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Designing for Learning Engagement in Remote Communities: Narratives from North of Sixty

Concevoir pour favoriser la participation active à l'apprentissage dans les communautés éloignées : récits d'Au nord du soixantième parallèle

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Abstract

There are multiple challenges to designing learning experiences for schools in remote communities, including technology and infrastructure limitations, high teacher and administrator turnover, and conflicting interests between local culture and school curricula. In this paper, we offer a brief history of educational initiatives in remote Arctic communities, focusing on: 1) the importance of traditional knowledge, 2) the role of Indigenous culture in school learning materials and activities, and 3) how and why technology might be used to enhance and preserve traditional knowledge, language, and culture. We share implementation examples of one design model, adventure learning, that has successfully engaged learners worldwide in remote and urban communities alike. We conclude by presenting design principles for engaging learners in remote communities through a focus on reflective presence, interaction, educator support, and simplicity of design. These principles are illustrated with a narrative centered on the design of a new online learning environment titled North of Sixty°.

Résumé

Concevoir des expériences d'apprentissage pour les écoles de communautés éloignées comporte de multiples défis, relatifs notamment aux limites liées à la technologie et aux infrastructures, au haut taux de roulement des enseignants et administrateurs et aux intérêts conflictuels entre la culture locale et le programme scolaire. Dans cet article, nous offrons un bref historique des initiatives éducatives dans les communautés arctiques éloignées, en mettant l'accent sur : 1) l'importance du savoir traditionnel, 2) le rôle de la culture autochtone dans le matériel et les activités d'apprentissage scolaire, et 3) les raisons et les façons d'utiliser la technologie pour renforcer et préserver les connaissances, la langue et la culture traditionnelles. Nous partageons des exemples de mise en œuvre d'un modèle de conception, l'apprentissage par l'aventure, qui a réussi à faire activement participer des apprenants de partout au monde, tant dans les communautés éloignées qu'urbaines. Nous concluons en présentant des principes de design pour

la participation active des apprenants dans les communautés éloignées en mettant l'accent sur la présence réflective, l'interaction, le soutien à l'éducateur et la simplicité. Ces principes sont illustrés par un récit centré sur la conception d'un nouvel environnement d'apprentissage en ligne intitulé Au nord du soixantième parallèle.

Introduction

> In a society in which sharing and humility are often valued above individual wealth and personal achievement . . . it should be a given that the education system's pedagogy and curricula should strongly reinforce these values, rather than contradict them, as is too often the current practice. (Nunavut Tunngavik Incorporated, 2012, p. 4)

Throughout the world, remote communities face similar educational challenges related to schooling. These challenges include recruiting and retaining qualified teachers and administrators (Sharplin, O'Neill, & Chapman, 2011), conflicting interests between local culture and curricula and state/provincial/territorial/national educational directives (McClean, 1995; Nunavut Tunngavik Incorporated, 2012; Redwing Saunders & Hill, 2007), and limited access to the infrastructure, technologies, and resources found in many urban and suburban communities (Irvin, Hannum, de la Varre, Farmer, & Keane, 2012). Due to climate and difficult terrain, remote communities are many times accessible only by plane or boat, and are thus isolated from the outside world except via technology such as computers, radio, and/or television. Access to the Internet may be limited or unavailable, and when available is typically satellite-based, slow in speed, restricted in bandwidth, and expensive in cost. These communities may also be home to Indigenous populations on whom mandated, government-sponsored schooling was initially forced, with little to no input from the local community (Berger, 2009; McGregor, 2012).

The circumpolar Arctic is home to many such remote, Indigenous communities. It is also a region that is receiving increasing global attention due to climate change debates and the opening of new possibilities for natural resource extraction and global transportation routes. This increased attention brings its own set of unique challenges, including new threats to local culture, language, and traditional knowledge bases.

In this paper, we offer a brief overview of the history of educational initiatives in the Arctic, focusing on: 1) the importance of traditional knowledge, 2) the role of Indigenous culture in school learning materials and activities, and 3) how and why technology might be used to enhance and preserve traditional knowledge, language, and culture. We also share implementation examples of one design model, adventure learning (Doering, 2006), that has been successfully employed to engage learners and enhance learning outcomes worldwide, ranging from remote Arctic communities to inner city schools. The adventure learning (AL) approach is focused on designing and developing a hybrid learning environment that blends a predesigned curriculum with local culture using a combination of online and mobile technologies; field-based authentic narratives; multiple media artifacts; and scaffolds for teachers and learners alike. For clarity, we define curriculum as a set of learning materials and activities tied to specific learning objectives.

We conclude our paper with a set of suggested principles that elaborate on the topic of designing for engagement in remote communities through a focus on reflective presence, interaction, educator support, and simplicity of design. We emphasize the importance of reflective presence

in particular, and the need for pedagogies and platforms that advance self-representation and community engagement in online learning. These principles are illustrated with a narrative centered on the design of a new online learning environment and adventure learning expedition titled North of Sixty°. The North of Sixty° project is collaborating with schools in six remote communities around the circumpolar Arctic.

Context and Objectives

This paper's authors are post-secondary educators and practitioners in the field of learning technologies, with extensive experience in both K-12 and post-secondary education. Both authors have spent time working with and conducting research with remote Arctic communities. Dr. Doering has more than a decade of experience working collaboratively with Arctic communities, with an emphasis on technology-enhanced education, climate change education, and adventure learning.

The goal of this paper is to share reflections and narratives from a recent project, North of Sixty°, along with observations from work with remote communities in the education field over the past decade. These narratives and observations are used to help illustrate the need for new technology-mediated education models, activities, and pedagogies that help advance self-representation and draw on community knowledge for academic content and engagement. We recognize that histories, infrastructure, and school organization vary from community to community and country to country around the Arctic, but some similarities exist that could benefit from similar educational innovations. The driving question for this paper thus was, what principles might be drawn from working with remote communities that could be applied by others seeking to design technology-mediated learning experiences for remote communities?

This paper is meant as a conceptual think piece, but it is grounded in field experiences and interviews conducted with community members, teachers, and school administrators. It includes discussion of the adventure learning model, its design, and its potential application within a specific context: remote schooling. We are not suggesting that adventure learning is a panacea for all the challenges faced by schools in the North; however, it is one model that could be applied that draws on local culture and experiential learning activities and blends them with technology-mediated learning. It has been shown through previous research studies to offer school-based opportunities to engage and scaffold students and teachers alike through technology-mediated experiences that incorporate cultural relevance, community voice, and multidisciplinary learning opportunities. It is not applicable to all learning situations, however, and can be applied only in settings where there is access to some form of technology that allows for the capture, editing, and storage of digital media, and ideally to the Internet as well. For comprehensive research studies that offer evidence as to how the adventure learning model is being used by teachers and learners in classrooms worldwide, and how it has impacted both engagement and content learning, we refer readers to our and others' previously published studies about adventure learning, of which there are several dozen (e.g., Doering, 2006; Doering, 2007; Doering & Miller, 2009; Doering, Scharber, Riedel, & Miller, 2010; Doering & Veletsianos, 2008; Henrickson & Doering, 2013a; Henrickson & Doering, 2013b; Koseoglu & Doering, 2011; Miller, Doering, Roehrig, & Shimek, 2012; Moos & Honkomp, 2011; Veletsianos & Doering, 2010; Veletsianos, Doering, & Henrickson, 2012).

Finally, we recognize that this paper largely captures our own experiences implementing the North of Sixty° project and the adventure learning model in a specific context and is missing the experiences of the participating schools and communities. We further recognize that monetary considerations are a key determinant to being able to implement technology-mediated solutions in remote schools. We are grateful to the National Science Foundation for funding North of Sixty°, and encourage other research and philanthropic organizations worldwide to support technology-mediated and community-driven educational initiatives in the Arctic.

