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Utilizing Technologies to Promote Education and Well-Being

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Utilizing Technologies to Promote Education and Well-Being

Editor's Note: This chapter presents a number of research papers on the Kuhkenah Network (K-Net). K-Net is an Ontario-based Aboriginal network that develops and supports broadband technologies and applications in remote and rural First Nations. The chapter begins with an introduction to K-Net—its history and the impact it has had on First Nations—by Penny Carpenter, the K-Net business manager. Four case studies are then presented that explore various uses of broadband technology in First Nations, including programs surrounding wastewater treatment, health, education, and video conferencing. The introduction and most of the case studies are written by individuals with first-hand knowledge of K-Net, many of whom were involved in its development; thus the papers are largely based on their own experiences. The hope is that the information presented here will introduce readers to the important work being carried out by K-Net, and will serve as a resource for those interested in developing similar programs in other regions.

The Kuhkenah Network (K-Net)

Penny Carpenter

Introduction

The Kuhkenah Network (K-Net) is an Aboriginal network that is partnering with telecommunication providers, governments, and First Nations to develop broadband connectivity solutions and applications in remote and rural regions of Ontario and the rest of Canada. The network is formally known as the Kuhkenah Network. Kuhkenah is an Oji-Cree expression for "everybody," and that is the primary goal of this network—it is for everybody.

The majority of partner First Nations are part of Nishnawbe Aski Nation (NAN), located in northern Ontario across an area roughly the size of France. NAN includes a population of approximately 25,000. Most of this population is Aboriginal and lives in remote communities with 300 to 900 inhabitants. In many communities, the only year-round access into or out of their area is by small airplane, though most have winter road access for five or six weeks during the winter season.

K-Net is a program of the Keewaytinook Okimakanak (KO—Northern Chiefs) tribal council. The First Nations in focus are linguistically and culturally either Cree, Ojibway, or Oji-Cree. Together they form the Keewaytinook Okimakanak

(Northern Chiefs) tribal council. KO is part of the Nishnawbe Aski Nation, a regional organization representing the political, social, and economic interests of 49 First Nations in northern Ontario.

This paper describes the development of K-Net and explores how community members harness information and communication technologies (ICTs) to improve local health, education, and economic development. Based on first-hand accounts and using a sustainable livelihoods framework, the paper attempts to capture some of the real impacts that K-Net's technical infrastructure and services have had on people's everyday lives.

This paper is directed at both Canadian and international audiences interested in how the K-Net experience has evolved. In particular, readers from other indigenous communities and countries from around the world are finding important lessons that help to inform their efforts to develop ICTs. My hope is that this paper is able to capture the lessons that are applicable elsewhere—referred to as "principles that travel."

The Principles of OCAP—Ownership, Control, Access, and Possession

Information and communication technologies (ICTs) are powerful vehicles that can be controlled and directed by indigenous communities to help them arrive at their own goals. Finding a healthy balance in the use and development of these communication tools is the challenge the people of the Nishnawbe Aski Nation region of northern Ontario have undertaken. This work is highlighted online in various video clips containing a wide range of personal stories from the K-Net partner communities (see **http://knet.ca** for the full multimedia report with video clips).

K-Net is a tool: it provides options that the people must decide how to use. These technologies challenge individuals, communities, leaders, regional organizations, and partners to find positive applications and opportunities for all citizens. The question of balance is important for Aboriginal people and belongs in all of their teachings. These are stories about how people embrace change with modern tools, while also balancing this change with the traditions and ways taught by their elders. This story is just a beginning.

Back in 1994, while discussing economic and social development options for their communities, the Keewaytinook Okimakanak (KO) political leadership singled out telecommunications improvements as a self-determining means for achieving community development and wellness. This vision guides the K-Net team and its partners in its ongoing development and growth.

Northern Ontario First Nations: A World Apart

In the context of northwestern Ontario, the word rural has no meaning and must be replaced by "remote." K-Net faces challenges with regard to attracting basic infrastructure investments that have no parallel in southern Canada. The fact that some of the northern communities received access to the Internet via satellite without first having access to telephones is indicative of the scope of the challenges. Infrastructure expansion in the North does not happen through market forces; regulatory and governmental incentive mechanisms are necessary to provide universal access for people in these communities. While Canada boasts some of the world's highest indexes of well-being and telecommunication access, communities in the North have not equally benefited from these achievements.

K-Net is an organization that has taken on the challenge of living in "two worlds"—maintaining and protecting First Nations culture for future generations while harnessing state-of-the-art communication and information technologies. K-Net is a regional information technology and content development organization that supports and manages various local First Nations telecommunication initiatives across this vast and remote region. It connects these northern communities with each other and the world by delivering a variety of broadband services and promoting the development of local electronic indigenous applications.

The following describes the KO communities in brief:

> Keewaytinook Okimakanak First Nations are members of Nishnawbe Aski Nation (NAN). They are small, remote, fly-in communities that have struggled for decades with the practical consequences of institutionalized isolation. Hospital and high school access requires air travel—with the exception of a ten-week period when 4x4 vehicles can travel along a winter road. Most homes are within walking distance of local services such as education, health, and administration buildings. Communities share demographic characteristics. Almost 25% of the total population is under the age of ten years. An additional 25% are between the ages of 10 and 19 years of age. Less than 4% of the total population is age 60 or older. Approximately 36% of the adult population is unemployed or receiving some form of social assistance. High school completion rates are low, particularly for those 45 years of age or older. All of the communities are located in resource rich areas. Forestry and mining activities are rapidly expanding into traditional territories and tourism is a seasonal mainstay for the area.

A Brief History

Since the early 1970s, many communities, organizations, and programs (First Nations of Nishnawbe Aski, Wawatay Native Communications Society, Ontario Network Infrastructure Program) have contributed to the introduction of basic telecommunications infrastructure in the region (two microwave networks and several satellite solutions). During that time, Wawatay was established and became active in media projects across the North, including the Northern Pilot Project High Frequency Radio network, which served 25 communities.

