean Marie website and we've updated it and I think they found that interesting to be able to say, 'yeah, we did that and it's on the internet and it's still there, that's what we did." So, I think it gives them a little part of, or sense of ownership over something that they created. And anytime that they create something that is quality they feel a sense of pride. (Participant T06)

Teachers have a range of interest in, and prior learning about, integrating the Internet and computer programs into their classrooms. Some teachers appear to shy away from too much time spent on the computer while others embrace technology and have programs that they use regularly year after year.

I’ve been on a couple of committees recently to try and bring all the people that have computer knowledge together and use us to generate new ideas of how we can use technology with our kids and it just flopped. It is hard to get people to put their heads together, I think because there are so many possibilities, and one guy does this, and another guy does that. I am really comfortable with this [Knowledge Forum] because I use it year after year. (Participant T10)
However, a teacher noted that introducing technology can be tricky in communities where the Internet is not reliable, so teachers have to be flexible and innovative in how they teach with technology.

We can stream video at the school, but if I have like 2 or 3 kids trying to stream video, it wouldn't load… and then they would lose focus. So something that isn't overly heavy in the download department…if it is something where I was projecting the iPad and we were doing it as a class it would be fine. We could have a more intensive and higher definition video…. (Participant T06)

Some participants noted that even when the Internet is functional, going to the computer lab can be a challenge and they indicated that website navigation is important for teachers and students. Further, some students quickly lose focus in a computer lab if the navigation of the web isn’t clear or even if the log-on process takes too long. The following remarks illustrate these issues.

Kids in a computer lab can really be a challenge in terms of doing something that is meaningful and purposeful within a timeframe. If you take kids to a computer lab it usually takes 45 minutes. But it takes 5 minutes to get there; it takes 5 minutes to get settled. By the time you are really getting into what you are there for its time to leave. And often what happens is, they abandon what they were doing and the next group that comes in has to kind of set things back up again… I think that whole searching business, that's kind of a waste of time. …in a school setting you only have so much time...

(Participant T10)

The teachers also made it clear that their instructional time was limited.
I think it is just that you want to make sure that it is a good use of your time… When I go in with students or if I do something online, it's not always that successful, so that is maybe why I haven't done much. (Participant T08)

I also asked a pretty direct question about what teachers would like to see in a resource website focused on the Mackenzie River. “What sort of approach would you like to see in an online website designed to specifically help students learn about the Mackenzie River?” While one teacher answered this question with a specific approach, most of the teachers spoke to general design features.

All teachers spoke to the need to have a variety of options for students to complete a task, so that written answers or readings were not the only modes in which students could demonstrate learning. For example, a piece of written text could also have an audio version that follows along or a picture that describes what is being discussed in the audio.

[The students are] all functioning a couple grade levels below. So, for those little guys, you're not going to get them to write very much. As far as writing is concerned I don't think we're quite there. I'm imagining that we could take pictures and write a short caption or something like that might happen… So we can do video, or if there is text, or something that the younger students can't read they can click on a button too... and it would read the text to them. (Participant T06)

“So, depending on what age you are gearing it towards it's always good to go on the simpler side and then a lot of the time the teacher will probably read what you have to them, so making that fun I guess.” (Participant T04)
One child might be able to draw a picture, another child might be able to write a simple sentence, and another child might be able to give you huge detail on what it was that they saw. So that is sort of three levels of differentiation. (Participant T07)

“Every teacher that would want to use it. ...would want to make sure that they [students] are being tested, the comprehension skills are improving and to keep them focused on it and entertained.” (Participant T03)

Another teacher spoke to need for materials to be personally relevant to students and to connect to their lives.

…a lot of these guys weren't keen on writing, but as soon as they were given the freedom to write about a fishing trip they were on, well, holy smokes now everyone is writing stories. And you know, before that, nobody would even pick up a pencil. (Participant T10)

Teachers also spoke about the need for a resource that helps integrate the Grade 4 social studies curriculum as well as showing students how the river connects them to each other. Many participants spoke about the river and its connection to language or as a connection to story as elements that could be important in a website resource. “You know the barges and stuff. I just think it would be interesting to have a little story... or, just a little something from everybody. That kind of thing. Different perspectives, different experiences, events, and things that happened.” (Participant T08)

But I think definitely bring in the legends, bring in the languages, and bring in people who are alive today down the valley who are key people in the community. Not just political leaders but people who know the land. People who have stories to tell from the land…Follow a historical timeline. Starting with the legends, moving through contact
time, Mackenzie himself, drawing on historical events. That could be a way to set it up. That is how we go through the curriculum. We start off with the origins of people and we move up to trading and modern industrial development with the diamond mines and how lives have changed over that time and new people coming into the territories. There is a lot of great material available and the kids seem to enjoy it. (Participant T05)

“Well, we have the Dene Laws… be responsible for what you do to other people as well as be respectful towards your teachers and other students, so incorporating those concepts would be, would make it more easy for students to relate to.” (Participant T04)

Going back to Mackenzie himself, because I know he wrote a journal…. it would be neat maybe to have kids find out… if this had elements from his journal along the way… like why did he set out to explore this area… and we all know, “it’s the river of disappointment”… Who sent him? Why was he doing this? (Participant T10)

Other teachers spoke of the fourteen communities that lie along the banks of the river as the connection with the lessons. They saw stopping to visit the community as a learning opportunity for information in the social studies units. Including both historic and current updated information was also noted as important.

... if you have a website you want to keep up with current events… if the river is low, which it was this year, which effects barges supplying communities… anything that deals with current events so the website can continuously change and grow... (Participant T03)

Some responses included fairly direct suggestions as to the structure or organization of a website.

And what I think would be kind of cool, is you know, if you did it in a sort of step-by-step presentation, that would be really fun, …you could learn about the communities, the
populations of the communities, about maybe some of the folklore elements of the communities. What really stands out in a community? (Participant T10)

Several teachers mentioned having a website with multiple types of media as being important in order to keep students engaged in what they are learning. I think having media: sounds, video, if there is text, having a button that you can click and the text will be read to them. Or having it so intuitive that they already know what to do. Having activities, like games online, and having things that get them outside and exploring their own part of the river, having a collaborative sort of thing where they are adding to the website and are being a part of creating it… there are a lot of stories along the river and if those sorts of stories could come out somehow, either through the kids or through you interviewing people or the kids interviewing people. (Participant T06)

… the Google maps street view of what places look like. You could also go into the histories of how the river is basically like the highway and the grocery store. If people can go to the website and they can see it and hear it and if they can see the place and then hear the stories about the place from the people that live there I would think that would bring it alive a little bit. (Participant T06)

Many interviewees spoke about the teacher’s role in entertaining, to bring subjects alive for students. But while teachers understand that students want to be entertained, the teachers cared most that the technology supports learning. This concern for the sometimes-dual roles of teachers (and resources) is reflected in the following comments. Teachers offered suggestions but
also some concerns for games in the classroom, “I mean it could be a game…based on a river theme but if its only real purpose is to keep kids glued to a screen while they’re hitting two keys… to me that would not be useful at all.” (Participant T05). Or Participant 10 who said, “The website has to be engaging without being totally distracting. If kids get distracted you can find that your time is up and no one has completed the assignment (other than the kids that always complete their assignment).”

Teachers discussed how a virtual tour of a river could work and what would make it useful for students.

If there was a virtual tour, or some resources that could show you what the river is and where you go, as you said, from Hay River up to Tuk along the Mackenzie River. To be able to see that I think that would be quite valuable for them and their learning and maybe as they get older they would want to take a trip on the Mackenzie River.

( Participant T01)

Participant T10 made some fairly detailed suggestions about developing the website as a form of “virtual journey”.

We [Teacher and students] are collecting information about Fort Providence, you get back in your canoe, you go on this little virtual journey, however that is presented. And around the next corner, then you hit a roadblock. There is something that you have to do that you tip your canoe maybe, how are you going to survive this? Like a board game sort of a thing? What would the experts do, you know? And then you know you get to the next community, and maybe you have to prepare for the journey first. How will you pack?
How will you prepare? And you can talk about all the things you need to go on this journey. The sky's the limit. (Participant T10)

The teachers clearly seemed to want a resource that engages students long term and takes them where they need to go in terms of their learning. Some participants suggested that having the students create something along the way and have a finished product at the end that they could take pride in having completed.

There are so many different cool things that could be done. But how do you share all of that... when I think of a finished product that a student is making...It sort of doesn't matter what the finished product is, but sometimes it's good if the finished product is really of quality and of value. (Participant T10)

For teachers with younger students in the classroom visual options were suggested, “As far as writing is concerned I don't think we're quite there. I'm imagining that we could take pictures and write a short caption or something like that might happen.” (Participant T06) While other teachers suggested a larger end product.