It is ultimately hoped that the overview we offer in this paper will lend understanding to those outside the North unfamiliar with educational histories and challenges there, and serve as a call to educators and learning technologists everywhere to include remote communities in their design thinking. As we discussed during sessions focused on both education and human capital at the Eighth International Congress on Arctic Social Sciences in May 2014, remote communities stand to benefit enormously from not only access to, but also the opportunity to contribute to online learning design and content.

Traditional Knowledge

> For thousands of years, education was centered on traditional Indigenous knowledge which included not only spirituality, culture, and language, but also focused on local environmental conditions, physics, geology, geography, math, astronomy and other sciences, as well as medicines and medical knowledge. Knowledge about family, community, national and political relations were intertwined with knowledge about our relations with the earth, water, sun, moon, sky, birds, animals, fish and plants. (Chiefs of Ontario, 2012, p. 1)

Indigenous peoples throughout the Arctic have historically depended heavily on traditional knowledge to educate and to sustain life, language, and culture (McGregor, 2010; Nakashima, Galloway McLean, Thulstrup, Ramos Castillo, & Rubis, 2012; Nunavut Tunngavik Incorporated, 2012; Roland & Semali, 2010). Traditional (or Indigenous) knowledge might be seen most broadly as culturally rooted, place-based, collective knowledge that is passed from generation to generation. As defined by Nakashima et al. (2012), traditional knowledge "encompasses not only empirical understandings and deductive thought, but also community know-how, practices and technology; social organization and institutions; and spirituality, rituals, rites and worldview" (p. 30).

The term *traditional knowledge* (TK) is sometimes used interchangeably with *traditional ecological knowledge* (TEK), although TEK can also be viewed as a subset of traditional knowledge (Alexander et al., 2011). A common definition of TEK is "a cumulative body of knowledge, practice, and belief, evolving by adaptive processes and handed down through generations by cultural transmission, about the relationship of living beings (including humans) with one another and the environment" (Berkes, 2008, p. 7). In this paper, we refer to TK with the view that TEK is embodied within it. We recognize TK as responsive and dynamic, "building on experiences and adapting to changes" (Berkes, 2008, p. 7), and acknowledge that TK embodies "process, a way of observing, discussing and making sense of new information" (Berkes, 2009, p. 153), rather than being simply comprised of static content.

There are an increasing number of initiatives that have begun to integrate TK into both formal and informal education programs within Arctic communities (Annahatak, 1994; Berger, 2009; McGregor, 2012; Pember, 2008). TK is also increasingly being integrated with western science in assessing and creating adaptive strategies for environmental issues such as climate change (Alexander et al., 2011; Cruikshank, 2012; Dikison, 2009; Nakashima et al., 2012; Rival, 2014; Robson et al., 2009). There is, however, sometimes disagreement among Indigenous and non-Indigenous educators, scholars, and scientists as to whether these different ways of discovering and knowing the world are complementary or at odds with each other (Agrawal, 2009; Berkes, 2009; Dickison, 2009; Henze & Vanett, 1993; Pember, 2008). See Table 1 for an often-cited comparison of Indigenous and scientific knowledge.

Based on recent studies in the academic literature as well as our own field experiences in Arctic and other remote/rural communities around the world, we believe these two ways of knowing can coexist and complement each other within the spheres of both education and "science." Within this paper, we provide examples from several Arctic communities that have found creative ways to weave TK into formal and informal education. First, however, we provide a brief history of educational initiatives in the Arctic.

Table 1: *Comparisons between traditional and scientific knowledge styles (Alaska Native Science Commission, 2013).*

Indigenous Knowledge	**Scientific Knowledge**
assumed to be the truth	assumed to be a best approximation
sacred and secular together	secular only
teaching through storytelling	didactic
learning by doing and experiencing	learning by formal education
oral or visual	written
integrated, based on a whole system	analytical, based on subsets of the whole
intuitive	model- or hypothesis-based
holistic	reductionist
subjective	objective
experiential	positivist

Educational Initiatives in the Arctic

Eurocentric schooling was forced upon many Arctic communities in the first half to the middle of the twentieth century, including curricula centered on topics that held little meaning for local residents and for which local residents had no referential background knowledge, along with

pedagogies that were largely instructionist and that preached values that conflicted with local beliefs (Barnhardt & Kawagley, 2005; Berger, 2009; McGregor, 2010; McLean, 1995). School calendars also often conflicted (and still do) with subsistence hunting and fishing practices, and other key cultural and life events in communities in the far North. Schooling has in fact been acknowledged as having contributed to "the erosion of indigenous languages and knowledge" (Nakashima et al., 2012, p. 66) in communities throughout the world.

Arctic communities have typically favored more collectivist forms of knowledge building, rather than the individualist and competitive approach favored by most Eurocentric schooling traditions (Rao, Eady, & Edelen-Smith, 2011). Pedagogies within Indigenous communities tend to be, by nature, more learner-centered and experiential, and grounded in communal, familial, and, sometimes, essential survival needs (McGregor, 2010; Nakashima et al., 2012; Seyfrit & Hamilton, 1997). Observation skills are key to learning, and traditional knowledge is key to both surviving and thriving in harsh Arctic environments.

Indigenous people worldwide have begun to demand more say in schooling and education; for an Arctic-specific example, see the work of Mary Simon and others in Canada around the crafting of an initiative and publication centered on Indigenous education: *First Canadians, Canadians First: The National Strategy on Inuit Education* (available from https://www.itk.ca/publication/national-strategy-inuit-education). And though there has been a trend in the late twentieth and early twenty-first century to incorporate Indigenous voices in education, there remains a need for more culturally relevant materials, materials in native languages of Indigenous communities, and pedagogies that better represent local cultures (Berger, 2009; Corson, 1995; Nunavut Tunngavik Incorporated, 2012). Several studies that investigated online learning in remote, Indigenous communities, found similar themes to hold true. For example, "for students in traditional, village-based settings, community-based knowledge and lessons learned from elders are important sources of education that are often ignored in distance education courses" (Rao, Eady, & Edelen-Smith, 2011, p. 23).

This disconnect between local cultural expectations and what students are being taught and how they are being taught—along with difficulties of recruiting, training, and retaining qualified teachers and administrators, including recruiting members of Indigenous communities to pursue careers as teachers—has led to numerous challenges for schools. Some of these challenges are grounded in issues of learner and community engagement, and include mistrust between local parents and Elders and the schools, poor school attendance by students, and high dropout rates among students (Nunavut Tunngavik Incorporated, 2012).

Examples: Narratives From Alaska And Canada

A primary, and millennia-old, method of collecting traditional knowledge has been through storytelling or narrative (Alexander et al., 2011; Crowshoe, 2005; Cruikshank, 2001; Cunsolo Willox, Harper, & Edge, 2012; Lekoko, 2007). This is the approach we have taken as we have traveled to communities worldwide through numerous past adventure learning projects such as Earthducation and North of Sixty°. We discuss adventure learning in more detail later as we discuss designing engaging experiences for learners in remote communities. First, we provide some traditional knowledge narrative examples that have been shared with us from Elders and others in Arctic communities in Alaska and Canada. This traditional knowledge has illustrated

for us the importance of collecting such narratives, as well as the dissonance between the past and the present, observations that complement Nakashima et al.'s (2013) work.