This foundation work created the institutional framework for K-Net. Between 1994 and 1995, the KO Northern Chiefs Council began mobilizing local and federal funding to establish an electronic bulletin board service, offer training, and acquire computers for each KO First Nation. From the very start, the K-Net organization focused on providing telecommunications connectivity (bandwidth) and training, promoting awareness, and, perhaps most importantly, linking the technological demands of the KO communities with various programs offered by telecommunication providers, regulators, academia, funding agencies, and vendors across Canada.

During its expansion phase (1996 to 1999), the organization began offering a wider range of services and added Internet service provision to KO communities and beyond. This included: providing advice on equipment and configuring it to work in network environments; lobbying efforts and work to establish bandwidth services (narrowband with MSAT/DirecPC solutions, and broadband through a Bell Canada infrastructure upgrade); using Linux open-source software to build routers that can be managed remotely, and including dial-up services for local configurations. In addition, it is worth noting that K-Net also became a regional information technology and content development organization. Thus, it now serves as a technical service provider, an application provider, and a content provider.

K-Net and its partner organizations have also dedicated efforts to political lobbying, not only on behalf of KO communities, but also throughout many Nishnawbe Aski Nations communities across northern Ontario. K-Net has played an important role in shaping regulatory decisions of the Canadian Radio-television and Telecommunications Commission (CRTC) that determine the services that are made available to rural and remote communities.

An example of a CRTC regulatory decision in which K-Net proved influential was the 1999 high-cost serving area ruling, which established the requirements for telephone connectivity that all private telecommunication operators must meet in order to hold a licence. Wawatay Native Communications Society, and subsequently K-Net, participated actively in the CRTC's high-cost serving area hearings. Their input influenced the final ruling, which established that "basic telephone services" for high-cost service areas would be defined as follows:

- Single-line touch-tone service with local access to the Internet;
- Access to enhanced calling features, including 911, voice message relay service for those with hearing difficulties, and features that protect privacy;
- Access to operator and directory assistance services;
- Access to long distance; and
- A copy of the current local telephone directory.

This ruling gave Canadian telecom companies until 2003 to provide basic service delivery. The above meant that residents of a rural community with only party-

line phones would now be entitled to have digital touch-tone phone service—the same service available to city residents. Rural and remote telephone subscribers would now be able to connect fax and answering machines to their phones, something that party-line telephone technology did not allow. However, if these subscribers wished to get access to the Internet, their speed of access would be limited to a PC modem that could not surpass phone-line speeds of 56 Kbps. This meant that high-speed modems, such as cable modems and digital subscriber line services (DSL) now available in larger cities in Ontario, were not considered a basic service option.

Two issues are significant here. First, K-Net was involved in shaping a federal policy that made it mandatory for telecommunications operators to improve services—many of which simply did not exist prior to this ruling. Secondly, during that same period (1997 to 2000), K-Net succeeded not only in leveraging resources from the Federal Economic Development Initiative for Northern Ontario (FedNor) to get many KO communities connected to phones (some for the first time), but on the basis of that platform, K-Net jumped ahead to broadband, providing connectivity far beyond these new "basic" CRTC requirements.

K-Net achieved these significant impacts because of a vision: the network's organizers understood that the educational, health, and economic development needs of the most remote communities in Ontario required broadband service; they could not be satisfied strictly with what regulators and commercial carriers had agreed to build.

This cumulative experience led K-Net to compete for Industry Canada's Smart Communities Initiative, a national competition for a five-million-dollar program that had to be matched with an additional five million dollars from other sources. K-Net succeeded and was selected in April 2000 as the only Aboriginal Smart Community Demonstration Project for all of Canada. As one of the requirements of this program, K-Net had to demonstrate community engagement, and "smart results." In other words, Industry Canada wanted to ensure that the services were developed *with* the communities, not *for* them, and that the impact was documented to allow others to learn from the demonstrations.

The summary below describes, in a very general manner, five stages in the evolution of the K-Net telecommunications investments:

- 1975 to 1994: Foundation work towards basic telephony infrastructure development
- 1994 to 1995: Establishment of K-Net within KO as a specialized service
- 1996 to 1999: Major expansion in roles and services, multiple funding in parallel
- 1999 to 2003: Beyond infrastructure to harnessing ICTs and documenting results
- 2003 to present: Developing a business case to maintain the network and services

Indian and Northern Affairs and Industry Canada have been strategic partners throughout K-Net's history. Other public funding partners include Industry Canada's Federal Economic Development Initiative in Northern Ontario (FedNor); Industry Canada's SMART Communities; Indian and Northern Affairs Canada's First Nations SchoolNet program; Northern Ontario Heritage Fund Corporation; Health Canada—First Nations and Inuit Health Branch; Indian and Northern Affairs Canada—Education; Human Resources Development Canada; and Industry Canada's Community Access Program (CAP).

Change that Supports Communities

The connectivity that K-Net has made possible is strengthening links among people, and between communities and the outside world; it is reducing a sense of isolation and separation for remote communities. This experience:

- allows community members who have left the community because of sickness, schooling, or work to keep in touch with their community and know what's happening (through video conferencing, home pages containing local news, photos, etc.);
- makes it easier for those who have left to return (as there is greater access to information and the "outside world"; communities are less "boring" and isolating);
- helps members within the community keep in touch with family members, such as children who are away at school;
- makes it possible for people to stay in the community longer and still have their needs met (e.g., people needing medical or psychological treatment, children receiving more time to mature before going away to school); and
- provides opportunities for community members to see what is going on in other areas (in the North or further away) and offers ideas about new things they may like to promote in their own communities.

Community members are recognizing and using K-Net as a tool that offers both benefits and challenges in relation to their local and cultural issues, including education, health, and economic development. Local people have been directing the implementation and application of the network since its beginning, and this needs to continue if the tool is to be applied to its full potential by the communities. A few brief examples of these applications are given below, some of which are elaborated on in the case studies that follow.

E-health

Keewaytinook Okimakanak Telemedicine (KOTM, **http://telemedicine.knet. ca**) provides a variety of e-health services, including telepsychiatry and medical education. KOTM is giving people in the NAN communities new choices. A tele-health pilot project demonstrated that one-quarter of all medical consultations

can be carried out effectively using telemedicine. This makes it easier, especially for elders, to get quality medical care without the discomfort and high expense of flying out of the community. The telediagnostics facilities also make it easier for care providers to provide services—local health workers have access to information sources, nurses can get specialized advice immediately, and doctors are finding the technology to be a useful support rather than a replacement for their services.