When the kids are done [using Knowledge Forum], they can print out these log books, and... It's in the form of a little book, and I'm not suggesting that you copy that, but you could… when they are finished they actually have an artefact of their knowledge collection…You need two people in a canoe, so there's a theme already prescribed... and maybe they keep a digital journal about their trip. One person is in charge of keeping the journal for day 1 and the next person is in charge of keeping the journal for day 2. (Participant T10)
Some teachers suggested building in links and activities on the website that would take the students outdoors and away from the computer.

But I also think that tying the website to activities outdoors is a really good idea...

Because so many of them [students] are in front of screens all the time. To get the screen to motivate them to go outside is a great thing... (Participant T06)

The teachers also expressed a need for good support, such as a teachers guide or a teacher web resource to help them succeed in delivering the social studies curriculum through the website. Ideas for a teacher’s guide included having the expected time it takes to go through a section of the website (to help teachers plan their class time), ideas for offline activities (including set up and transitions) that would support the online content and suggestions for student evaluation. One teacher spoke to ‘samples of flexibility’, which are suggestions on how to approach a topic in different ways.

If you can make it so the teachers don't have to create much, like all the package is there, then they love you resource-wise. If you have to start hunting for things, sometimes teachers don't like that. And even lesson plan-wise, or activity-wise, if it is already created and laid out it makes their lives a lot easier. Like going up the Mackenzie, like for me, if I was teaching grade four again, it would just be neat if I could say, 'there is Norman Wells' . And if there was an icon and it would show Norman Wells on the map and it would also show, maybe a DVD of scenery and maybe some pictures of the school and whatever is there... all the little things, community-wise of importance, a little history on Norman Wells then it is a little easier for a teacher to teach that. …Yeah, yeah. And if you have a couple samples of flexibility, and I know that is probably going to put a bit of extra work on your thing... but they'll love you even more. (Participant T07)
I then asked the teachers to tell me about any concerns that they had with using digital media in the classroom. Many teachers, particularly those with only low-bandwidth connections to the Internet emphasized their concerns about having to wait too long for high-resolution photos or high-quality videos to load. Websites that take too long to load are viewed as having the potential to cause distractions in the classroom.

I guess things that take way too long to load or don't load. We have pretty good bandwidth at the school… we can stream video… but if I have 2 or 3 kids trying to stream video, it wouldn't load... [if] I had four students trying to download voice or audio it would crash... well not crash, but it wouldn't load and then they would lose focus. So something that isn't overly heavy in the download department. Something that is [not] full of bugs and glitches obviously. (Participant T06)

The participants viewed teachers as needing options so that they can avoid total reliance on a website. The options would include hard copy materials and other resources for when there are computer glitches or when the Internet is slow.

Something that we can access offline is nice. Not that we lose our Internet connection very often, but it does provide an opportunity if the Internet does go down or if it is something where you wanted all the kids to participate or all the kids to be doing something at the same time. (Participant T06)

The participants also saw the website as needing to be easy to open, easy to navigate and easy to leave/quit, for both students and teachers. Further, it was felt that activities on the website should not involve searching for a resource. Rather all materials that are necessary to complete a task should be made available as links directly from the website.
When you go on the Internet sometimes you do a Google search for Mackenzie River and you find, you know hundreds of pages of information about the Mackenzie River and the question becomes, well, which one do I pick? And where do I start, and how much time do you end up wasting making that final decision. *Participant T10*

From the perspectives of the participants in this study, teachers need online resources that are free, respect the privacy of their students, are directly accessible to them and don’t require any special steps for access. Even if the resources are good, it was felt that teachers wouldn’t choose them if they require a payment, or if accessing the resources has to be done through the school principal, processes that add extra steps.

I always go right past the ones that I have to pay for. I know that everybody has got to make a living but when I find a resource that cost twenty dollars I usually try to find a free activity…The other thing that can make it a bit difficult is sometimes resources are available [only] through the school, and the school has to get it. It's not necessarily an added step that I want to do. Making the activity directly accessible to the teachers is important. *Participant T04*

Teachers want to ensure that student’s privacy is respected and that they can, as one teacher (Participant T10) put it, “shut it down”, particularly if students are able to communicate with each other through the website.

If it is web-based, would they be able to access it from home? If you are concerned about privacy, would it be something where there is a front door? Where they have to put in a name and a password to be able to get in and to look at their work? All of that stuff is kind of important. *Participant T10*
Teachers who live in smaller communities may find themselves teaching multiple grades in one classroom. In these classes the students will study as groups for a subject. These teachers must have new information each year in order to make the subject engaging for a student who may be in the same class group for three consecutive years.

“You have the [grade] three, four, fives all taking the same social studies...unless it's continually changing it’s not something that they can use every year.” (Participant T03)

Many teachers noted the importance of having the website display written text that will challenge students with a variety of reading abilities. This consideration should be for all the materials, including any links to other websites, because a text-heavy activity can result in losing the interest of half of a class.

As one participant put it, “The accommodations is the hardest part, just knowing that in every class there is probably between four to six different grade levels in there.” (Participant T04) Other teachers reinforced this sentiment, such as in this comment:

My guys are certainly 80-90 percent below grade level. So you know, I think that should be a consideration in how the material is presented. Particularly, if it is going to be independent… if the kids are going to be asked to do stuff, that they can understand and do it.  (Participant T05)

Defining – Summarizing Teacher Comments to Create General Website Design Elements

Following my analysis of the interview transcripts I used the insights of the teachers to create a preliminary list of design elements (Appendix F) that could serve to define the point of view of the teachers (Define Step) and guide the brainstorming (Ideation Step) for the creation of a prototype website (Prototype Step). This list of insights or key points was based on my analysis
of the interview data, including the categorization of data into design features such as navigation, look and feel, etc.

**List of Draft Design Elements Emergent from the Teacher Interviews**

1. The website should be organized as a journey down the Mackenzie River System (Slave River, Great Slave Lake and Mackenzie River to Beaufort Sea). The River itself should organize the content.

2. The website should use communities along the river as key points for student learning.

3. The website should involve a student product at the end of the journey such as a log book or journal.

4. The website should have built-in language and cultural resources arranged along the river theme and provide students with opportunities to find connections between their cultures and the river through language, legends, stories and current activities—hunting, fishing, travel, etc.

5. The website should include topics that students are intrigued with such as traditional lifestyles and animals.

6. The website should help develop students’ understanding of the histories of the communities along the river and of the various travellers who have made the journey.

7. The website should provide resources on the physical and biological “geography” of the river: land changes, major features, landmarks, and tributaries to the river.

8. The website should highlight why the river is important, such as the amount of flow down the river, how local communities use the river as a resource and depend on the land around it as well.
9. The website should include various types of media to support the journey experience: pictures, video, audio, etc.

10. The website should provide options to address a range of technical conditions so that each section is accessible even to teachers who do not have good or reliable Internet access.

11. The website should be easy to upgrade so that new features and resources can be added and older materials that are no longer relevant can be removed or revised.

12. The website should support student learning with reading and comprehension activities but be flexible enough not to alienate lower level readers.

13. The website should be simple to access, navigate, use, save and exit.

**Ideation - Brainstorming Solutions for the Prototype website**

In the Ideation Step of the Human-Centred Design process for this design study, the PWNHC web designer, Rajiv Rawat and I based our decisions on the 13 design elements listed above. Through several discussions Rajiv and I reviewed each of the design elements and then discussed how we might make them work in the prototype. For example, Design Element #9: *The website should include various types of media to support the journey experience: pictures, video, audio, etc.* We discussed multiple options from clicking on links that take you to another website that contains the media, to embedding the photos within the website, including media the students submit, etc. Throughout this process I tried, as much as possible, to incorporate the main needs and wishes of the teachers.

Eventually the list of ideas was compressed to those ideas that both met the needs of the teachers and were possible to create in the limited time period and budget. With this list of ideas I created a draft outline (see appendix G & H) that would inform the Prototype.
Creating a prototype website

In the Prototype Step, using the decisions and draft outline made during the Ideation Step, Rajiv Rawat and I built a prototype website called The Big River Journey. Rajiv Rawat created the prototype using a template from Wordpress®, a popular blogging and basic website creation tool. The prototype website works well on all modern browsers (e.g. Chrome© and Firefox®). While it does work on mobile phones the screen of the mobile must be large enough to see both the content and the map.

I provided the text and media to populate the website. The prototype was populated primarily with text from existing social studies materials and includes videos, archival photographs, avatars and an animated canoe that moves along a route on the river from stop to stop. Permission to use these materials was requested and granted via email to the Department of Education, Culture and Employment, the Department of Environment and Natural Resources, the Department of Municipal and Community Affairs and by the musicians featured on the website for the purposes of this thesis. Some photos were covered by a creative commons licence or were photos that I had taken, for which I have copyright.