> Eroding modes of knowledge transfer and learning, increased alienation of youth from older generations, and the degradation of social networks are all contributing to decreasing resilience and increasing vulnerability of indigenous communities (Ford et al., 2006). If relationships between generations continue to degrade 'the younger generations would have difficulty making sense of their observations because it is the elders that help frame knowledge, and lead the discourse through which observations are translated into new knowledge' (Berkes, 2009: 153). (As cited by Nakaskima et al., 2013, p. 51)

We heard similar concerns expressed by Elders in Noatak, Kodiak, and Kotzebue, Alaska, USA, as well as in Qikiqtarjuaq and Pangnirtung in Nunavut, Canada. An Elder, Michael* (names have been changed throughout to help protect the identity of participants), with whom we spoke in Pangnirtung conveyed that he was concerned for the safety of youth who travel out on the ice and who have not learned from the Elders what clues to look for in assessing routes that yield the fewest hazards, particularly as the changing climate leads to less predictable seasonal changes and to less stable ice conditions. Two Inupiaq Elders in Kotzebue, Christopher and William, shared that while some families maintained close connections to the land and provided guidance to their children in hunting, fishing, winter survival skills, and other land-based traditions, other families no longer had access to traditional knowledge and language to pass along to their children. Christopher and William both noted that factors related to degraded social networks, alienation between generations, and a loss of culture and language included the forced location of the Inupiaq people into settled communities, a cash-based economy, and a Western school calendar at odds with local traditions, all of which had devastating effects on traditional culture and language as well as subsistence hunting activities and opportunities for youth to learn basic survival skills critical to understand in such an extreme climate as is found in Arctic Alaska. Christopher shared this story:

> The white people figured out a way to lock us in, they built the schools, kept us from learning what we needed to learn about survival…. When I was a kid we couldn't wait to move to camp. Then we were free to live with the elements, to welcome the animals that were coming back in the springtime…. I miss that, I miss that because now, unless my grandkids have a certain number of days in school, they will not graduate, they will not move up in the next grade… So we've got to adapt to that and we've done that…. But you see what I'm saying about the consequences of forced regulations onto us?

In Arctic Canada, we met Jamie, a Baffin Island Elder, who shared a similar story. He discussed the slaughter of sled dogs by the Canadian government in his community and elsewhere in Arctic Canada in the 1950s through the 1970s. Having had their means of transportation forcibly removed, restricting subsistence travel on the land for hunting and fishing, this event and others forced Inuit people into settled communities and dependence on cash-based economies and store-bought food. (Note: Evidence of this event as a widespread and pre-mediated phenomenon is mixed, and the subject is controversial. We refer readers to the Qikiqtani Truth Commission report for further information: http://www.qtcommission.com).

William, an Inupiaq Elder who works with youth in the schools in Arctic Alaska teaching Inupiaq language and culture, noted that since the time of his own childhood:

> We had a great big change, like urban lifestyles now… We've got better machines, better technology, better houses, but it costs money. In order to live that new urban lifestyle you have to have a good job to pay for [it]. Fifty years ago it wasn't like that. Fifty years ago there was no running water here, there was hardly any electricity, people were packing their own water, they were hauling there own wood to heat the houses, and they went out to hunt off the land to bring food on the table.… [But] you still can't learn it all in a classroom… Our place, our lifestyle here in this region above the Arctic Circle, is about survival. You're talking about cold weather, you're talking about gathering food… You've got to have experience on it, you've got to know how to do it. When I teach our language, I include our culture. And we do a lot of hands-on training with our kids using our language, telling stories. Telling stories is important and they learn about [their cultural identity] through our stories.

William emphasized the importance of making learning meaningful for kids, which among other things, might help improve attendance and graduation rates in the region. He talked about the value of experiential learning programs and how critical it is to make learning more culturally relevant to the communities with which he works. We had the opportunity to participate in a school program with William while visiting Kotzebue in February 2013, traveling out by snow machine with a small group of students, teachers, and Elders from Kotzebue High School. The temperature that day was -20F, and we traveled over 70 miles across the ice, collecting ice and snow and water depth samples to be used both in science class as well as by the local authorities in town to help them communicate the safest routes across the ice. All told, the students spent 7.5 hours outdoors, learning not only important science concepts, but also critical winter survival skills, while also contributing important civic knowledge that would aid the safety of the community as a whole as residents traveled out across the traditional routes about which the students had just gathered important ice data.

On the island of Kodiak, an Alutiiq leader detailed similar challenges his people are facing in reviving a near-lost language and cultural practices. He and others are working to help reinstate traditional knowledge and language in a living context by forming connections and establishing experiential learning opportunities between Elders and students in the schools.

Other education-related challenges that were conveyed by community members and educators that we spoke with in Arctic North America included the challenge of recruiting and retaining skilled teachers who were committed to engaging with the communities they served, and how to make mandated curricula more place-based, culturally responsive, and meaningful to their students. Technological and infrastructure limitations found in many remote communities also were a concern, and need to be taken into consideration in the design and implementation of any technology-enhanced learning opportunities in these regions (Kawalilak, Wells, Connell, & Beamer, 2012). The differences we observed in Internet access and speed between communities we visited in the Northwest Arctic Borough of Alaska and those on Baffin Island in Canada were great. The schools we visited in Alaska had relatively reliable access with acceptable bandwidth speeds, whereas the Baffin Island schools had unreliable access, slow connection speeds, and restricted bandwidth. Nunavut has by far the slowest Internet speeds of any province or territory in Canada (see the CRTC *Communications Monitoring Report 2013* at http://www.crtc.gc.ca/eng/publications/reports/policyMonitoring/2013/cmr6.htm), and the

schools on Baffin we worked with had the slowest speeds of any of the Arctic communities involved in our North of Sixty° project.

Online and technology-enhanced learning, however, open up new opportunities to meet some of the learning challenges faced by remote Arctic communities (Abankina, Krasilove, & Iastrebov, 2012; Irvin, Hannum, de la Varre, Farmer, & Keane, 2012; Rao, Eady, & Edelen-Smith, 2011). For example, they can serve as a means for teacher training; offer sensitivity toward cultural expectations; provide learner-centered, collaborative environments modeled on Indigenous communal communication styles; offer a multidisciplinary curriculum grounded in the local culture and landscape; and be accessed on a more flexible basis, allowing communities that are reliant on hunting and fishing, for example, to work on schooling around cultural calendar needs.

One model for the design of online and technology-enhanced learning that has had success in drawing from both Indigenous and Western culture and in utilizing learner-centered, inquiry-based, experiential activities and lessons to engage students in remote communities as well as urban ones, is adventure learning. We introduce this model next, and then explain how it is being put into play in a new online learning environment that is specifically targeted at remote learners in the Arctic.

Adventure Learning

Adventure learning (Doering, 2006; Doering & Miller, 2009) is a form of hybrid distance education that blends experiential (Dewey, 1938; Kolb, 1984) and inquiry-based (Bransford, Brown, & Cocking, 1999) pedagogies. It emphasizes the importance of real-world, authentic problem solving, and merges an online learning environment with teacher-led classroom activities, making use of both online and mobile technologies to share real-world issues with learners.

Within an AL program, a team undertakes an exploration centered on a specific location and topic; for example, climate change in the Arctic. The team travels into the field to capture authentic data and narratives that are synched with a predesigned inquiry-based curriculum tied to that issue and location. The field experiences, data, media assets, and observations of the team are then shared online in an environment in which learners are able to actively participate and collaborate with the explorers, their peers around the world, their teacher(s), and a variety of field experts. These online collaboration and interaction opportunities allow learners to form connections between what is happening in the real world and their studies. Learners complete activities related to those real-world events, engage in online and face-to-face discussions around them, and present potential solutions to issues that are raised.

AL programs have been consistently shown to serve as an effective means to engage students in learning, and as a successful model for interdisciplinary teaching and learning that integrates real-world issues and place-based learning across the curriculum (Doering, 2007; Doering & Veletsianos, 2008; Doering, Scharber, Riedel, & Miller, 2010; Henrickson & Doering, 2013a; Henrickson & Doering, 2013b; Koseoglu & Doering, 2011; Miller, Doering, Roehrig, & Shimek, 2012; Moos & Honkomp, 2011; Veletsianos & Doering, 2010; Veletsianos, Doering, & Henrickson, 2012). These studies have shown that when content is authentic and situated and when the learner has opportunities to actively participate in the learning environment, the learner is more likely to be engaged in the content and to advance along a path of continual learning.