E-learning

By improving access to ICTs, K-Net is having significant impacts on the education of remote First Nations communities. Until recently, in order to continue their education after grade 8, First Nation children living in remote communities were forced to leave their families and communities to attend secondary school hundreds of kilometres away. For many young people, this involved major culture shock and a loss of social support, and often resulted in students quitting school. Now, youth have the choice of staying in their communities longer to attend grades 9 and 10 online, using the Keewaytinook Internet High School (KiHS). Thanks to programs like First Nations SchoolNet, the children are quickly learning new skills and sharing this information with their elders.

K-Net's network and the online applications allow people of all ages in First Nations to participate in government programs, university courses, and online education in a more equitable and timely manner. Community members are actively harnessing the information and communication tools available to them, feeling empowered to both influence and be influenced by what they are learning on the Internet, in chat rooms, and at their local e-centres. They are educating themselves while also sharing their cultural heritage and traditions with a global community. Young people are staying in their communities longer while learning powerful communication skills. K-Net is levelling the playing field so that First Nation community members can also participate in the information age.

Economic Development

The technology is changing the way people communicate, access information, and link to the outside world. Web portals allow each remote community to connect with a wealth of resources and people. New skills and jobs have been created at public access e-centres in each community to support and maintain the network, and to provide services to customers in the community. The technology allows a global audience to access the communities: local handicrafts and ecotourism are now more easily accessible. Most significantly, the new generation of First Nations children is acquiring a computer literacy level that is on par with kids in any urban centre in Canada, giving them a new image of themselves and a new platform upon which to reinvent their society. It is all about balance for Aboriginal youth—celebrating their culture while harnessing the tools of tomorrow.

Network Development

The above services and opportunities are possible thanks to a sophisticated technological network that K-Net has built from the ground up. The K-Net broadband network provides support for band office programs, and for health and education services in each participating First Nation. The network supports the development of online applications that combine video, voice, and data services requiring broadband and high-speed connectivity solutions. The long-term objective is to establish a wide area network of local community networks linked across the country to other networks that share and distribute broadband services and programs benefiting local communities.

This is already beginning. In the Atlantic region, the Atlantic First Nations Help Desk is now providing broadband connections and online services with all of the First Nations across the four Atlantic provinces. In Quebec, the First Nations Education Council is connecting its member First Nations over a broadband network. Both of these regional First Nation networks are connected to K-Net, so any partner First Nation can link directly to any other community on these private, managed networks.

What K-Net has accomplished in less than a decade in terms of network and technical infrastructure development is incredible: communities have gone from having one phone for 400 people eight years ago, to accessing broadband services from individual homes. There are few rural communities in Canada—and particularly few remote ones—that have experienced such a dramatic transformation. For groups wishing to replicate K-Net's work, the main message is this: pay close attention to the process. The technology and network infrastructure have grown from a vision, and are the result of the communities' unique needs and demands. The technology is directed by and for the community.

Conclusion

Information and communication technologies are notorious for increasing gaps—be they economic (digital divides) or social (such as generation or gender gaps)—within some environments. In Aboriginal communities in particular, the introduction of these technologies has profound consequences for people's everyday lives. For the elders, the change is sometimes difficult to comprehend; for the young, it is taken for granted, and for everyone, the challenge is always to find that balance that ensures that everyone benefits.

The technology is a tool offering new power and paths, but it is the people, especially the younger generations, who will harness it and put it to work to find meaning for their own cultures. This technology brings the world to remote areas, with the risk of making everyone seem the same, but it also holds promise, allowing cultures with unique identities to celebrate their legacy and renew it. After nearly 15 years of development, the K-Net experience tells a story that is just beginning.

Endnote

1 This paper is a modified version of a series of studies that was completed in 2004 by a team of researchers led by Dr. Ricardo Ramirez at the University of Guelph.

Case Study 1:

Video Conferencing and Remote and Rural First Nations

Susan O'Donnell, Brian Walmark, and Brecken Rose Hancock

Introduction

Video conferencing offers many benefits to individuals, organizations, and communities. Obvious benefits include saving travel time and money and reducing fossil fuel consumption when choosing video conferencing over travel (Molyneaux et al. 2007). Another important benefit is allowing people living in different places to communicate face to face in real time. This provides more options for people living in remote and rural communities and people living in urban centres to access resources and services available only in distant locations.

Our research has highlighted examples of how remote and rural First Nations use video conferencing to support sustainable development. First Nations are using video conferencing not only for distance learning and telehealth, but also to increase their participation in a range of social, economic, political, and cultural activities (O'Donnell et al. 2007; O'Donnell, Beaton, and McKelvey 2008).

Video conferencing has obvious advantages for remote and rural First Nation communities, but a significant impediment to its more widespread use is the lack of a coordinated national plan to build, maintain, and support the necessary digital infrastructure. There are plans and policies for video conferencing for telehealth and education, but they are in separate silos and not aimed at increasing video conferencing for other purposes in communities. In addition, policy and program initiatives to develop broadband across Canada, including in First Nations, do not generally distinguish between high-speed Internet and broadband networks capable of sustaining real-time audio and video communication. High-speed Internet allows fast email and web browsing, but does not guarantee the quality of service required for reliable video conferencing. In contrast, broadband networks that support video conferencing have the capacity for rich visual and audio interaction (Perley and O'Donnell 2006).

The network infrastructure that allows many schools in remote and rural First Nations across the country to use video conferencing is supported by First Nations SchoolNet, a program of Indian and Northern Affairs Canada (INAC); however, the First Nations SchoolNet program faces an ongoing struggle for sustainability. Since 2006 the federal funding to Regional Management Organizations (RMOs) from SchoolNet has decreased significantly and there are no guarantees that the program will continue to be funded after 2009 (O'Donnell, Beaton, and McKelvey 2008). Without the networks supported by SchoolNet, many of the video confer-

encing activities in First Nations are in jeopardy, including telehealth, distance education programs, and the wider range of community-based activities using the technology.

This case study explores three main questions: Is visual communication important to remote and rural First Nations? What is the prevalence and purpose of video conferencing in non-institutional settings? What are the challenges for First Nations using video conferencing? Some recommended policy directions to increase the use of everyday video conferencing in remote and rural First Nations are also given.