Once the prototype website had introductory pages and animation to take the website user from Fort Smith and Fort Providence with activities, we determined the website was ready for testing. I tested the website as if I were a first time user and made note of any problems with links or text. Rajiv then updated this section of the website so that it would be ready to be tested by teachers.
Testing - The 2nd Teacher Interviews

In early June 2015, for the Testing Step of the HCD framework I sent the prototype website to all ten of the teachers who were originally interviewed in the fall of 2014. Testing the prototype is a key component of the design process and I was excited to hear back from the teacher participants. This is a busy time of year for teachers with student Track and Field meets, marking and other end-of-year business; however, six of the ten teachers responded that they were interested and able to test the website and do a follow-up interview. The follow-up questions were focused on the experience of the teachers in using the prototype website, as well as asking about information that was missing and whether and how the teachers would see themselves using the website in their classes. Further questions were asked about any technical challenges (e.g. if the animation or videos took too long to load) and any comments made by their students about using the website.

The teachers were provided with two weeks to review the prototype and were encouraged to try out sections with their students if it was convenient to do so. Throughout the Testing Step teachers identified a number of benefits and limitations in the prototype. A review of the comments and suggestions from the teachers—the intended major users of the website—showed that there was real potential for the resource to be valuable to students. Their comments are described in the following section.

Teacher comments on the prototype and implications for revisions to the prototype

Tables 4.1 to 4.14 list the design elements that were applied in the prototype along with teacher feedback during the Testing Step. Screenshots of the prototype are also included to illustrate the design elements where appropriate.
Table 4.1
Teachers’ comments on the portion of the prototype that reflected design element #1.

<table>
<thead>
<tr>
<th>DESIGN ELEMENT</th>
<th>TEACHER COMMENTS</th>
<th>MODIFICATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The website should be organized as a journey down the Mackenzie River. The River organizes the content.</td>
<td>I actually went through a lot of the trips and places and it was awesome. The interactive nature of it was great, the fiddle music was amazing and it was great to be able to control the canoe, cause that will empower the kids a bit and the pictures are amazing. It was just a really good visual tool that I can definitely see using if I end up teaching the Dene Kede for Grade 8 because they do canoe stuff. (Participant T04)</td>
<td>While changes were made to the look of the website the basic concept of a virtual journey was retained.</td>
</tr>
</tbody>
</table>

“I felt like I just wanted to keep going and I think the 'journey' on the river drives it, gives the website direction.” (Participant T08)

![Figure 4.2](image.jpg)  
*Figure 4.2.* A Screenshot of the opening page of the *Big River* website.
Table 4.2
*Teachers’ comments on the portion of the prototype that reflected design element #2.*

<table>
<thead>
<tr>
<th>DESIGN ELEMENT</th>
<th>TEACHER COMMENTS</th>
<th>MODIFICATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. The website should use communities along the river as key points for student learning.</td>
<td><em>I liked the general information about the towns but there could be more specifics. For example boxes with interesting facts or Did You Know.</em> (Participant T05)</td>
<td>No changes were made to the prototype but a future final website should include more community details and interesting facts.</td>
</tr>
</tbody>
</table>

*Figure 4.3. Screenshot of the first community that appears on the Journey – Fort Smith, NWT.*
Table 4.3
*Teachers’ comments on the portion of the prototype that reflected design element #3.*

<table>
<thead>
<tr>
<th>DESIGN ELEMENT</th>
<th>TEACHER COMMENTS</th>
<th>MODIFICATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>3. The website should involve a student product at the end such as a logbook or journal.</td>
<td>Very easy to use but wasn’t sure if some of the links were supposed to open other apps. E.g. journal - Is that meant to be an electronic journal or are the students just to write in their notebooks...Some [students] were confused by the text that suggested they write in their journals and thought that the icons should click to an online journal. (Participant T02)</td>
<td>The revised prototype includes an online journal, which can be saved and reopened later. The final website should also include a journal handout so that students have an option to draw or write on a hard copy if going through the website as a class rather than individually.</td>
</tr>
</tbody>
</table>

*Figure 4.4.* Green boxes link to an online journal where students can answer the question that is posed to them. Journals can be saved, edited, and printed.
Table 4.4
Teachers’ comments on the portion of the prototype that reflected design element #4.

<table>
<thead>
<tr>
<th>DESIGN ELEMENT</th>
<th>TEACHER COMMENT</th>
<th>MODIFICATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>4. The website should have built-in language and cultural resources arranged</td>
<td>I really enjoyed the interviews and incorporating the elders and their knowledge of the area… referencing Respect to the Land and incorporating Dene laws. Part of the history of each location. Our own history in the NWT isn't in any of the textbooks. So I find that this would be a very valuable resource for teachers that are teaching social studies to incorporate that part of the history. (Participant T01)</td>
<td>Additional cultural resources added to more recent prototypes including audio recordings of Sahtu legends. More resources should be added to a future final website.</td>
</tr>
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<td>along the river theme and provide students with opportunities to find connections between their cultures and the river through language, legends and stories.</td>
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*Figure 4.5. Screenshot of Big River website showing two videos. The top video is of a young girl practicing a cultural tradition of respect by “paying” the river with tobacco. The bottom video is of respected community member Mary Shafer talking about cultural practices and how she respects the land.*
Teachers’ comments on the portion of the prototype that reflected design element #5.

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<th>DESIGN ELEMENT</th>
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<tr>
<td>5. The website should include topics that students are intrigued with such as traditional lifestyles and animals;</td>
<td>“The wildlife got their attention.” (Participant T05)</td>
<td>More facts, photos and audio of wildlife and fish should be added to the final website.</td>
</tr>
</tbody>
</table>

Figure 4.6. A screenshot showing ducks that can be found in the Slave River Delta (a stop on the journey). Clicking on images enlarges them. Above the photos is an audio file of the late elder Alex Lafferty doing calls of birds found in the delta.
Table 4.6.
Teachers’ comments on the portion of the prototype that reflected design element #6.

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<tr>
<td>6. The website should help develop students’ understanding of the histories of the communities along the river and of the various travellers who have made the journey.</td>
<td>They [Students] thought it could increase their knowledge and awareness of the river if there was a bit more engaging content, articles and activities. They thought that they would use the website in school and could use it for a school research project. (Participant T02)</td>
<td>Additional work should be done for the final website to see where there is opportunity to make content more engaging such as with gamification. More content should be added to the final website.</td>
</tr>
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Figure 4.7. Screenshot showing archival photos, historic information and a map of historic forts in the NWT.
Table 4.7
Teachers’ comments on the portion of the prototype that reflected design element #7.

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<tr>
<td>7. The website should provide resources on the physical and biological “geography” of the river. How the land changes, the major features and landmarks, and tributaries to the river.</td>
<td>Most of the students here only get out on the river a couple of times in the summer if someone takes them out. So they don't really see the river in its entirety. To them it's like a lake, it's just huge and a lot of them call it the lake... I mean the smaller ones [students]...so I think this helps to create a clearer picture. And to be honest I think that is something that is difficult for the younger kids, who don't get out much, to think about where they are in the world. So this helps to clarify things a bit. (Participant T06)</td>
<td>The website is using Google Maps as a platform for the student to move through the landscape. This can give a perspective of how the river changes and moves and its relationship to other geological features on a large scale.</td>
</tr>
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</table>

*Figure 4.8.* Screenshot of the canoe animation on the Google map showing the relationship of the river to other features nearby such as a road, community, or other water body.
Table 4.8

*Teachers’ comments on the portion of the prototype that reflected design element #8.*

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<tr>
<td>8. The website should highlight why the river is important, such as the amount of flow down the river, how local communities use the river as a resource and depend on the land around it as well.</td>
<td><em>This website will definitely affect students perception of the Mackenzie and river systems in the NWT. What you have in the website is a map that comes alive and all students will be able to see where their community fits in, even if not directly on the route. (Participant T08)</em></td>
<td>More amazing river facts need to be added and more about the importance of the river in the final website.</td>
</tr>
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</table>

*Figure 4.9. Screenshot showing a “Did You Know?” Fact about the Slave River.*
Table 4.9
*Teachers’ comments on the portion of the prototype that reflected design element #9.*

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<td>9. The website should include various types of media to support the journey experience: pictures, video, audio, etc.</td>
<td>I liked the embedded videos. Cause then you could play them while you are teaching the kids. Having different forms of media is always great for kids cause their attention spans are so so short. It was pretty good—overall I was thoroughly impressed. (Participant T04)</td>
<td>The final website should have additional low-res embedded video and more archival footage and photographs with dates and background information.</td>
</tr>
<tr>
<td></td>
<td>“As well, great photos including the PWNHC historical ones, which I would like to have more info on, including approximate date.” (Participant T08)</td>
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*Figure 4.10. Screenshot showing an example of an embedded video in the website journey. Reproduced with Permission.*
Table 4.10.
Teachers’ comments on the portion of the prototype that reflected design element #10.