Further, the authentic and collaborative components of AL make environments based in this framework particularly conducive to community building, which can foster deeper engagement in the learning process if learners feel a sense of belonging to that community and a desire to contribute to its knowledge base (Bruckman, 2006; Lave & Wenger, 1991; Whittaker, Isaacs, & O'Day, 1997). Research has indicated AL programs enhance content learning and academic outcomes as well as facilitate learning engagement (Miller, Doering, Roehrig, & Shimek, 2012; Moos & Honkomp, 2011). For example, one AL study looked specifically at STEM learning among Indigenous students engaged in an AL program (Miller, Doering, Roehrig, & Shimek, 2012). AL has further served as the basis for successful teacher professional development programs grounded in experiential learning (Veletsianos, Doering, & Henrickson, 2012).

The most successful AL programs to date have included place, Indigenous culture, and the natural world as central to their learning activities, using them as jumping-off points to help students practice critical and creative thinking across disciplines. A prime example is the GoNorth! series of circumpolar dogsledding expeditions, "a program whose central goal was to deliver an online multidisciplinary K–12 program focused on climate change, sustainability, and Arctic culture" (Veletsianos, Doering, & Henrickson, 2012, p. 48). The GoNorth! program collaborated with millions of students worldwide, including students at remote communities throughout the Arctic, which the GoNorth! expedition team personally visited during their travels. Another example is the Earthducation project (www.earthducation.com), which is collecting narratives on education and sustainability from individuals in climate hotspots around the globe.

Much online and technology-enhanced learning today uses generic or stock media and text to feed content to the learner, is focused largely on cognitive elements, and offers little to no outlet for learners to interact with each other or share their questions, stories, and discoveries. Online learning often thus misses the opportunity to generate a more meaningful, personalized, and engaging experience for learners (Parrish & Botturi, 2009).

In AL programs, however, and in designing for engagement online, it is possible to provide for meaningful, personalized learning through such components as the incorporation of authentic activities, collaboration opportunities, and experiential learning (Doering, 2007; Herrington, Oliver, & Reeves, 2003), all of which are important components in Indigenous pedagogies as well. Based on over a decade of designing online learning environments used in remote communities, we next discuss suggested principles for the design of learning engagement in remote communities, as established through the design of a new online learning environment titled North of Sixty°.

North of Sixty° Design Principles for Learning Engagement

The mission of North of Sixty° is to create a global tapestry of climate stories, weaving together the history and culture of Arctic communities worldwide while preserving the voices and ecological knowledge of generations. To begin, we are collaborating with six remote communities scattered throughout the circumpolar Arctic: the Northwest Arctic Borough in Alaska, USA; two villages in the Baffin Island area of Nunavut, Canada; Digermulen, Norway; Kilpisjärvi, Finland; and Murmansk, Russia. Students at schools in these communities work together in teams guided by a teacher to collect video narratives from Elders, knowledge keepers, and others in their local community. These narratives are focused on changes that have occurred

or are occurring in the natural environment, culture, and/or language of their community. The videos are captured in whatever language the students and storytellers find most comfortable, and then subtitled into English if need be.

Participating schools were identified through existing relationships from previous work by the author(s) in the communities, or through contacting the superintendent or principal at potential schools to discuss the project and offer an invitation to participate. Once specific schools were set, one teacher from each school was identified to pilot the project at the school. Teacher identification was based on discussions with the school principal or vice principal, and a call was then issued to potential teachers, who were offered the opportunity to consent or decline participation in the project. Students also were offered the opportunity to consent or decline participation in the project, as were community members interviewed on behalf of the project.

Participating schools were provided with technology kits that include iPod Touches, iPads, and preloaded apps that will allow them to easily collect, edit, and upload stories to the North of Sixty° online learning environment (see Fig. 1). All of the participating schools have Internet access, but we also provided Flash drives for them to mail their contributions to us in case they struggled with slow Internet speeds or limited bandwidths.

Figure 1. The North of Sixty° tapestry kit includes an iPad, iPod Touch, tripod for the iPod Touch, external hard drive, cables, and power adapters.

The online environment scaffolds students and teachers in the collection, editing, and dissemination of these video stories, while providing a venue for them to share their narratives and view and comment on other school's contributions as well. The online environment also includes educational activities centered on Arctic culture and concerns tied to an adventure learning expedition that involved a team of educators pulking (pulling pulks, or large sleds, filled

with gear while skiing or snowshoeing) between two remote communities on Baffin Island in Nunavut, Canada. The expedition team visited with and provided professional development to two of the North of Sixty° schools during their travels, while sharing field reports live online that blended with the stories being contributed by the student participants in the project.

Videos that have been collected and shared in the online tapestry to date, both by the participating classrooms as well as the expedition team, have ranged from celebrations of local culture and the natural environment to traditional knowledge narratives shared by Elders reflecting on changes in the culture and environment that have occurred in their lifetimes or that were shared by their own Elders. These include narratives such as those shared above in our examples from Alaska and Canada. Videos are still being captured and edited by participating classrooms from regions across the Arctic.

The design of this online environment incorporated several principles that we propose led to the success of the project and could be used by others looking to design similar projects geared at engaging remote communities in learning. These principles include reflective presence, interaction, educator support, and simple aesthetic design.

Reflective Presence

By reflective presence, we mean allowing schools, learners, and communities to establish their own public identity and be recognized as unique and important contributors within the learning space. The North of Sixty° project and online environment were designed to provide tools, training, and communal cyberspace for communities to collect their own knowledge and stories, and then choose what to share publically online.

Cultural engagement, youth identity formation, self-representation, and resilience are key concepts in Indigenous communities struggling with rapid environmental and societal changes (Allen et al., 2013; Garrett et al., 2014; Mistry et al., 2014; Nichols, 2011; Wexler, 2009). Wexler (2009) notes, "identifying with one's heritage and developing a strong cultural identity is extremely important for Indigenous young people. . . . Psychological well-being encourages individuals to meaningfully engage with larger societal issues" (p. 269). For a comprehensive and recent study on pathways to well-being for Indigenous youth transitioning to adulthood within a rapidly changing Arctic, see Allen et al.'s 2013 Circumpolar Indigenous Pathways to Adulthood study.

Experiential learning programs and participatory video projects are becoming a popular means of engaging communities in combined cultural and twenty-first-century-skills learning, as well as helping form bonds across generations (Mistry et al., 2014; Petheram, High, Campbell, & Stacey, 2011; Shellman, 2014; Wexler, Eglinton, & Gubrium, 2014). There are many wonderful programs for Arctic youth that have been initiated in recent years. These include culture camps that connect Elders with youth within a community (e.g., see Davies, 2009). The majority of these programs, however, are available only outside the school setting, thus limiting accessibility and reach. Examples in the Canadian Arctic include Ikaarvik (http://www.aquablog.ca/2013/12/ikaarvik-awarded-arctic-inspiration-prize), IK-ADAPT (http://www.ikadapt.ca/notes-from-the-field-rigolet), and the kANGIDLUASUk Student Program in Labrador (http://www.torngatyouthcamp.com). Some of these programs incorporate technology (e.g., participatory video), some do not. It has been exciting to hear about such

programs at Arctic-focused conferences such as ArcticNet and the International Congress of Arctic Social Sciences, but discussion of these projects in the academic literature are few. We encourage more research and publication around these types of projects, and more discussion of ways that real-world, technology-mediated experiences for Indigenous youth may be incorporated into formal education.

The schools, teachers, and students participating in the North of Sixty° project were enthusiastic about participating in this project as a means to engage the broader community, make learning more meaningful for students, and strengthen both culturally responsive learning and twenty-first-century skills learning in their curriculum. Elders we spoke with in participating communities echoed this enthusiasm, seeing a need for stronger bonds between Elders and youth, and the opportunity to share knowledge and experiences critical not only to cultural survival but to physical survival as well. Inupiaq and Alutiiq Elders in Alaska stressed to us their perceived importance of passing on their knowledge to the younger generations. William, an Inupiaq Elder, saw a need for youth who did not have family members versed in traditional knowledge to be able to access that knowledge. This concern was echoed by Inuit Elders we spoke with on Baffin Island in Canada. Beyond imbuing youth with a strong cultural identity, safety was also a concern. Michael, for example, an Inuit Elder, stressed that with the changing ice conditions due to a changing climate, it is more critical than ever for youth to be able to "read" the ice as they travel by snow machine to hunt or fish with their peers.