Social Presence and Video Conferencing in Everyday Life

Our first question—about the importance of the visual aspect of video conferencing—requires some background discussion. Social science research on video conferencing began with attempts to understand why the visual is an important component of communication. A core theory from this early period is social presence. Social presence theory was originally developed by John Short and colleagues more than 30 years ago (1976) to understand the social psychology of video conferencing. According to this theory, video conferencing is richer in social presence than other non-visual media and communication channels—such as telephone conversations—because it can convey information important for good interpersonal communication.

Recent research in this area has highlighted three themes that make up social presence: 1) being together, including co-presence, co-location and mutual awareness; 2) psychological involvement, including saliency, immediacy, intimacy, and making oneself known; and 3) behavioural engagement, the immediacy behaviours through which social presence is realized (Rettie 2003). Other recent research argues that social presence is facilitated by observation of visual cues, such as facial expressions and body movements. Social presence and media richness theories suggest that increased richness of the media leads to increased social presence. Video, with its greater ability to support visual cues such as facial expression recognition, will give people a greater sense of social presence than audio alone (Roussel and Gueddana 2007).

Technology research and development on video conferencing has focused almost exclusively on improving the social presence and media richness of the experience, for example by creating higher-definition images, better camera placement and multiple cameras for increased eye contact, and larger screens for an immersive experience. In 1992, two researchers from the Bellcore labs in the United States published an influential paper that argued that instead, video conferencing should aim to be better than in-person communication by adding functionality to the communication experience that is not possible in an in-person setting (Hollan and Stornetta 1992). Their research is based on their belief that

video conferencing will reach a critical mass of users only when it is used widely for everyday communication. Further, they argue that unless video conferencing is better than in-person communication, it will not be used on a daily basis and thus will remain limited as a form of communication.

Research Focus, Questions, and Methodology

For the research discussed in this paper, a mixed methods approach was used. Methodologies included a content analysis of a random sample of 100 video conferences from the 293 video conferences archived on a K-Net server in October 2006; a traffic analysis of the K-Net video conference bridge log for a nine-week period ending early 2007; and 15 in-depth interviews with staff and associates of K-Net and the Atlantic Help Desk conducted during fieldwork visits to partner organizations in April 2007. In July 2007, the project organized and supported two national public multi-site video conferences connecting remote and rural First Nations with researchers and policy-makers in urban centres to discuss video conferencing issues. Transcripts of these two sessions were analyzed along with the 15 in-depth interviews to understand the video conferencing experiences of a wider range of participants.

More information about the participatory methods used in this project and the details of the interviews conducted are described in other publications from this project (O'Donnell et al. 2007, 2008a, 2008b; Simms, O'Donnell, and Perley 2008). The research methods and instruments were developed in consultation with the research partners. The research follows ethical guidelines developed by KORI (Keewaytinook Okimakanak Research Institute) in consultation with elders, youth, women, and other community members.[1]

Research Findings

Importance of Visual Communication for First Nations

Earlier, we discussed the link between visual communication and social presence and how a high degree of social presence is important for effective interpersonal communication. In this section, we discuss the research findings on the importance of visual communication to First Nations people.

In the interviews, we asked specifically about the visual aspect of video conferencing. In their responses, all of the interview participants said that having visual communication is important when communicating at a distance. Many of the participants in the national public multi-site video conferences also mentioned the visual aspect of video conferencing. They want to see the other person during a discussion, and to be able to see that people are paying attention when they are speaking. With visual communication, people take the meetings or gatherings more seriously because others are watching them. Several interview participants said visual communication allows them to build or maintain relationships with

people they cannot meet in person. Four quotations illustrate the importance of visual cues:

> We're visual people, as humans, in general, and Native culture is even more so. I think there's a misconception when we talk about oral traditions. We tend to think only about sound, but I believe that oral traditions are audiovisual. When the granddad was telling those stories, and you were sitting around the campfire, you were thinking thoughts that had images attached to them. It's very definitely audiovisual … it's not just sound. (Interview participant in Atlantic region)

> It's just more personable. You see the person and their reaction, you know they're not working on other things. It gives you that closeness to that person … After a while, it's just like meeting the person, so I think when you see them on camera, and when you see them in person, you kind of already feel that they're familiar. (Interview participant in northern Ontario)

> You see. It's like you're there, you see everyone, and you see expressions on people's faces. You can see reactions to people as they're discussing, so you can engage and understand what they're presenting much, much better than only through audio. (Interview participant in Atlantic region)

> The benefit of video conferencing is that we don't stop meeting face to face completely … face-to-face meetings are very important by video conferencing compared to telephone. (Multi-site video conference event participant in Ottawa)

Some want visual communication primarily to be able to show things to the person they are speaking with, as illustrated in the quote below:

> You can point the unit at the whiteboard and you can do a drawing and explain things which otherwise are really hard to do by emails going back and forth. Emails are second if you're trying to explain something, even worse than the telephone. (Interview participant in northern Ontario)

Several of the interview respondents highlighted the particular benefits of the visual for communicating at a distance with First Nations people with disabilities, the frail and elderly, and those staying in urban hospitals. Friends and relatives have used video conferencing to see for themselves how these people are doing. Video conferencing has also been important for Native-language speakers who want a visual connection with each other. Regular elders' video conferences, in which many participants speak Native languages, take place both in the K-Net and the Atlantic Help Desk communities. There are several examples where the only contact some elders have with people speaking Mi'kmaq is during these video conferences, because there are no other Native-language speakers in their communities. For them it is not necessary to make a speaking contribution to these gatherings—hearing the language and seeing the facial expressions and gestures is enough to help them feel connected to their language and culture. Recognizing the importance of the technology for family events, in December 2008, K-Net offered a seasonal service: "Meet your family for the Xmas holidays using video conference," which provided families living in different communities with the opportunity to meet via real-time audio and video exchange over the holidays.