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<td>10. The website should provide options to address a range of technical conditions so that each section is accessible even to teachers who do not have good or reliable Internet access.</td>
<td>“Yeah, I think we could project this [question about iPad or tablet use]. We have an iPad for every student, so students could follow along, or I could just project it. Some links were blocked in the prototype so there were concerns noted about that.” (Participant T02)</td>
<td>The website was altered between prototypes to a version which has a simpler set up and took less bandwidth to run. The final website should ensure that embedded videos are not of too high a quality so that loading times are faster. The revised prototypes were moved from a shared GNWT server to a local PWNHC server so that the videos wouldn’t be blocked (the GNWT filters for inappropriate content for public servant viewing is not highly developed.</td>
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<td></td>
<td>“I think the video quality is a little bit high for our Internet. I was just watching the Ft. Smith video and it would load a bit and then play.” (Participant T06)</td>
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<td>“The videos were also taking too long to load which resulted in majority of the class wandering around the computer lab, and not sitting at their computer.” (Participant T01)</td>
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<td></td>
<td>“Biggest concern was that some of the videos are blocked by the GNWT.” (Participant T02)</td>
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Table 4.11
Teachers’ comments on the portion of the prototype that reflected design element #11.

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<td>11. The website should be easy to upgrade so that new features and resources can be added and older materials or materials that aren’t relevant be removed.</td>
<td>No teacher comments</td>
<td>The website was altered between prototypes to a version which has a simpler set up and took less bandwidth to run and is easy to upgrade and change.</td>
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Table 4.12
Teachers’ comments on the portion of the prototype that reflected design element #12.

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<td>12. The website should support students with reading and comprehension learning but be flexible enough not to alienate lower level readers.</td>
<td>“I have a lot of low level readers and it was difficult for them to read as well as to navigate on their own on the website.” (Participant T01) &lt;br&gt;“The students said that the website was easy to read.” (Participant T02) &lt;br&gt;“If we are doing it together the reading level is totally appropriate. I also like how you can play the button to play some of the text. Things like that are also helpful.” (Participant T06)</td>
<td>The final website should be professionally edited to ensure that the language is appropriate for Grade 4 students. Additional narration for the final website should be recorded.</td>
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Table 4.13
Teachers’ comments on the portion of the prototype that reflected design element #13.

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<td>13. The website should be simple to access, navigate, use, save and exit;</td>
<td>“I like the icons that label different parts.” (Participant T06) “I like the design, and it seems quite user friendly. I didn’t feel lost or too many clicks away from the path.” (Participant T08)</td>
<td>The final website should be reviewed by a designer to ensure that the font sizes and buttons are an appropriate for young students.</td>
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Figure 4.12. Screenshot showing the instructions for navigation on the website with the existing font size which should be made larger in the final website.
Teachers who tested the prototype website with their students identified areas that the students liked, including the amount of information, the maps, the straightforward navigation, the quality and type of information, the mission or adventure “story” that framed the website and the website’s look (colour, icons etc.). In this project I have relied on the Teacher participants to report on their students’ feedback to the prototype website.

“In general, I really like the website and think it will be very useful in the classroom. I like the variety of elements included and I think that it's good that it doesn't have a narrower focus” (Participant T08).

The suggestions for modifications of the prototype (Tables 4.1 – 4.14, above) are based on the comments from the teachers. The comments made by the teachers reflect their perceptions about how well the prototype will support their instructional work in the classroom. Using the revised design specifications the prototype could be revised and retested with teachers. In a further round of testing, students could comment directly about a revised prototype and their comments could be collected and assessed along with separate teacher assessments.

**Teacher comments on Prototype limitations (Testing)**

While one teacher (Participant T02) noted that a student found that the repeating format became boring and another that it was long, students overall seemed to like the website and indicated that they would want to use it for school projects.

**Additional Teacher ideas to build on the prototype (Testing and Re-Definition)**

One teacher (Participant T02) reported directly about students’ suggestions for improvement. These included having more information on boats, more photos, greater personalization (student name), information about what travelling on the river is like, and more information about the actual river (rather than the locations that the river passes through).
Other teachers suggested that additional colour; outdoor activities and gamification of the website would make it more engaging for students.

I was thinking that you could have activities where you have the students going out and doing something or building something or creating something aside from the journal—like listening for bird sounds or building a small canoe. More hand-on things.

*(Participant T06)*

One thing was I first read the website and it says that your mission is to deliver mail, and I sort of imagined a button that I would press that would say, “Mail Delivered”. Just to feel like, okay, I've completed those objectives. I felt like I was on this mission but I didn't feel like I was completing something because I was missing that delivery part. Maybe there could be a pop up that says, “You delivered the mail”, or something like that. *(Participant T06)*

“I liked the design but it could be a little more ‘playful’ for kids. Maybe some cartoon animations or animal characters delivering information and more colourful.” *(Participant T02)*

In summary, I used the Human-Centred Design model to interview teachers to find out what their needs were (Empathy Step); summarized these interviews to determine a teacher point of view and to define the design challenge (Define Step); brainstormed ideas for what the end product could look like to meet the teachers’ needs (Ideation Step); worked with a web designer to create a prototype based on these ideas (Prototype Step); and finally, returned to the teacher participants and had them test the prototype (as well as review the text for the website; see Appendix H) (Testing Step).
In the following chapter I will discuss how using the Human-Centred Design process and mindsets affected my overall design study question, present the key findings from the process and make a summary of recommendations for a final Big River Journey Website.
Chapter 5: Reflecting on the Journey

My approach to the research for this thesis was grounded on the idea that teachers would be the best people to tell me how to create a learning opportunity for the children they teach about the Mackenzie River System. This design study was an applied environmental education project using the Human-Centred Design (HCD) process (IDEO.org, 2015) as a theoretical framework. The sections below describe my original vision, the project’s successes and challenges as well as recommendations for the completion and implementation of the final design. I also comment on the effectiveness of the application of the HCD approach to this project and possible directions for future research.

Learning about a River

I started this project by simply wanting to expand student awareness of the great Mackenzie River System. I wanted to create an opportunity for students to know the river even if they never pushed a canoe off of its banks. Perhaps because I paddled the river when I was recovering from an illness, or because I lived in several of the communities that line its shores, I feel this sense of obligation to it. Essentially it is my story, the story of not knowing the cultural, ecological and historical importance of the river until I was an adult, and I did not want to see that repeated for a new generation of students. I want the story of the students to be like the boy I met on the banks of Tsiighetchic who said, “welcome to my land” with all the pride, love, wisdom and faith of someone who has been taught who he is and where he comes from. I want students to understand the value of the river, not in a monetary way, but in a deeper, ecological, cultural and emotional way.
Using Human-Centred Design for Environmental Education

This question led to my design approach: “From the perspective of classroom teachers in the NWT, what design elements of a virtual river system will facilitate students’ online learning about the Mackenzie River system?” The HCD process begins with the designer establishing empathy (See Figure 4.1) for the experiences and knowledge of the intended users or clients of a design. My interviews with teachers led to the definition of 13 design elements, which were subsequently incorporated into a prototype website that could be tested by the participating teachers. Additional recommendations were developed for incorporation into the design followed the testing of the prototype website.

Application of the Human-Centred Design process gave me insights into the classrooms, teacher and student needs, and the challenges and opportunities in making something that was truly unique and relevant to the needs of the users. “If we want to change education and learning to make it more relevant, more effective and more enjoyable for all involved, teachers need to be the entrepreneurial designers and re-designers of the “systems” of schools and of the schools themselves” (IDEO.org, 2012, p. 8).

My design study supports IDEO’s and those of their former CEO Tim Brown’s claim that working with teachers (or end users) to create the design is key to a successful design process (Brown, 2009; IDEO.org, 2012). If I had attempted to design a resource without the experts and teachers that I spoke with at the outset, the prototype website would likely not have been as well received as it was. The HCD approach in education is taking off in many schools and has led to the use of design thinking in new approaches in designing curriculum, spaces, processes and tools – even whole educational systems (IDEO.org, 2012). For example, while not specifically referred to as a HCD process, both the Government of the Northwest Territories and The
Government of British Columbia have produced new education plans that were collaboratively developed with teachers, parents, experts and elders; however, it is unclear how much actual prototyping of the education plans took place (BC Ministry of Education, 2015; GNWT, 2013a).