The collection and sharing of traditional knowledge, however, is a sensitive topic. One major concern relates to the question of who owns that knowledge and who controls how it is conveyed and disseminated (Burfitt & Heathcote, 2014; Khan, 2014; Orozco & Poonamallee, 2014; also see *Policy Sciences* special 2013 issue covering this topic, volume 46, issue 2). Additional concerns include management of the collected knowledge, language and translation issues, technology costs, computer literacy, and technology education (Dyson, Hendriks, & Grant, 2007). While many Indigenous communities and individuals welcome opportunities offered by online and mobile technologies, some question the cultural appropriateness of using technology to capture and share traditional knowledge, and others view cyberspace as a space of sustained Western ethnocentrism (for a powerful discussion of this subject, albeit dated in terms of current technological capabilities, see Howe, 1998; see also Bowers, Vasquez, & Roaf, 2000; Ginsburg, 2008). It is therefore essential to confirm consent with individuals and communities engaged in projects such as North of Sixty° that what is being shared online is acceptable to the participants. North of Sixty° puts the participants in the driver's seat in this respect, giving them control over what they share with the world and what they share only within their community.

In the North of Sixty° online environment, reflective presence has been accomplished through several means:

1. On the home page of the site, the participating communities are highlighted on a map of the circumpolar Arctic (see Fig. 2). Schools and learners immediately see that they are part of a small, select, and important group and that their community as a whole has worldwide significance.

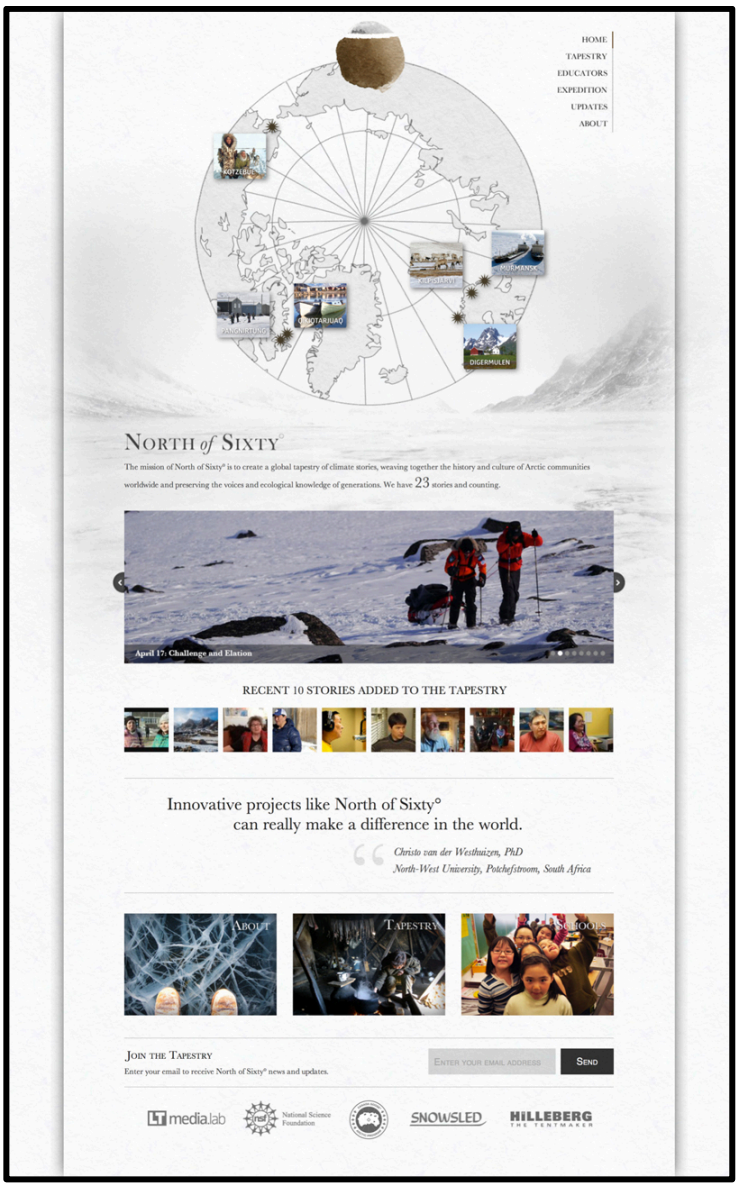

Figure 2. The North of Sixty° home page.

2. When learners select a community on the circumpolar map, they are brought to a page that provides an overview of that community and school and that provides background for what makes them unique. Schools were encouraged to submit photos to include on these pages and to contribute to the text there.

3. Schools and learners also have contributed to the formation of their identity as they have shared their video narratives within the online learning space. They have full control as to what stories they choose to collect and share, how they edit and convey them, and how often they contribute to the video tapestry.

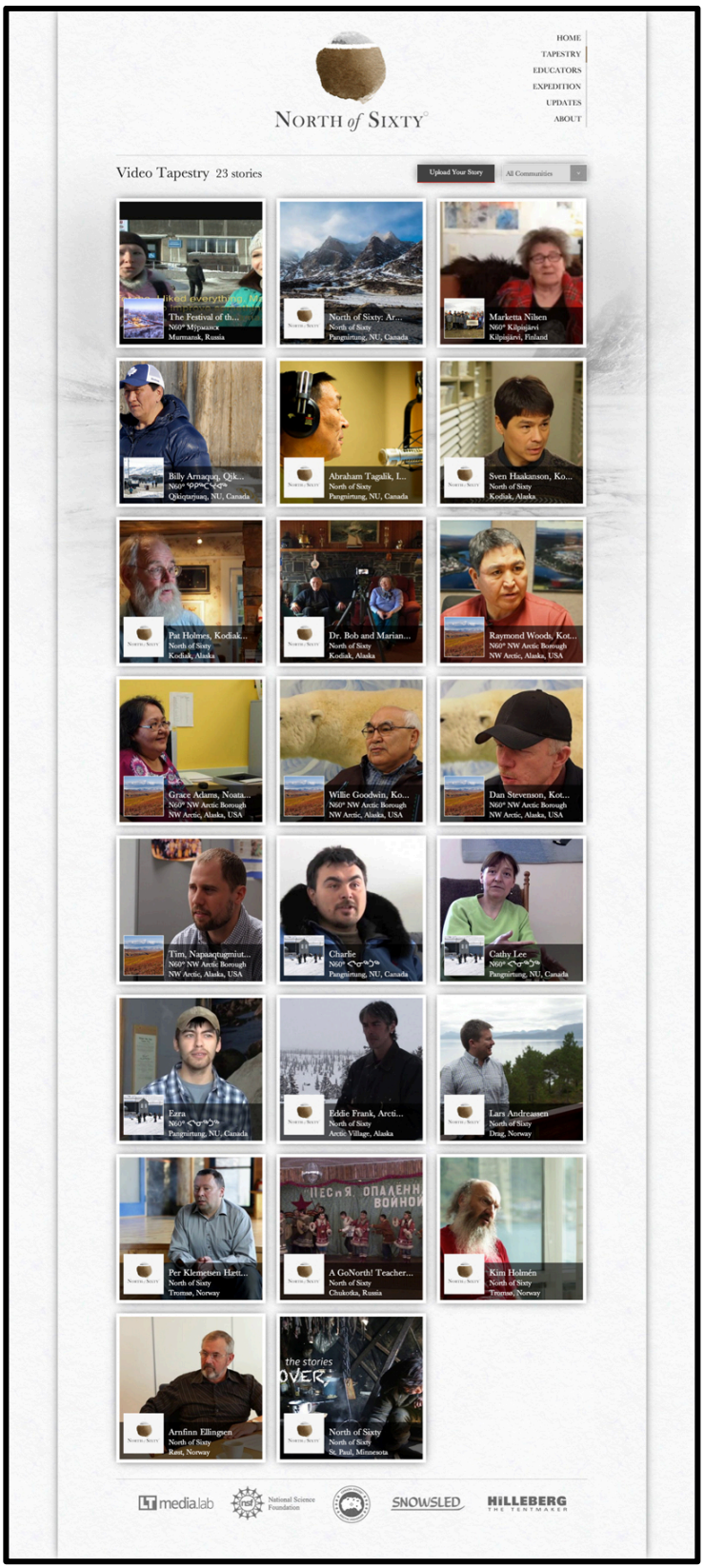

Figure 3. The North of Sixty° tapestry page.