Prevalence and Purpose of Video Conferencing in Non-institutional Settings

The second research question addressed a different theme: video conferencing used by remote and rural First Nations for non-institutional purposes. Exploring this question primarily involved the analysis of the video conference bridge logs and the content analysis of archived video conferences.[2]

The analysis found that both the K-Net bridge and the Atlantic Help Desk bridge are used to support two-way video conferences, multi-site video conferences, and web streaming for simultaneous audiovisual exchange. In addition, K-Net, the Help Desk, and the community sites on their networks, also initiate point-to-point (two-site) video conferences within and outside their networks. Our findings suggest that K-Net supports about a thousand video conferences and multi-site video conferences a year, in addition to telehealth sessions. The findings suggest that the Atlantic Help Desk supports about 150 video conferences and multi-site video conferences a year.

These video conferences connect people in many different locations (sites). Of the video conferences we analyzed, only 3% connected two sites and the rest connected more: 44% of the video conferences connected six to ten sites, 28% connected three to five sites, and 15% connected more than ten sites. Most often video conferences connected people located in the same province (73%), but some video conferences were interprovincial (7%) or international (1%). Most of the video conferences (66%) had more than ten participants, 14% had six to ten participants, and 5% had three to five participants. Overall, the analysis of the gender ratio of participants suggests that video conferencing is used more often by women.

The content analysis of the video conferences archived on the K-Net server allowed us to develop statistics about the basic purpose of the video conferences: 62% were for learning related to personal, professional, or community development. For 14% of the video conferences, the main purpose was a meeting. For 14%, the main purpose was a community get-together; examples include the popular ongoing elders' video conferences to link elders in different communities who communicate in their Aboriginal language. Finally, 9% of the video conferences were streaming a large meeting to virtual participants; one example is a meeting in British Columbia about information and communication technology in First Nations, with participants joining by video conference from two other provinces, and which was streamed on the web to other participants across the country.

The content analysis found that the most common topic of the video conferences (59%) was health and wellness. Note that these were not clinical telehealth video conferences, but rather other kinds of sessions discussing health and wellness; a typical example is a multi-site interactive seminar for community health professionals on diabetes prevention. For 14%, the topic was education and learning.

For 9%, the topic was culture and language. For 6%, the main topic was information and communication technology; in addition, 32% of all the video conferences included discussion of information and communication technology as part of their main topic of discussion. For 5%, the topic was economic and community development.

Analysis of the interview transcripts found that video conferences are used by First Nations primarily when an in-person meeting or gathering would be appropriate but is impossible. The realities of remote and rural communities mean that travel is often too costly and time-consuming to be a realistic option. Alternatively, a tiny community may not be able to host a gathering because of a lack of food or appropriate accommodation for a large number of visitors. The quote below illustrates one example of family use of video conferencing:

> The biggest thing is the reduction of travel costs. Patients don't have to leave home. They don't have to leave their families. They don't have to leave work. We also use it for family visits when high school students go out to school. They're able to visit their families here at home. (Participant in multi-site video conferencing event from northern Ontario)

Challenges for Video Conferencing in Remote and Rural First Nations

The final theme of our paper—the focus of the third research question—is challenges for First Nations using video conferencing. The data from the transcripts of interviews and public multi-site video conferences was analyzed to answer this question; our research findings are also discussed in our recent publication (O'Donnell, Perley, and Simms 2008). The challenges we identified were guided by a framework we developed for analyzing video communications for social interaction (O'Donnell, Molyneaux, and Gibson, forthcoming). The four categories in the framework are: technical infrastructure, the interactions of the users with the technical infrastructure, the production and reception of audiovisual content, and the organizational and social relations.

Our analysis found that the primary challenge for technical infrastructure in remote and rural First Nation communities is network and bandwidth constraints. Video conferencing requires much more network bandwidth than exchanging text data. Across Canada, the bandwidth available in urban communities is significantly greater than in rural and remote communities. In small communities, the commercial telecom providers are often not interested in providing network infrastructure, and if they do, it is expensive and can take considerable time to acquire. Some of the remote communities serviced by satellite have enough bandwidth for only one video conference at a time. The limited bandwidth has to be managed to ensure that video conferencing sessions are not degraded by other uses of the network, such as downloading and sharing large music and video files. Managing the network involves providing quality of service (QoS) for video conferencing, which requires human and technical resources that need to be maintained and sustained.

One example of the kind of technical infrastructure required to support video conferencing in remote First Nation communities is the introduction of a solar-powered tower and radio equipment installed in 2008 in Koocheching First Nation which will provide its residents with access to K-Net that will support the community's use of video conferencing, IP telephones, and high-speed data connections. The antenna will connect to K-Net at the site of the new cellular telecom tower located in Keewaywin First Nation.

Another infrastructure challenge is ensuring a critical mass of quality video conferencing units in First Nation communities. In the Sioux Lookout district of Ontario, the communities usually have three video conferencing units: in the school, health centre, and band office. In the Atlantic region, the communities with a school usually only have one in the school, although more Atlantic First Nation health centres are acquiring video conferencing units, and in a few communities the band office has one. The need for QoS implies using good quality set-top video conferencing systems. Although the cost of these systems is dropping, they are still expensive compared to desktop video conferencing systems using webcams. Currently desktop systems do not consistently provide the visual quality necessary for successful multi-site video conferencing sessions, although this may change in the future.

Moving on to the topic of community members interacting with the technology, a major challenge is the lack of awareness in communities that the technology is available and useful. Low levels of awareness and understanding remain after more than six years of introducing video conferencing equipment to these remote and rural communities. Sometimes, staff working in community organizations that have the capacity to use video conferencing are not aware that it exists and that they can use it. Organizations in First Nations need to change their work processes so that video conferencing fits within them, or, if video conferencing does fit their current work processes, they need to know how to make it work for their organization. This would involve basic training to use the equipment; in some organizations staff turnover is high, compounding the challenge.

Another primary challenge in this category is technical support. In urban government, institutional, and corporate offices there are trained technical contact persons who assist staff to use computer and video conferencing equipment. Conversely in remote and rural communities, these persons may not exist, and funding for such a position is always in short supply.

Another challenge is the difficulty of accessing the video conferencing equipment in remote and rural communities. The video conferencing unit is generally there for a specific purpose, such as health, education, or band office administration. It can be a daunting task to find out where and how to access the video conferencing unit in the community. In band offices, the units are often in meeting rooms that are heavily booked. The equipment in schools and health centres is usually not set up for community use; when it is, the rooms with the video conference units are often not available after 4 p.m. and on weekends.