**Successes**

This study was successful in that the creative approach to the design process resulted in a website that is totally unique. Other aspects of the study’s success came by building off of existing materials. The website design is based on a simple and pre-existing Google® map and used a WordPress® template. The content put into the website was almost entirely based on the existing Grade 4 Social Studies NWT curriculum (GNWT, 2008b) or was provided by the PWNHC. As the content, archival images and the learning objectives were already officially approved and available, the original element of the website was to collate the existing content and display it along an online map of the river system in a way that should work for teachers and their students.

The bottom line is people can’t get to the museum quite as readily as Yellowknifers can. You gotta have access to the stuff that is in the museum. And I think you’ve done a really good job making that stuff accessible. It’s all in one package. It’s not like people are searching all these different websites to get information. It’s a real concise approach and there is lots of good information there that teachers can use when they are teaching about that topic…. like why would you go any place else really. (Participant T10)

**Environmental education through connection to place and story**

Throughout my discussions with teachers, stories were a key theme. Weaving the legends of the Dene, Métis, Cree and Inuvialuit, the stories of the fur traders, the history of the
communities and the stories of the elders was important to both the design and content in the website.

I think definitely bring in the legends, bring in the languages, and bring in people who are alive today down the valley who are key people in the community. Not just political leaders but people who know the land. People who have stories to tell from the land…(Participant T05)

I want students to understand the stories but also the connections of the stories to the river. This project invites students to reflect on their stories, to see that their personal stories about being out on a camp can be connected to the stories told by others hundreds of years ago. Stories have a particular cultural importance in the NWT where lessons have traditionally been taught by travelling the land with adults (Andrews & Buggey, 2008; Andrews, 2004). The stories that are told to the young are tied to the landscape so that it is the land that provides the clues for remembering and then telling a story. In this way, the land is a link for the young to learn, remember, and strengthen their cultural identities, histories, and the protocols and behaviours of their communities (Andrews & Buggey, 2008; Andrews, 2004). The stories of the past also provide opportunities for students to consider how they relive these stories in their own lives; through behaviours, on-the-land activities and in how they govern themselves (McKeon 2012; McGregor 2010).

As designed, the website offers many opportunities to make connections among stories. For example, at the Rabbitskin River stop there is information about the cultural views about rabbits.

The rabbit is a special animal. It is an important source of food when larger animals cannot be found. Knowing how to snare a rabbit is a good skill for survival. It is said the
rabbit is a gift from the Creator and must be respected. You must never let a rabbit suffer.

It is also said the rabbit gave the gift of dance to the Dene. (PWNHC, 2015)

As the website design is developed further it could include language “buttons” so that users can hear the different words for rabbit in Dene and Inuvialuit languages. A user could listen or read a story about the legend of rabbit and read a recipe about how to skin and cook a rabbit. Students could also write reflective essays about camping on the land with their families at places like the Rabbitskin River. This topic also provides an opportunity for teachers to talk to students about why this river is named Rabbitskin. The website could feature archival photos of children wearing rabbitskin clothing. These are just a few possibilities for a single “stopping point” on the Big River Journey. There are a total of 44 stops on the website as currently designed, so it provides a great many opportunities for conversation and connection to multiple curriculum links.

It is my opinion that knowing and sharing the stories of the river can help create personal connections and respect. Care and the development of relationships with the land are embedded in cultural practices and on-the-land protocols, such as ‘paying the river/land’, or spiritual ceremonies such as ‘feeding the fire’. These practices teach children how to maintain balance between family, community and the land (McKeon, 2012). Acts of caring within both social and environmental relationships create an understanding of wholeness which includes emotion, leading to an understanding that to care for ourselves we must also care for the ‘non-human’ elements of the world (Abrams, 1996; Cajete, 1994; Colleges and Institutes of Canada, 2014; Mckeon, 2012; Sutherland & Swayze, 2012b; Thomashow & Streatfield, 2002).

The future of education in the NWT
I believe that using a river-based website to showcase museum resources and to organize the existing curriculum through a virtual canoe journey can help promote greater connections between students and their communities, cultures, environment and history. These connections are consistent with the Education Renewal Goals of the GNWT, which list the development of resources for Aboriginal language and culture as a priority for the future of education in the NWT (GNWT, 2013a).

Furthermore, a fundamental shift in current understandings of education is under way. This shift moves away from being centred on individuals, toward a more ecological understanding of learning where connections and relationships are most important. The individual remains important as a unique member in a web of relations with people, environment, ideas, and self. People learn best when their social, emotional, physical, intellectual, and spiritual needs are met. (GNWT, 2013a, p. 17)

Challenges

Overall using the HCD design process went fairly smoothly, but there were challenges. At the beginning of the study I had tried to conduct all of my interviews at an annual Yellowknife teachers conference. I was anxious to have face-to-face interviews with teachers from across the Mackenzie Valley and not to have to travel to the communities to conduct them. Travel expenses were not in my budget, and transportation to some of the remote communities would cost thousands of dollars and take days of travel. However, teachers are busy at conferences and while I captured four face-to-face interviews I eventually had to shift my approach to telephone interviews for some teachers. These meetings proved to be a reasonable solution but lacked the immediacy and personal connection of a face-to-face interview.
Several technical challenges occurred during the testing of the prototype website. Although some issues were easily corrected by moving the whole website to a local computer server and changing the website template to one that ran smoothly, problems still occurred with communities that have poor Internet access in their classrooms.

“It’s super frustrating as a teacher who wants to use technology…as an educator I think, gosh if we are being driven to use technology to support education then somebody in Education should be doing something to make sure it runs properly.” (Participant T10)

Another challenge was finding a reading level appropriate for the diversity of students who would be accessing the website. There were mixed reviews from teachers during the testing of the prototype. While some teachers found the text to be at an appropriate level, others reported having students who struggled too much with the content, which led to distractions in the classroom. Finding the right balance in reading level may be tricky given the diversity of students and teaching methods. Thankfully, the rapid prototyping part of the Human-Centered Design process allows for, and even celebrates, these types of problems as valuable learning opportunities. Even with additional tweaks and fixes in the final design, the website may likely not work for the classes of every Grade 4 teacher in the NWT. Teachers ultimately must choose those resources that work best with their own strengths and those of their students.

Limitations and Delimitations

This research study is limited to the experiences and opinions of the participants who were involved in the project to design and develop a new website-based educational resource focused on the Mackenzie River system. While six of the seven NWT education regional districts were represented in the empathy step of the interviews, only five of the seven regions were represented in the prototype-testing step. Although the two missing regional districts may have
unique issues with their Internet access, a factor that cannot easily be addressed in the website’s design, it was disappointing not to be able to get feedback from those regions.

While I didn’t know any of the participants well, I did have some familiarity with five of the ten participants prior to the study. This might have made the participants more likely to participate in the study than they would have been otherwise. The study was situated in a unique geographical and cultural context. While the information gained from experience with the general HCD process may be informative for other designers, the specific outcomes and details of the process in this unique context may not be applicable to other curricula or geographical settings.

**Credibility and trustworthiness**

Throughout this process I kept a journal. The journal was useful for reflecting on what I had done and on my thinking along the way. I checked in with my participants frequently during the testing step to ensure that they were able to access the website and to clarify and troubleshoot any problems.

The interviews that I collected in the empathy step were very detailed and rich and included a number of excellent insights as to the needs of the participant group. The results would be an excellent resource for those who want to further develop the website or to use a similar process for another type of web project.

**Recommendations for a final Big River Website**

As the sponsor of this research project and the host of the website prototype, I recommend to the Prince of Wales Northern Heritage Centre that they complete the work necessary to turn the website prototype into an official resource for GNWT teachers (see
Appendix K). The website meets the mandate of the PWNHC and was seen to be a useful resource by all of the participant teachers.

Based on my suggestion that the prototype website be finalized I have made a number of technical recommendations. The following recommendations are based on the results of the Testing Step of the HCD process in which the Big River Journey website prototype was tested with the study participant teachers.

1. The website should be further developed to provide opportunities to include and showcase the stories of students so they can be shared between communities down the river and beyond the river to the rest of Canada.

2. A teacher’s guide should be developed to include a print-out of the journal questions as a template. In this way students could follow along if they are using a hands-on printed map, such as the PWNHC replica barge chart roller or if the teacher is projecting the website on a Smartboard to work on the journey with a class.

3. More information should be added about preparing for a journey, with excerpts from people paddling the river including video logs or journals and more information about safety on the river.

4. More offline and outdoor activities should be built in to the website and many of these should be included as options in the teacher’s guide.

5. Along the way, the website map and text should include more of the Dene and Inuvialuit place names.

6. Language resources, such as words that can be clicked for an audio version should be included in the refined design.
7. More text should be narrated including narration and text in the NWT official languages with downloadable fonts\textsuperscript{13}.

8. Additional game design elements could be applied to the website. In particular, a gamification approach might be applied to the activity of delivering the mail so that students would have to finish Level One before getting to Level Two. The website could also provide a collection of printable stickers or badges for each river section or task completed.