Interaction

Features within the North of Sixty° online environment that were designed to motivate learners to interact and share within the environment include those detailed below. These features helped students become excited about the learning content, the technology used to capture the shared stories, and working together with their peers to capture stories that best represent their community, land, and culture.

1. The home page of the site highlights the most recent stories that have been contributed. Students were motivated to share projects early and often.

2. On the tapestry page of the site (see Fig. 3), which provides thumbnails and overviews of the contributed videos, specific communities and videos are featured on a changing basis. This feature served as motivation for both the students and their teachers to contribute content that was strong and that introduced the world to the challenges, hopes, and dreams faced by them and their communities.

3. As noted earlier, each school was provided with a "tapestry kit," or technology kit, that included exciting new mobile technologies that served to motivate learners to want to engage with the technology and allowed them to both capture and edit high-quality videos that they could be proud to share online. The mobile technology also allowed for easy sharing of the equipment itself, and allowed students to venture outside the classroom to capture content.

4. The online environment was designed to support collaborative efforts, to capture communal visions, and to support experiential learning and learning from Elders, all of which have been shown to be important components of learning within remote, Indigenous communities.

Educator Support

The online environment and the North of Sixty° team scaffolded and aided teachers by providing them with TPACK (technological, pedagogical content knowledge; Mishra & Koehler, 2006) supports. This is an especially important component for designing for learning in remote communities, given that many teachers in these communities are new teachers recently entered into the profession, and that there is often high teacher turnover, so supports need to be in place to allow for easy understanding of both how to implement the educational project within an existing curriculum, and also how to use the provided online learning environment and any supplemental technology. In the case of North of Sixty° this was accomplished through:

1. Online and downloadable tutorials for teachers that cover everything from pedagogical and curriculum-related support to how to use the provided technology to capture, edit, and upload videos to the online environment (see Fig. 4).

2. The aforementioned tapestry kits provided teachers with resources they might not otherwise have access to, and introduced them to current technologies as well as ways those technologies could be integrated in their classroom. By providing teachers with mobile technology we also allowed for flexibility in use configuration in terms of having

a choice to have learners work in pairs, groups, or solo, and to work either within or outside the classroom.

Figure 4. The North of Sixty° educators page.

3. One teacher or administrator at each school was identified as the project lead, to serve both as the main contact for the project from a communication standpoint, and also to serve as a mentor to other teachers at the school who were interested in contributing to the project or in learning about the technologies being used.

4. Online and email support was offered to all participants in the project. In-person visits and on-site professional development opportunities were also provided to several of the participating schools.

Simple Aesthetic Design

Aesthetic design is an important consideration in designing for schools where there might be technological and infrastructural limitations, as well as limited teacher training in the use of technology for learning. We designed an environment that strips away complexities and targets a simple task.

1. The environment is clean and simple but aesthetically engaging, and designed to be accessible to communities that have slow Internet access and/or limited access to computers.

2. The tapestry kits provided mobile technologies that could be employed without needing access to the Internet and that were preloaded with apps that aided in the capturing and editing of video stories. The kits also included external hard drives that could be used to back up captured videos and store other electronic data related to the project.

3. The videos could be uploaded to the site either automatically via an app that was preloaded onto the mobile devices and that was synched with the North of Sixty online environment, or via a button within the North of Sixty online environment.

In summary, we believe that incorporating these principles of reflective presence, interaction, educator support, and simple aesthetic design (Fig. 5) can support learner engagement in online learning environments, and particularly in those environments designed for use in remote communities worldwide where authentic, experiential, and communal learning are valued, and where challenges such as technology and infrastructure limitations, high teacher and administrator turnover, and conflicting interests between local culture and school curricula may exist.

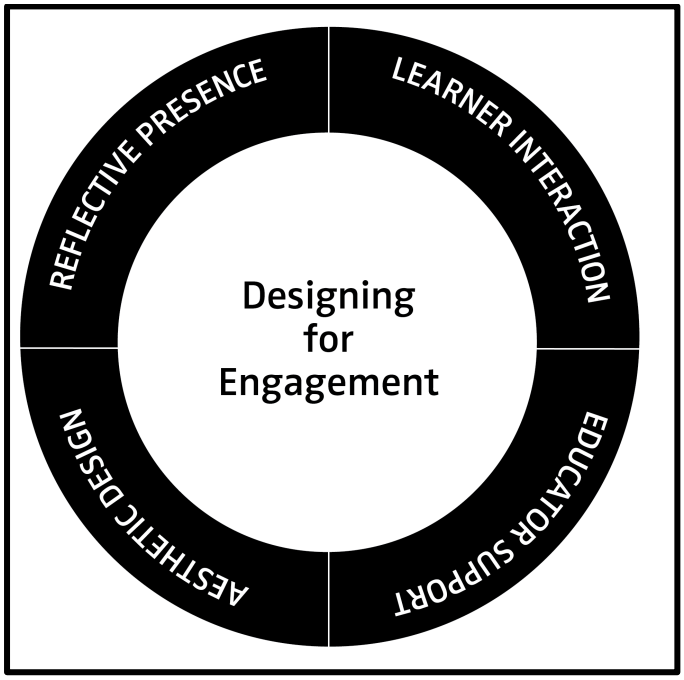

Figure 5. Key factors in designing for learner engagement.

Conclusion and Significance

As organizations such as UNESCO have highlighted, remote communities worldwide face growing threats to sustainability from climate change, global demand for natural resources, technological and infrastructural limitations, and educational challenges. Remote communities face similar educational challenges related to formal schooling. These challenges include recruiting and retaining qualified teachers and administrators (Sharplin, O'Neill, & Chapman, 2011), conflicting interests between local culture and curricula and national/state/provincial/territorial educational directives (McClean, 1995; Nunavut Tunngavik Incorporated, 2012; Redwing Saunders & Hill, 2007), and limited access to the infrastructure, technologies, and resources found in many urban and suburban communities.

Online and mobile technologies offer one means to engage remote communities in learning that can assist learners in understanding and adapting to changes in the environment and in preserving traditional knowledge, language, and culture. Such technologies must be integrated in learning in engaging, meaningful, and culturally relevant ways, however. In many Arctic communities, there is a disconnect between local cultural expectations and what and how students are being taught. For example, unlike many government-sponsored educational initiatives, Arctic communities have typically favored more collectivist forms of knowledge building, and Indigenous pedagogies tend to be learner-centered, experiential, and grounded in communal and familial needs (McGregor, 2010; Nakashima et al., 2012; Seyfrit & Hamilton, 1997). As shared by Elders with whom we have spoken in regions throughout the circumpolar Arctic, observation skills are key to learning, and traditional knowledge is key to both surviving and thriving in harsh Arctic environments.

In this paper, we presented the adventure learning model along with four principles that might be used to design technology-enhanced learning opportunities aimed both at learner engagement and at helping remote communities sustain culture, language, and ecological knowledge in the face of climate and other regional changes. These design principles of reflective presence, interaction, educator support, and simple aesthetic design were illustrated with a narrative centered on the design of a new online learning environment and adventure learning expedition titled North of Sixty°, through which we have been collaborating with schools in remote communities throughout the circumpolar Arctic.