Our analysis found several challenges related to organizing video conferencing events. In many First Nation communities, there is a perception that people prefer to travel to meetings outside the community rather than use video conferencing to attend the event. This is not always the case, but unless the video conference option is widely known and appreciated people will not have the option. There needs to be someone in the community willing to organize the video conference, and until this skill becomes as much a part of everyday life as making a phone call, there will be few volunteers. People will be hesitant to participate in video conference events until they become familiar with basic video conference etiquette and good practices. Some people are not sure of what to do for a video conference, where they should sit and so on—and they will not get this experience unless video conferencing is more widely used.

Finally, the analysis identified two main challenges related to broader organizational and social relations outside the community. The first was the need for outside funding to develop the community capacity to maintain and run the equipment, to train people how to use it, and to support its use. Most funding sources do not have a community or social development focus or provide for sustainable development in communities. As a result, funding is generally unavailable for most communities themselves to sustain video conferencing.

The final challenge is the low level of video conferencing activity by urban organizations. The interview respondents and participants in the multi-site video conferencing event identified a general lack of awareness, by professionals and institutions in urban centres, of the communication needs of rural and remote communities and the importance of video conferencing as a tool for connecting with community residents. In some cases, government and other partner organizations in urban areas do not have adequate support for video conferencing in their own organizations and need K-Net and the Atlantic Help Desk to support their use of the technology.

Conclusions and Policy Implications

Video conferencing—high-quality real-time visual and audio exchange among people separated by distance—offers real benefits for people living in remote and rural communities. The visual aspect of video conferencing is important for remote and rural First Nations because the increased social presence—compared with other non-visual modes of communicating over a distance—allows more effective interpersonal communication. People using it can experience the type of connection that builds trust and social relationships. Broadband networks that support video conferencing are found in most remote and rural First Nations across the country, many set up through the First Nations SchoolNet program and maintained by a national network of six RMOs. Our research with two of these RMOs—in Ontario and the Atlantic region—found that communities are using video conferencing not only for education and telehealth, but also for many

other community, social, and economic development purposes, and that non-institutional uses are limited. Our research identified significant social and organizational constraints that limit the more widespread diffusion and use of video conferencing in communities.

The main conclusion we draw from this investigation is that video conferencing is a powerful communication technology with the basic infrastructure to support it in place in many remote and rural First Nations. The technology meets the clearly articulated need to have a visual component involved in communicating with First Nations people; however, video conferencing will not be widely used for community, social, and economic development until it becomes a part of everyday life in communities.

How can video conferencing become more a part of everyday life in remote and rural First Nation communities across Canada? Making this happen will require changes and developments on many levels; this paper will make three recommendations on a national policy level:

1. All federal departments and agencies with a public service mandate need to review their own department's video conferencing capacity. At the 2007 public multi-site video conference analyzed for this study, several government participants said that many bureaucrats in Ottawa and other urban centres are not aware of video conferencing, and that the government lacks champions to promote video conferencing to reach out to First Nations. The long-term goal should be that all federal public servants who communicate now by telephone with the public should in future be able to communicate by video conference, which will enable them to reach remote and rural First Nations. In many departments it is likely that the internal computer support and technical service teams lack the expertise or are reluctant to use video conferencing. They may not know how to properly manage their video conferencing traffic within their own internal networks. This may be due to a lack of training or experience with video conferencing on the part of network managers. The best way to gain experience with video conferencing is to use it.

2. Federal departments with programs involving regular communications with people living in remote and rural First Nations need to work together on the infrastructure challenge. It makes little sense to have a patchwork quilt of broadband infrastructure development and support programs—one for schools, one for health, one for justice, and so on—when the same infrastructure will support many program areas. Further, if the support is for the infrastructure itself and not for specific uses of it, it frees up First Nation communities to dream up innovative ways to use the infrastructure for their own community, social, and economic development purposes. A common-purpose infrastructure with no program-specific strings attached will go a long way toward the goal of having video conferencing become a part of everyday life in communities.

"Infrastructure" refers to more than cable, satellite, and wireless connections, and the hardware and software that makes it usable. Infrastructure includes the capacity to use it. This means that the federal departments using this infrastructure need to ensure that they themselves have the capacity internally to use it. They also need to ensure that the remote and rural First Nations also have the capacity to use it. The goal should be to provide to the communities the same level of technical support available to the federal government partner.

Working together on the infrastructure will mean continuing to work with the RMOs currently funded by the First Nations SchoolNet program. They are the organizations nationally with the capacity to understand video conferencing and the needs of the communities they work with. The six RMOs have all expanded beyond supporting broadband connectivity in First Nation schools. They are the community-based organizations best positioned to work with the federal government and with the communities in their regions to develop partnerships and connectivity solutions with a range of players, from large telecommunications companies to local connectivity solution providers.

3. There should be a federal fund available to communities who want to increase their community capacity to use video conferencing for everyday non-program specific purposes, such as social networking and a wide range of community development initiatives. The fund would cover building community awareness, community skills training, and community-based technology support, as well as organizing multi-community events connected by multi-site video conferencing. The funding should also be available for communities that want to take the lead to develop resources to share good practices for community video conferencing.

Video conferencing will continue to be used by remote and rural First Nations. The big challenge raised in this paper is for all the partners in this process—the RMOs, their funders and government partners, their research partners, and the local technology and infrastructure providers—to work together to develop solutions that support innovative uses of this powerful technology by all members of remote and rural First Nation communities.

Acknowledgements

Endnotes

1 To see the guidelines, go to <**http://research.knet.ca/images/upload/06-12-11_Community%20Consultation%20Guidelines.pdf**>.

2 For more information on the methodology used, see O'Donnell et al. 2007.

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Case Study 2

Part 1: Digital Education in Remote Aboriginal Communities

Brian Walmark

Introduction

Education is understood as one of the primary tools to break the chains of dependency, chronic poverty, and poor economic conditions that exist in many First Nations communities. The conventional wisdom among Canadian and First Nations leaders and educators is that Aboriginal students need to learn essential cultural and scientific skills that will equip them to live in both mainstream and First Nation societies. The result for many First Nations youth is an educational chaos, as the Left agonizes over the line between what is culturally appropriate and appropriation and the Right reinforces a standardized curriculum for their children that emphasizes such positivist knowledge as the second law of thermodynamics and other lessons that ensure the status quo remains.