**Directions for future research**

This design study was focused on the teachers as the principle users of the WWW site. In future research it would be interesting to consider interviewing students directly in a Human-Centered Design approach to environmental education to see what the resulting design would be. Researchers could involve students in the testing of the prototype website through group interviews or by observing and speaking with students as they use the prototype.

A number of researchers in environmental education speak to the importance of place-based learning (Cajete, 1994; Simpson, 2014b; Thomashow & Streatfield, 2002). While the Big River Journey website provides a glimpse into the stories, people and history that can be learned from and about the river, the website cannot give a child the experience of sinking into the mud on a riverbank when you get out of your canoe or the exhaustion of sore arm muscles that have been paddling all day. To know if students form a deeper connection to the Mackenzie River System after virtually paddling the river would require further research.

\textsuperscript{13} This prototype used the Google fonts Ubuntu and Didact Gothic, which work with Dene orthography. In December 2015 the Government of Canada published an open source font called *Canada 150*, which supports all Canadian languages.
Conclusion

This research showed the potential opportunities in using digital media to support environmental, historical and culturally relevant learning. It also highlights the importance of the empathy step in the HCD process wherein the potential users of a design play a critical role in defining the specifications early in the process.

Many teachers recognized the Big River Journey website as more than an application for just Grade Four students. I recently demonstrated the prototype website to an audience of 100 teachers from the South Slave Region during a cultural learning in-service session. While I spoke about the curriculum links and content that was specific to Grade 4, I was surprised that some teachers who spoke to me after the talk did not teach Grade 4. For example, one of those who approached me was a teacher for Grade 12 biology who was interested in using the site to support his freshwater science students. Another was a special needs teacher who saw the visual aspects of the website as being a real benefit to her students in multiple classrooms.

I hope that the Big River Website is embraced by the Government of Northwest Territories Department of Education, Culture and Employment as an opportunity not only to support the Grade 4 Social Studies curriculum but also as an opportunity to showcase across the NWT the many archival photos and collections in a new and engaging way. Going forward the existing prototype website has the potential to be further developed and to be more interactive and engaging. Much like a traditional story, there is opportunity with this prototype website to evolve and change over time to reflect changes in technology and the interests of students.

The experience of conducting this HCD process was exciting. I was happy to see the passion expressed by the teachers about engaging the students with the content in new ways, and
in providing suggestions and ideas to make the website even better. Their suggestions were often beyond the scope of my imagination. By interviewing the teachers before deciding on the design of the product I was able to better understand what the teachers’ needs were on a variety of levels, appreciate the limitations and constraints in their classrooms, and discover both what they’d like to see in a research product and also what they did not want or need. I felt that by interviewing teachers (as the end users) I met the needs of the teachers and students much more effectively than I would have otherwise. More environmental education programs might find success if they first visit and enter into deeper conversations with the people they are trying to reach about what it is that they most need.

14 This presentation was not part of the research design for this study
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VERBI. (n.d.). MAXQDA. Berlin, Germany: VERBI Software - GmbH.

http://doi.org/10.1016/j.compedu.2010.09.007


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Appendix A: Sponsoring Agency Letter of Support

This letter indicates the support of my sponsor, The Prince of Wales Northern Heritage Centre, for my research study. The letter indicates that my research supports their mandate and that they are able to provide support for the study through the use of their materials and staff time.

Northwest Territories Education, Culture and Employment

Ms. Michelle Swallow

Dear Ms. Swallow:

Mackenzie River Educational Resources

The Prince of Wales Northern Heritage Centre is pleased to partner with you in the development of educational resources related to the Mackenzie River. Your project for your Master of Arts program is very much in line with our mandate to document and share information about the land, people and history of the Northwest Territories (NWT).

We can offer you in-kind services including consultation with our Coordinators of Education and Public Programs and our Web and Media Technologies Specialist, use of existing digitized maps and resources, and printing of maps required for pilot testing educational activities. We look forward to including materials you develop in a new Edukit that will be available for loan to all NWT schools.

We are happy to have this opportunity to collaborate with you.

Sincerely,

[Signature]

Barb Cameron
Director
Culture and Heritage

c. Ms. Brenda Hans
Coordinator of Education and Public Programs
Appendix B: Information Package for the Recruitment Of Interested Teachers

Below is the image that was used as an information poster about my research study. This poster was provided to teachers at an NWT Teacher Conference and was sent via email to NWT principals for distribution to teachers in their schools.
Appendix C: Consent Form for Interviews

Below is a copy of the consent form that was provided to and completed by all teachers participating in the research study prior to the interviews.

Title of Study: Determining critical design elements that bridge virtual and physical learning about the Mackenzie River.

Project: Masters in Environmental Education and Communication student from the Royal Roads University.

If you have any questions prior to proceeding, or at any time, please don’t hesitate to contact me. If you would like to verify the authenticity of the research project please don't hesitate to contact my research supervisor, Dr. Milt McClaren or Dr.Rick Kool, Program Head.

Participant’s Name: ______________________ Date: ______________________

Principal Investigator: Michelle Swallow, Student, Royal Roads University

1. I have read and understood the attached information sheet giving details of the project.

2. I understand that this consent form is an agreement to participate in a Phase 1 interview to take place during the Northwest Territories Teachers’ Association territory-wide educators’ conference taking place September 29 - October 1, 2014 in Yellowknife, Northwest Territories and a Phase 2 interview in which the date, time and location is TBD, but will likely happen in the spring, 2015.

3. I have had the opportunity to ask the researcher any questions that I had about the project and my involvement in it, and understand my role in the project.

4. My decision to consent is entirely voluntary and I understand that I am free to withdraw at any time without giving reason.

5. I understand the data gathered in this project may form the basis of a report or other form of publication or presentation.

6. I realize that every effort will be made to protect my confidentiality to the extent I prefer.

7. I understand that consent will be sought before any contributions to interviews may be attributed to me.

8. I understand that unless I check the box below, a pseudonym will be used to keep my identity anonymous.

I, ______________________ , have read and understand this consent form. By signing below I agree to be part of the study Determining critical design elements that bridge virtual and physical learning about the Mackenzie River.

I would like my real name used and do not wish to have my identity kept anonymous.

Researcher’s signature: __________________________ Date: _____________________

(Informed consent sheet continues below) Thank you for showing an interest in this project. Please read all of the information carefully. Please keep a copy of this sheet for your future reference.
Appendix D: Interview Questions – 1st Interview with Participating Teachers

These are the questions that were used to guide the conversation with the teacher participants in the first interview before the website was designed. Conversations were either conducted in person or over the phone when a face-to-face meeting wasn’t possible.

1. Let's start with what you are doing now. Tell me about your current role and the work you do. What sort of learning experiences and activities do you now do with your students about rivers in general (or water and water resources) and the Mackenzie River in particular? Do you have particular printed or hard copy resources that you use in your classes (posters, curriculum kits, books, DVDs, etc.)?

2. Here are some examples of online resources that are generally about rivers, lakes, water resources, and similar topics. They have been produced by various agencies and companies but aren’t specifically about the Mackenzie River, or even about Canadian examples. (I will have a computer set up to show the examples). What do you like about these resources? What do you like about some of these? Are there things missing from these examples that you would like to see in an online resource for teachers and students? Are there things that you really do not like? (Discuss both content and presentation/design features.)

3. What online materials have you used in the past that have been a pleasure to use/which ones have not been a pleasure to use/why not?

4. What sorts of online education materials are enjoyed the most by students? Games, videos, etc?

5. How do you like to work with online materials?

6. What sort of approach would you like to see in an online website designed to specifically help students learn about the Mackenzie River? What are your feelings now about how informed or interested your students are about the river, and how do you think an online resource could be helpful to improve or develop their interests?

7. What concerns do you have about interactive and online media?

8. Is there anything that I've missed? Anything else you would like to add?
Appendix E: Example of Codes used in MaxQDA® Software Program

The MaxQDA software program allowed me to load all of my interviews and then assign a colour or code to sentences that related various aspects of the future prototype website. The image below shows the broad categories and sub-codes. For example, “Design Ideas” is a broad category that has 106 sentences from the all of my interviews that broadly speak to design. The next line is for the code “User”, this is a sub-code of “Design Ideas” and has 129 sentences that more specifically speak to how the teacher participants want to interact with the website, such as through navigation of the site. Using this program allowed me to sift through the hours of interviews to pull out those design ideas that seemed most important to the teacher participants.
Appendix F: Sample – Page 1 of Key Points Table

Below is a sample of the table that was used for the Big River Journey prototype website. Column A refers to key insights or points that came out of the analysis of the teacher interviews in the Empathy stage. Column B is the result of the brainstorming between website designer Rajiv Rawat and me about how the key point could best be realized in the prototype website.