The North of Sixty° project is providing a platform for students and teachers in remote villages around the circumpolar Arctic to capture sustainability stories and engage in discussion about what challenges their communities face and how students might help influence the future of their land and culture. By encouraging experiential learning and dialogue between generations around issues that matter greatly to communities that rely heavily on the land and social traditions for survival, the project hopes to provide schools with alternative means of engaging with students and with the communities they serve. The project has also provided training in twenty-first century technologies that is critical in remote communities and that can lead to new job opportunities in regions such as the Arctic where unemployment runs high. North of Sixty° has also offered professional development to teachers in regions where teaching staff have fewer training opportunities and are often unprepared for the technological and cultural challenges they face.

We hope our experiences offer helpful guidelines for others seeking to design learning opportunities for remote communities around the globe. In order to be meaningful and engaging, we believe such learning opportunities should first and foremost reflect the culture and values of the community they serve, as well as provide ease of use, simple but compelling aesthetics, opportunities for communal interaction, and scaffolds for learners and teachers alike. We further challenge instructional designers and curriculum developers to create more environments that offer voice to the communities they serve to be able to share their own narratives and lessons and thus best be able to sustain longstanding cultural values and traditional languages. Providing online opportunities for self-representation in education is particularly key to helping mediate legacies of colonialism in the Arctic, and to empowering youth to advance their own concepts of identity, sustainability, and livelihood in remote communities worldwide.

*Names have been changed throughout to help protect the identity of participants.

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References

Abankina, T. V., Krasilova, A. N., & Iastrebov, G. A. (2012). The educational strategies of rural school students. *Russian Education & Society*, *54*(10), 14-23.

Agrawal, A. (2009). Why "indigenous" knowledge? *Journal of the Royal Society of New Zealand, 39*(4), 157-158.

Alexander, C., Bynum, N., Johnson, E., King, U., Mustonen, T., Neofotis, P., & ... Weeks, B. (2011). Linking indigenous and scientific knowledge of climate change. *Bioscience*, *61*(6), 477-484.

Allen, J., Hopper, K., Wexler, L., Kral, M., Rasmus, S., & Nystad, K. (E-pub ahead of print, August 21, 2013). Mapping resilience pathways of Indigenous youth in five circumpolar communities. Special Issue *Transcultural Psychiatry*. Retrieved from http://tps.sagepub.com/content/early/2013/08/21/1363461513497232.abstract?patientinform-links=yes&legid=sptps;1363461513497232v1

Barnhardt, R., & Kawagley, A. O. (2005). Indigenous knowledge systems and Alaska Native ways of knowing. *Anthropology & Education Quarterly*, 36(1), 8-23.

Bartko, T. W. (2005). The ABCs of engagement in out-of-school programs. *New Directions for Youth Development, 105,* 109-120.

Berger, P. (2009). Eurocentric roadblocks to school change in Nunavut. *Inuit Studies, 33*(1-2), 55-76.

Berkes, F. (2009). Indigenous ways of knowing and the study of environmental change. *Journal of the Royal Society of New Zealand, 39*(4), 151-156.

Berkes, F. (2008). *Sacred ecology*. New York: Routledge.

Bowers, C., Vasquez, M., & Roaf, M. (2000). Native people and the challenge of computers: Reservation Schools, individualism, and consumerism. *American Indian Quarterly, 24*(2), 182-199.

Bransford, J., Brown, A., & Cocking, R. (Eds.). (1999). *How people learn: Brain, mind, experience, and school*. Washington, DC: National Academy Press.

Bruckman, A. (2006). Learning in online communities. In R. K. Sawyer (ed.), *The Cambridge Handbook of Learning Sciences* (pp. 461–472). NY: Cambridge University Press.

Burfitt, B., & Heathcote, M. (2014). Valuing footsteps—towards a valuation model of indigenous knowledge and cultural expression for the sustainability of indigenous people's culture. *Journal of Intellectual Property Law & Practice, 9*(5), 383-388.

Chiefs of Ontario. (2012). Our children, our future, our vision: First Nations jurisdiction over First Nations education in Ontario. Retrieved from http://www.peopleforeducation.ca/wp-content/uploads/2012/02/COO-Education-Report-Feb-8-20121.pdf

Corson, D. (1995). "Sami Language Act": Emancipatory implications for the world's Aboriginal peoples. *Language in Society, 24*(4), 493-514.

Crowshoe, C. (2005). Sacred ways of life: Traditional knowledge toolkit. Prepared for the First Nations Centre, National Aboriginal Health Organization. Retrieved from http://www.naho.ca/documents/fnc/english/2005_traditional_knowledge_toolkit.pdf

Cruikshank, J. (2001). Glaciers and climate change: Perspectives from oral traditions. *Arctic, 54*(4), 373-393.

Cruikshank, J. (2012). Are glaciers "good to think with"? Recognising Indigenous environmental knowledge. *Anthropological Forum, 22*(3), 239-250.

Cunsolo Willox, A., Harper, S., & Edge, V. (2012). Storytelling in a digital age: Digital storytelling as an emerging narrative method for preserving and promoting indigenous oral wisdom. *Qualitative Research, 13*(2), 127-147.

Davies, M. (2009). Spring camp adventures. [Personal web blog.] Retrieved from http://kluglanoch-corner.xanga.com/701970248/spring-camp-adventures

Dewey, J. (1938/1997). *Experience and education.* New York: Simon & Schuster.

Dickison , M. (2009). The asymmetry between science and traditional knowledge. *Journal of the Royal Society of New Zealand, 39*(4), 171-172.

Doering, A. (2006). Adventure learning: Transformative hybrid online education. *Distance Education, 27*(2), 197–215.

Doering, A. (2007). Adventure learning: Situating learning in an authentic context. *innovate, 3*(6). Retrieved from http://innovateonline.info/index.php?view=article&id=342&action=article

Doering, A., & Miller, C. (2009). Online learning revisited: Adventure learning 2.0. In C. Crawford et al. (Eds.), *Proceedings of Society for Information Technology and Teacher Education International Conference 2009* (pp. 3729–3735). Chesapeake, VA: AACE.

Doering, A., Miller, C., & Veletsianos, G. (2008). Adventure Learning: Educational, social, and technological affordances for collaborative hybrid distance education. *Quarterly Review of Distance Education, 9*(3), 249-266.

Doering, A., Scharber, C., Riedel, E. & Miller, C. (2010). "Timber for President": Adventure Learning and Motivation. *Journal of Interactive Learning Research, 21*(4), 483-513.

Doering, A., & Veletsianos, G. (2008). Hybrid Online Education: Identifying Integration Models using Adventure Learning. *Journal of Research on Technology in Education,* 41(1), 101-119.

Doering, A., & Veletsianos, G. (2007). Multi-Scaffolding learning environment: An analysis of scaffolding and its impact on cognitive load and problem-solving ability. *Journal of Educational Computing Research, 37*(2), 107-129.

Dyson, L. E., Hendriks, M., & Grant, S. (2007). *Information technology and indigenous people.* Hershey, PA: Information Science Publishing.

Elmborg, J. (2006). The other Dewey: John Dewey's "Democracy and Education" and information literacy. In C. Gibson (Ed.), *Student Engagement and Information Literacy* (1–15). Chicago: Association of College and Research Libraries, American Library Association.

Ford, J.D., Smit, B., & Wandel, J. (2006). Vulnerability to climate change in the Arctic: A case study from Arctic Bay Canada. *Global Environmental Change, 16*(2), 145–60.

Fredericks, J., Blumenfeld, P., & Paris, A. (2004). School engagement: Potential of the concept, state of evidence. *Review of Educational Research, 74,* 59-105.

Garrett, M. T., Parrish, M., Williams, C., Grayshield, L., Portman, T. A. A., Rivera, E. T., & Maynard, E. (2014). Fostering resilience among Native American youth through therapeutic intervention. *Journal of Youth and Adolescence, 43*(3), 470-490.

Ginsberg, F. (2008). Rethinking the digital age. In Wilson, P. & Stewart, M. (Eds.), *Global Indigenous Media: Cultures, Poetics and Politics* (pp. 287-305). Durham, NC: Duke University Press.

Henrickson, J., & Doering, A. (2013a). Adventure learning and learner-engagement: Frameworks for designers and educators. *Journal of Interactive Learning Research, 24*(4), 397-424.