As outside experts debate what First Nations education should be, youth living in remote and isolated communities are going online and taking more control over their learning. First Nations students in Ontario's far north are voting with their feet. The dropout rate in provincially run schools is matched only by the dropout rate of the privately run First Nations schools in Thunder Bay and Sioux Lookout.

This is not to say that First Nations youth are not interested in learning. These youth, like their urban counterparts, are embracing broadband technologies and applications. K-Net supports over 90,000 email addresses and over 30,000 personal pages, which are facilitated by youth living in remote and isolated First Nations communities in the far north. Some have developed their IT skills "on the job" as employees of K-Net Services. Others have learned these skills through a variety of courses and programs offered by K-Net Services, many of which are taught by Aboriginal trainers. Still others have little or no direct contact with K-Net Services. First Nations youth in this third category are, for the most part, self-taught. They learn by doing and they share their skills and knowledge with other indigenous youth and like-minded "techies" online around the world.

Broadband connectivity and applications are empowering First Nations youth in Ontario's far north. This is the attraction of the Keewaytinook Internet High School (KiHS) for many First Nations youth in the Sioux Lookout Zone.

Background

The Keewaytinook Internet High School (KiHS) is the first Ministry of Education–approved digital high school in Ontario. KiHS provides youth living in remote First Nations communities in Ontario's far north with the opportunity to pursue a high school education under the supervision of accredited teacher specialists without the need to travel south and attend school far from the influences of their families and communities.

KiHS is a bridge between a conventional face-to-face classroom and an online digital learning environment (Walmark et al. 2005). It developed against the backdrop of the residential school system, the failures of various educational institutions to increase the number of Aboriginal high school graduates, and the refusal of the Department of Indian Affairs to provide funding to educate First Nations youth at levels equal to that which the provinces provide for school boards.

KiHS addresses the demands of the First Nations leadership and parents for better high school opportunities on-reserve, and the requirements of Indian and Northern Affairs Canada (INAC) for First Nations schools "to meet or exceed provincial standards." And, KiHS does so in a climate of severe underfunding.

This paper will explore the First Nations educational environment in the Sioux Lookout Zone in which KiHS was created. It will document the migration of broadband services in Ontario's far north that made it possible for the establishment of KiHS, and it will examine how KiHS overcame some of the technical challenges that stymied other First Nations educational institutions in the Sioux Lookout Zone, which were given a similar mandate by the First Nations leadership.

The Educational Backdrop of KiHS

In response to the "Indian Control of Education" document produced by the Indian Brotherhood, First Nations in the Sioux Lookout Zone established the Northern Nishnawbe Education Council (NNEC). NNEC had been given a mandate from the chiefs to facilitate local control of education, but this work was hampered by inadequate funding from Indian Affairs. Caught between the mandates of the First Nations leadership and the lack of adequate funding from INAC, NNEC embarked on a variety of programs to improve education for First Nations students. Some were successful, others not so.

One of the most expensive experiments was the establishment of Pelican Falls High School in Sioux Lookout in 1992 and Dennis Franklin Cromarty High School (DFC) in Thunder Bay. While INAC supported elementary school education on-reserve, it remained reluctant to provide adequate resources for full secondary school programs on-reserve. The only First Nations in Ontario's far north that could provide secondary school education were the largest bands, and even these communities were only provided with enough resources to offer a limited range of

grade 9 and 10 courses in the non-academic stream. Secondary school programs were for the most part one or two classrooms set aside in elementary schools or portable classrooms not conducive to a good learning environment. The situation was compounded by a high turnover in teaching staff, many of whom had to teach multiple grade levels in multiple subjects. Many high school teachers found the working conditions, the professional and physical isolation, and the workload too great. Few completed their contracts and many left the north after an academic term or two.

To address these challenges, NNEC worked closely with the Thunder Bay District Office of Indian Affairs Canada to experiment with the creation of private First Nations high schools independent from the provincial school system. To critics, this initiative was the reintroduction of the residential school system, administered by First Nations educators instead of the churches. Just as in the days of the Indian residential schools, students left their First Nation communities to go south to attend high school at either DFC or Pelican Falls, itself the site of a former residential school. The students either lived in residence, as was the case of Pelican Falls, or in boarding homes, as was the case at DFC. Thunder Bay presented some serious challenges for the DFC students who were exposed to some of the darker aspects of urban life during their spare time. Many dropped out of DFC and Pelican Falls. Those who returned home carried with them a variety of social problems that the communities lacked the resources to deal with. Without a high school diploma, these youth had trouble accessing employment or job training.

In response to the growing numbers of First Nations youth in need of a high school education and the demands of the leadership to decentralize control of secondary school education to the First Nations communities, the Northern Nishnawbe Education Council created the Wahsa Distance Education Centre in 1991. Wahsa works in partnership with the Independent Learning Centre to deliver Ontario Ministry of Education approved courses for grades 9 to 12. Wahsa offers over 50 secondary school credit courses and two non-credit courses in outdoor education. During the 2006–07 academic year, there were almost a thousand students enrolled in Wahsa courses taught by a faculty of 12 teachers. Wahsa originally delivered its courses by radio because the telephone service was inadequate in the north. It later provided instruction by teleconference as telephone service improved. Lack of infrastructure and the desire to embrace new communications technologies are major challenges for Wahsa.

By the end of the decade, the Sioux Lookout chiefs grew impatient with the Northern Nishnawbe Education Council due to the high dropout rates, the low high school graduation rates, and the inability of the graduates of Dennis Franklin Cromarty and Pelican Falls to enrol directly into programs at Lakehead University and Confederation College.

The chiefs appointed a task force to develop a strategy to address the growing crisis in education. The task force interviewed parents, teachers, and other education

champions at the community level, and drafted the Academic Readiness Project (ARP). The ARP called for more secondary educational opportunities available at the community level, better access to special education, the development of a bilingual/bicultural curriculum, and more parental and community control of education. The District Education Planning Committee (DEPC) was established by the Sioux Lookout chiefs to execute the Academic Readiness Project. The DEPC operated at arms length from the Northern Nishnawbe Education Council and established the Kwayaciiwin Education Resource Centre. It created a work plan to develop a bilingual/bicultural curriculum for senior kindergarten to grade 12, as well as a program to connect special education specialists and allied professionals with teachers working in remote and isolated First Nations schools.