<table>
<thead>
<tr>
<th>A: Key Points from Teachers</th>
<th>B: Design Implications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ability to produce something of quality at the end (a compilation of writing or a log book from the trip). [Student outcome]</td>
<td>Students who complete the virtual Mackenzie River trip will be able to print off a “Visitor’s Log book of places visited”</td>
</tr>
<tr>
<td>Access offline Technical information</td>
<td>Perhaps just link to information cards **</td>
</tr>
<tr>
<td>All students (not just top readers) [Student Characteristics]</td>
<td>Each activity will have reading appropriate for grade four and options for below grade readers.</td>
</tr>
<tr>
<td>Animals (includes) [Content]</td>
<td>Will include information on animals – cool facts and an animal icon. Will also include photos and legends that involve animals.</td>
</tr>
<tr>
<td>Being active [Student Engagement/Outcome]</td>
<td>Stories about being active along the Mackenzie River (canoeing, trapping, boating, hunting etc) as well, activities will ask students to reflect more about their own experiences being active on the water.</td>
</tr>
<tr>
<td>Animation, images [Media/Design]</td>
<td>Images will be used from the Prince of Wales Archives where relatable to the point locations. ** Animation may not be possible for the prototype due to time and financial constraints.</td>
</tr>
<tr>
<td>Audio, video, text, buttons, stories read out [Technical/Design]</td>
<td>A variety of options for learning style will be used. Audio recordings of stories will be embedded. Links to related video or when possible embedded video will be used.</td>
</tr>
<tr>
<td>Authored Student outcome</td>
<td>Students will be encouraged to write stories as part of activities along their journey.</td>
</tr>
<tr>
<td>Break down lessons into intro and an activity. Have worksheets. [Content/design]</td>
<td>Will have an intro for each activity and a hardcopy worksheet with options that are offline in case the Internet is down.</td>
</tr>
<tr>
<td>Broader audience [Potential Users]</td>
<td>The website will be public.</td>
</tr>
<tr>
<td>Building and manipulating games [Student Engagement/Outcome]</td>
<td>There will be a reference to a map-building activity (offline).</td>
</tr>
<tr>
<td>Celebrate animals and water systems [Student Outcomes/Engagement &amp; Design]</td>
<td>There will be a gift icon to represent the gifts of the river. Some activities will ask students what gifts the river gives to them and what gifts they can give the river. Other activities will talk about animals such as muskrat that live in water.</td>
</tr>
<tr>
<td>Celebrates unique aspects [Content]</td>
<td>Will highlight sections of the river with unique aspects on the website. Will have a Unique Icon. Examples include: Slave River Rapids and the River Pelican colony, Great Slave Lake (Deepest lake in Canada), Mackenzie River (longest river in Canada), important areas for migrating birds, falcon nesting areas, unique geography such as Bear Rock, etc.</td>
</tr>
</tbody>
</table>

** indicates a potential technical concern
Below is a sample of the table that was used for the Big River Journey prototype website. Reference numbers, e.g. S001, provide direction to the website designer Rajiv Rawat about where various photos, audio files and video files belong. This sample shows the photos and media that were used on four stops of the journey around the Slave River Delta (S006-S008). The full table includes directions for the full length of the journey (S001 - S044).

<table>
<thead>
<tr>
<th>Sub ID</th>
<th>DRAFT TEXT</th>
<th>Game</th>
<th>Audio (not archival) files in Share Drive</th>
<th>Photos with captions (not archival) in Share Drive</th>
<th>Film (not archival)</th>
<th>Audio Archive number</th>
<th>Photos from Hi-resolution Gallery and saved in Share Drive</th>
<th>Photos from Archives with numbers (for future site)</th>
<th>Film Archives with number</th>
<th>Audio from Collections needed</th>
</tr>
</thead>
<tbody>
<tr>
<td>S006 A</td>
<td>You have paddled all the way from Fort Smith to the Slave River delta. The Slave River and the Slave River Delta provide gifts for the rest of the journey. Can you think of some of those gifts and why they are important?</td>
<td>TBD</td>
<td>NSGAI CHANNEL</td>
<td>Frank Lafferty-Trapping types of traps (video is in the Share Drive)</td>
<td></td>
<td>N-1979-004: 0046</td>
<td>N-1979-003: 0036, N-1979-004: 0046</td>
<td>N-1979-003: 0036</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S006 B</td>
<td>You've reached the Slave River Delta. This is a special place for many animals, especially ducks. Can you guess how many types of ducks can be found here? Ducks can be identified by the color of their feathers and what is another way?</td>
<td>TBD</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>N-1979-003: 0036, N-1979-004: 0046</td>
<td></td>
<td></td>
<td>Alex Lafferty Duck calls that are used in the Museum Dinorama - use as sound here.</td>
</tr>
<tr>
<td>S007 A</td>
<td>Way to go! You made it to Fort Resolution! Time to stretch your legs and find out what makes Fort Resolution a special place! Why is Fort Resolution called a “Fort”? What other communities can you name that are “Fort”s? Read the timeline for the Northwest Territories from 1700, 1724 and 1832. What were the big changes that came to the North during this period? <a href="http://www.timeline.ca">www.timeline.ca</a> or look at the Flip Book of interviews with Ft. Resolution elders. <a href="http://wwwmuseum.northernheritagecentre/docs/data/the_way_we_lived/ftrres/pdf/560071.pdf">http://wwwmuseum.northernheritagecentre/docs/data/the_way_we_lived/ftrres/pdf/560071.pdf</a></td>
<td>Crossword for Fort names</td>
<td>RES BAY 5ks</td>
<td>Arthur Beck - Chief Sound, taking care of the water, picking up trash (video in share drive)</td>
<td>Ft. Resolution tent camp. 1: BIC 1st at Fort Resolution, Great Slave Lake. 2: NRCan Canada 2003, DBCA 04/15/03, LR: BIC 1st at Fort Resolution, Great Slave Lake, NWT. 3: Yukon's BIC Company archives.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S007 B</td>
<td>The renewable resource officer wants you to take some time to Hero River for her. While you meet with her she tells you a bit about how she respects the land and what her job is.</td>
<td>Narrator</td>
<td>Jordan Sook - Being a Renewable Resource officer, respecting the land (video in share drive)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix H: Sample from the Big River Journey prototype Website Script

Below is a sample of the text, or the ‘script’, that was used for the Big River Journey prototype website. Reference numbers, e.g. S001, provide direction to the website designer Rajiv Rawat about where the text belongs. This sample includes text from the introductory pages of the website and the first community of Fort Smith going from S001 to S004. The full website script has text for the full length of the journey (S001 - S044).

**S001**
Welcome to the Northern Rivers Website! To get started click here: http://river.northernheritage.ca/fort-smith/

**S002**
You have a mission: to bring mail and supplies down the Mackenzie River Valley. Before you begin your journey let's take a look at where you are starting from and where the river will take you!

- Map: Canada with NWT highlighted
- Video: "The Land Up Here" PWNHC [https://vimeo.com/channels/landuphere/73015951](https://vimeo.com/channels/landuphere/73015951)

You will be writing and drawing in a journal on your trip. A journal is a book where you keep track of your thoughts and ideas. You can use it to draw or write about what you see along the way. Take a look at these photos of different journals that were kept by people travelling in the NWT. Now make sure that you keep a journal handy for this trip!

- Photos: Journals
- Q: It's time to pack! What do you need to take on this journey? Make a list in your journal. When you make your list think about:
  - How long you will be gone?
  - Where you will be sleeping?
  - What will you want to eat?
  - What are some of the tools you will need to take with you?
  - Photos: Pictures of things you would take on a trip, Preparing for a Journey

Did you remember to pack a map? Maps are drawings of the land and water. Barge Captains use river charts. A river chart is a map that shows you the direction to go on the river. This way the Captain can avoid rocks and shallow water, and estimate how long it will take to get to the next spot.

- Additional Resources
  - The journals of Norman Robinson. [http://www.pwnhc.ca/item/a-northern-experience/](http://www.pwnhc.ca/item/a-northern-experience/)

**S003**
The rivers you will be travelling on go through the traditional lands of the Dene and the Inuvialuit.

The word "Dene", when translated, is two words: "Deh" meaning flow or river, and "Ne" meaning mother or earth. So the Dene people flow from the Earth. There are distinct regional groups with their own territory and dialect. But all Dene share a common ancestry and come from the same language family. All of these regions make up what is known as "denendeh" which means, "the people’s land". The
Dene have always lived in harmony with the land. Their respect and knowledge for the land has allowed them to thrive in one of the most demanding environments on the planet.

The word Inuvialuit means, “The real people”. They live on the coast of the Arctic Ocean.