Henrickson, J., & Doering, A. (2013b). Teaching sustainability through adventure. *Journal of Sustainability Education, 5*. Retrieved from http://www.jsedimensions.org/wordpress/content/teaching-sustainability-through-adventure_2013_06

Henze, R. C., & Vanett, L. (1993). To walk two worlds: Or more? Challenging a common metaphor of Native education. *Anthropology & Education Quarterly, 24*(2), 116-134.

Herrington, J., Oliver, R. and Reeves, T. C. (2003). Patterns of engagement in authentic online learning environments. *Australian Journal of Educational Technology, 19*(1), 59-71.

Howe, C. (1998). Cyberspace is no place for tribalism. *Wicazo Sa Review, 13*(2), 19-28.

Irvin, M., Hannum, W., de la Varre, C., Farmer, T., & Keane, J. (2012). Factors related to rural school administrators' satisfaction with distance education. *Distance Education, 33*(3), 331-345.

Kawalilak, C., Wells, N., Connell, L., & Beamer, K. (2012). E-learning access, opportunities, and challenges for Aboriginal adult learners located in rural communities. *College Quarterly, 15*(2). Retrieved from http://www.collegequarterly.ca/2012-vol15-num02-spring/kawalilak-wells.html

Kearsley, Greg, & Shneiderman, Ben. (1998). Engagement theory: A framework for technology-based teaching and learning. *Educational Technology,* 38(5), 20–23.

Khan, S. (2014). A new kind of colonialism. *Harvard International Review, 35*(3), 37-39.

Kolb, D. A. (1984). *Experiential Learning: Experience as the source of learning and development*. New Jersey: Prentice Hall.

Koseoglu, S., & Doering, A. (2011). Understanding complex ecologies: An investigation of students experiences in adventure learning programs. *Distance Education. 32*(3), p. 339 – 353.

Kuh, G.D. (2001). Assessing what really matters to student learning. *Change,* 33(3), 10-66.

Lave, J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation*. Cambridge: University of Cambridge Press.

Lekoko, R. (2007). Storytelling as a potent research paradigm for indigenous communities. *Alternative: An International Journal of Indigenous Scholarship*, *3*(2), 82-95.

Maher, M. (2012). Teacher education with indigenous ways of knowing, being and doing as a key pillar. *Alternative: An International Journal Of Indigenous Peoples*, *8*(3), 343-356.

McClean, S. (1995). To educate or not to educate? Canadian discourses concerning Inuit schooling from the 1930s to the 1950s. *Journal of Historical Sociology, 8*(2), 182-197.

McGregor, H. E. (2012). Curriculum change in Nunavut: Towards Inuit Qaujimajatuqangit. *McGill Journal of Education / Revue des sciences de l'éducation de McGill, 47*(3), 285-302.

McGregor, H. E. (2010). *Inuit education and schools in the eastern Arctic*. Vancouver: UBC Press.

Miller, B. G., Doering, A., Roehrig, G., & Shimek, R. (2012). Fostering indigenous STEM education: Mobilizing the adventure learning framework through snow snakes. *Journal of American Indian Education, 51*(2), 66-84.

Mishra, P., & Koehler, M. J. (2006). Technological Pedagogical Content Knowledge: A new framework for teacher knowledge . *Teachers College Record, 108*(6), 1017-1054.

Mistry, J., Berardi, A., Haynes, L., Davis, D., Xavier, R., & Andries, J. (2014), The role of social memory in natural resource management: Insights from participatory video. *Transactions of the Institute of British Geographers, 39,* 115–127.

Moos, D., and Honkomp, B. (2011). Adventure learning: Motivating students in a Minnesota middle school. *Journal of Research on Technology in Education, 43*(3), 231–252.

Nakashima, D. J., Galloway McLean, K., Thulstrup, H. D., Ramos Castillo, A. & Rubis, J. T. (2012). Weathering uncertainty: Traditional knowledge for climate change assessment and adaptation. Paris: UNESCO, and Darwin: UNU.

Nichols, R. (2011). *Growing up Indigenous: Developing effective pedagogy for education and development*. Boston: Sense Publishers.

Nunavut Tunngavik Incorporated. (2012). 2010-2011 Annual report on the state of Inuit culture and society: The status of Inuit children and youth in Nunavut. Retrieved from http://www.tunngavik.com/files/2012/11/2010-11-SICS-Annual-Report-Eng.pdf

Orozco, D., & Poonamallee, L. (2014). The role of ethics in the commercialization of Indigenous knowledge. *Journal of Business Ethics, 119*(2), 275-286.

Parrish, P., & Botturi, L. (2009). Assessing engagement and aesthetic qualities in learning experiences. Manuscript in preparation. Retrieved from http://www.comet.ucar.edu/~pparrish

Pember, M. (2008). Diversifying pedagogy. *Diverse: Issues In Higher Education*, *25*(5), 18-20.

Petheram, L., High, C., Campbell, B. M., & Stacey, N. (2100). *Lenses for learning: Visual techniques in natural resource management. Journal of Environmental Management, 92*(10), 2734-2745.

Rao, K., Eady, M., & Edelen-Smith, P. (2011). Creating virtual classrooms for rural and remote communities. *Phi Delta Kappan*, *92*(6), 22-27.

Redwing Saunders, S. E., & Hill, S. M. (2007). Native education and in-classroom coalition-building: Factors and models in delivering an equitous authentic education. *Canadian Journal of Education, 30*(4), 1015-1045.

Rival, L. (2014). Encountering nature through fieldwork: Expert knowledge, modes of reasoning, and local creativity. *Journal of the Royal Anthropological Institute, 20*, 218-236.

Robson, J. P., Miller, A. M., Idrobo, C. J., Burlando, C., Deutsch, N., Kocho-Schellenberg, J-E., Pengelly, R., D., & Turner, K. L. (2009). Building communities of learning: Indigenous ways of knowing in contemporary natural resources and environmental management. *Journal of the Royal Society of New Zealand, 39*(4), 173-177.

Roland, M., & Semali, L. (2010). Intersections of indigenous knowledge, language, and sustainable development. *CIES Perspectives* (153). Retrieved from http://www.cies.us/newsletter/may_10/IK_and_CIES.html

Seyfrit, C. L., & Hamilton, L. C. (1997). Alaska Native youth and their attitudes toward education. *Arctic Anthropology*, *34*(1), 135.

Sharplin, E., O'Neill, M., & Chapman, A. (2011). Coping strategies for adaptation to new teacher appointments: Intervention for retention. *Teaching & Teacher Education*, *27*(1), 136-146.

Shellman, A. (2014). Empowerment and experiential education: A state of knowledge paper. *Journal of Experiential Education*, *37*(1), 18-30.

Stephenson, J., & Moller, H. (2009). Cross-cultural environmental research and management: Challenges and progress. *Journal of the Royal Society of New Zealand, 39*(4), 139-149.

Veletsianos, G., & Doering, A. (2010). Long-term student experiences in a hybrid, open-ended and problem based Adventure Learning program. Australasian Journal of Educational Technology, *26*(2), 280-296.

Veletsianos, G., Doering, A, & Henrickson, J. (2012). Field-based professional development of teachers engaged in distance education: Experiences from the Arctic. *Distance Education, 33*(1), 45-59.

Wexler, L., Eglinton, K., & Gubrium, A. (2014). Using digital stories to understand the lives of Alaska Native young people. *Youth & Society, 46*(4), 478-504.

Whittaker, S., Isaacs, E., & O'Day, V. (1997). Widening the net: Workshop report on the theory and practice of physical and network communities. *ACM SIGCHI Bulletin, 29*(3), 27–30.

Wilson, B.G., Switzer, S.H., Parrish, P., & the IDEAL Research Lab. (2007). Transformative learning experiences: How do we get students deeply engaged for lasting change? In M. Simonson (Ed.), *Proceedings of selected research and development presentations.* Washington D. C.: Association for Educational Communications and Technology.

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