Take a look at this map to see the location of each language group of the Dene and Inuvialuit in the NWT. Map: [http://www.ece.gov.nt.ca/files/K-12/Curriculum/social-studies/maps/official-Languages-of-NWT.pdf](http://www.ece.gov.nt.ca/files/K-12/Curriculum/social-studies/maps/official-Languages-of-NWT.pdf)

The first river you will be travelling on is the Slave River. In the Cree language, this river is called: Omahamow Sipiy.

Water is low on the Slave River right now so you will be using a canoe. What are some of the things to think about when choosing which type of transportation to use? Make a list in your journal.

**S004 - FORT SMITH**

You are starting your journey in Fort Smith.

Photo: FORT SMITH

The Northern Life Museum and Cultural Centre has some photographs to be delivered to Fort Resolution. It is your job to go and pick them up. Take a look at the photos the Heritage Centre has given you. What stories do these photos tell about the Slave River? Make a list in your journal.

Photos: FS2, Google Drive - Slave River 2 and 3, Calypso Bulbosa.

Fort Smith is a multicultural place. Q. Who were the original people on this land? Take a look at the community names chart. What was the traditional name for this area? What does that name mean in English? Make a list in your journal.

Website: Community Names Chart. [http://www.pwnhc.ca/cultural-places/geographic-names/community-names/](http://www.pwnhc.ca/cultural-places/geographic-names/community-names/)

**DID YOU KNOW?** The Slave River gives 75% of the water to Great Slave Lake! There are 3.4 million litres of water that pass by the town of Fort Smith every second!

Photo:

Before you start your journey, you take a moment to “Pay the River”. When people use any part of the land (plants, animals or water) they must pay respect to the land or water. This can be done by talking to the animals or by ‘paying’ the land. To pay the land or water, place some tobacco, matches, or a twist of willow on the ground or in the water. Nothing is to be taken from the land or water without giving something back to it.

Photos: Offering tobacco to the river, Pelicans on the Slave River.

Video: Pay the River [https://vimeo.com/12435784](https://vimeo.com/12435784)

Additional Resources:

Read more about the First People at the NWT Timeline (1700) [http://www.nwttimeline.ca/](http://www.nwttimeline.ca/).
Appendix I: Information sent to Teachers for Prototype Testing

The following information was sent as a guide for participant teachers to help them get started with testing the prototype website.

Start Up

The Big Rivers Website is set up a resource to support the Grade 4 Social Studies curriculum. To reach the website go to: http://river.northernheritage.ca/.

The purpose of the website is to support the hands on materials and real world places that you have access to in the edu-kit and in the community you live in.

Preparation

Make sure that your Internet is working, that website is full screen and that your speakers work. Students will need workbooks or journals along with a pen and paper.

- Make sure your Internet and speakers are working on your smartboard or projector.
- Make sure your Browser is not Windows Explorer or it won’t work. You can use any other browser. See a list here: http://outdatedbrowser.com/en
- To access the website click here: http://river.northernheritage.ca/
- Make sure you have the page set to ‘full screen’
- Make sure students have a notebook (journal) and pencils/crayons/etc handy to answer questions
- Click on the blue text box at the bottom of the page that says “Begin your trip”

When you click on photos or maps they will enlarge. Photos and maps are opportunities for the teacher to start a conversation with the class in a way that makes sense for you as a teacher and for your classroom.

Once you have gone through a page click on the blue button at the bottom right. This will take you to the next page or section of the river. Once you have reached Ft. Providence you will have completed the journey of the Website Prototype (the real website should go all the way to Tuk).

Decisions

Before you begin decide if students will proceed through the classroom individually, in partners, groups or as a class. All options are possible but a decision should be made early on.

Time

The amount of time that it takes to go through the website varies on how much time you as a teacher want the students to spend on the activity. In general, I think you could travel through 3-4 locations in a single teaching block.
Materials

Although this is a virtual resource almost every activity will require an offline action. At the minimum it is a drawing or a short answer of a question being asked, and at the most there is an action to go outdoors to write in a journal.

A journal is necessary for all students to participate in the website. In the future, it may be possible to have the journal online as part of the website where students can simply print off their journal at the end. However, for the purposes of using this prototype please have the students use journals. Journals can be blank paper stapled together or exercisers. The students should be told that these are their ‘special places’ and they can draw, paste, or write on the journals as they wish.

There are some activities that would support the online lessons nicely but are not practical to add to a website. For these activities I have listed them next to their location of the online resource.

Sample of Curriculum Links:

4-K-L008 &L009 - Identify on a map the major lakes, rivers and communities of the NWT. Locate traditional areas of Aboriginal peoples and language groups on a map of the NWT.

4-V-I-004,4,4A : Value their cultural, social and Northern Identities, value the First People of this land, Value their Dene, Inuvialuit or Inuinnaqt identities. & 4-K-T-017, Demonstrate an understanding of traditional ways of life.

Screenshots of 1st Prototype for Testing.

First Page – this is what you should see when you click on the link.
Step 2 – There are two Intro pages – click on the bottom right blue button to continue.

Step 3 – Getting on the River - Canoe Animation: once on the river click on the bottom left blue buttons to watch the canoe travel to your next spot on the river.

To skip the intro pages and go straight back to a point click on the blue or green icons on the map at the opening page (only the blue icons have been completed for the prototype).
Appendix J: Interview Questions for Prototype Test

These are the questions that were used to guide the conversation with the teacher participants regarding their experiences using the prototype website. Conversations were either conducted over the phone or, when that wasn’t possible, a couple of teachers asked to send their comments via email.

1. What was your experience like using the prototype website? Was it a pleasure to use/why not?

2. What sort of information was missing, or did you wish was there?

3. Did you find the website useful? Why/not? How would you see yourself using it in your classes?

4. Did you like the look and design of the website? Why/not? What would you like to see changed?

5. In what way do you think this website will affect (if at all) student’s perceptions of the Mackenzie River? Do you think the website would increase students’ awareness of the river and their interest in it?

6. What concerns do you have about the website?
Appendix K: Follow up Letter to the Prince of Wales Northern Heritage Centre

Dear Ms. Locke Setter:

Mackenzie River Educational Resource – Big River Website

Thank you so much for your support and sponsorship of my thesis titled, *Determining critical design elements that bridge virtual and physical learning about the Mackenzie River*. The use of the PWNHC resources and in particular the skills and staff time of Rajiv Rawat, and the advice of Tom Andrews were invaluable to the successful completion of this project.

As per the sponsorship agreement I am providing you with a copy of my thesis, a list of recommendations and specifications for a final website based on the findings from interviews with teachers that participated in the study and expert.

Overall the prototype website that was tested with the participant teachers was a large success and all of the teachers said that they hope the website would be completed as a resource for their classrooms as they would certainly make use of it. As a result of the positive feedback from teachers I recommend to the Prince of Wales Heritage Centre that they continue to host the website prototype and complete the work necessary to turn the website prototype into an official resource for GNWT teachers.

Based on my suggestion that the prototype website be finalized I have made a number of technical recommendations that are from the results of my research and in particular the testing of the Big River Journey website prototype the study participant teachers.

- The website should be further developed to provide opportunities to include and showcase the stories of students so they can be shared between communities down the river and beyond the river to the rest of Canada.

- A teachers guide should be developed to include a print-out of the journal questions as a template. In this way students could follow along if they are using a hands-on printed map; such as the PWNHC replica barge chart roller or if the teacher is projecting the website on a Smartboard to work on the journey with a class.

- More information should be added about preparing for a journey, with excerpts from people paddling the river including video logs or journals and more information about safety on the river.

- More offline and outdoor activities should be built in to the website and many of these should be included as options in the teacher’s guide.

- Along the way, the website map and text should include more of the Dene and Inuvialuit place names.
f. Language resources, such as words that can be clicked for an audio version should be included in the refined design.

g. More text should be narrated including narration and text in the NWT official languages with downloadable fonts.

h. Additional game design elements could be applied to the website. In particular, a gamification approach might be applied to the activity of delivering the mail so that students would have to finish Level One before getting to Level Two. The website could also provide a collection of printable stickers or badges for each river section or task completed.

i. As the lead researcher on this project, I recommend to the Prince of Wales Heritage Centre that they continue to host the website prototype and complete the work necessary to turn the website prototype into an official resources for GNWT teachers. In addition to the above recommendations I would be happy to meet at your convenience to provide any formal briefings to individuals or groups you might identify.

j. Although copyright was obtained for all of the website resources for the purposes of this thesis final copyright should be sought for a final website.

Not all recommendations are needed in order for the website to be finalized, as the prototype process and the website design allows for changes to be made over time. In addition to the above recommendations I would be happy to meet at your convenience to provide any formal briefings to individuals or groups you might identify.

Sincerely,

Michelle Swallow

cc. Tom Andrews
Mindy Willet
Rajiv Rawat