The Building of Keewaytinook Internet High School

While the District Education Planning Committee was going forward with the work of the Academic Readiness Project, Keewaytinook Okimakanaka (KO), the Northern Chiefs Council, began embarking on a path to adapt telecommunications to address the educational crisis in the Sioux Lookout Zone. Keewaytinook Internet High School (KiHS) was established in 1999. The chiefs mandated the creation of a pilot project to determine whether the Internet could be an effective tool to deliver education. The purpose of the project, as directed by the KO chiefs, was to find a method for grade 9 and 10 students to remain at home in their communities while completing accredited high school courses. In the past, students had to leave their families to continue their secondary school educations at an urban centre in the south, such as Sioux Lookout or Thunder Bay. Many of these students were as young as 14 years of age when they had to leave home for the first time. Following a successful evaluation, the first intake of 30 grade 9 students was admitted to KiHS from three KO communities. By 2001, KiHS expanded to eight communities and had an enrolment of 79 students. Expansion continued the following year with the addition of five new First Nation communities with a total of 134 students. In 2003, KiHS began its fourth year of operation with 142 students in 13 communities.

KiHS is not a distance education program. It represents a unique departure from both traditional classroom models and conventional models of distance education. Unlike other Internet-based secondary school programs, KiHS requires students to attend a classroom in their community from 9 a.m. to 4 p.m. under the direction of an accredited teacher who is responsible for classroom management, tutoring, and mentoring as the students complete their assignments online. In addition to the normal classroom responsibilities, each KiHS teacher is a specialist responsible for delivering two courses to classes across the network. For example, the KiHS teacher in Sachigo First Nation is a science specialist and, while he is responsible for classroom management in his home community, he teaches science to all 148 students attending the 13 KiHS classrooms across Ontario's far north.

KiHS does not use Blackboard or WebCT or any other learning management system. Rather, KiHS has developed its own platform that has been created to suit the needs of Aboriginal students and teachers. The KiHS platform has been adapted for use by other Aboriginal educational organizations including Oshki-Pimache-O-Win, Nishnawbe Aski's post-secondary institute. The Faculty of Education at Lakehead University in Thunder Bay, Canada, had also considered using the platform for delivery of its new Aboriginal bachelor of education degree; however, the university decided to deliver the program using WebCT, an industry standard in the education sector.

KiHS was constructed as a hybrid, blending the strengths of a conventional classroom led by an accredited teacher specialist and the promise of broadband technologies and applications. Each KiHS classroom is facilitated by a teacher specialist who is responsible for creating a learning environment appropriate to the needs of the students in his or her community. The KiHS teachers mentor and tutor the students in their classrooms while assisting them individually to address the "gaps" arising from underfunded community-run elementary schools that each student may face in mathematics, science, and literacy.

Making Technology Work for Communities

When KiHS was established, WebCT was (and continues to be) the industry standard broadband education platform. WebCT was designed to supplement and enhance the urban classroom experience. Although WebCT is marketed as a distance education solution, it fails to provide students outside of the urban environment with the same level of data, voice, and video that students in the city take for granted. WebCT is also expensive and is not intuitive. Users must be trained or must invest time to learn how to use WebCT beyond its elementary applications. WebCT was not a good fit for the KiHS model, which required connections between multiple remote sites with multiple remote administrators (teachers). Most critical of all, the first supervisory officer appointed to oversee KiHS was denied administrative access by the software owner of WebCT because she was not an employee of KiHS. Without the approval of the Ontario Ministry of Education, funding for KiHS from Indian and Northern Affairs Canada would have ended.

By the end of the pilot phase of KiHS, WebCT was abandoned and the KO technical staff was developing its own learning platform for the new school year. The KO technicians called their new platform "Zed." While Zed required less bandwidth than WebCT, it lacked many of the applications available on WebCT and proved to be difficult to use and it was time-consuming to train users of the program. It also lacked the network support that teachers had come to expect from WebCT. Zed too was abandoned. However, Zed provided KiHS teachers and KO technicians with a capacity-building exercise that would prove valuable as KO moved towards the adoption of open-source platforms, such as Moodle,

currently utilized as the online learning environment by KiHS. KiHS has created so many modifications to the original Moodle learning platform that it now carries a new name, Moodle First Nations. KO makes Moodle First Nations available on the KiHS website free of charge where other Aboriginal groups can download this platform to create their own digital educational platforms.

The period of experimentation and exploration with different learning environments by KiHS was critical. Through trial and error KO was able to develop the necessary technical capacity to provide KiHS classrooms with the tools required to create a learning environment better suited to the learning styles and interests of First Nations students. It was those lessons learned and the development of promising practices for the creation of an open-source learning platform that made it possible for KO to provide other broadband services, such as Internet Protocol (IP) video, a managed broadband network, and online workshops that facilitate digital education and training in Ontario's far north.

Conclusion

Education remains the best tool to break the chains of dependency that exist in many First Nations communities. However, many youth, especially those living in poverty in remote and isolated First Nations communities in Canada, are no longer prepared to be foot soldiers in the endless war of words between the First Nations leadership and the Canadian government. Many of these youth recognize that the tools of social change are different today than those used half a century ago, and more importantly, in Ontario's far north they have access to broadband technologies and applications, the new tools of communications.

KiHS appeals to the sensibilities of First Nations youth. KiHS is a learner-centred secondary school environment that provides students with the opportunity to work in a conventional face-to-face learning environment while accessing the resources of a full faculty of teachers and teaching resources through broadband. The administrators of KiHS understand that many of their students have greater tech savvy than their teachers. The teachers depend on the students to maintain and troubleshoot the broadband network and the students need the teachers to guide them through their credit courses. As a result, the traditional power relationship between the teacher and the student does not exist within the KiHS classroom. This may account for the growing numbers of First Nations youth who have dropped out of high school in Sioux Lookout and Thunder Bay, but who have prospered in KiHS. It also accounts for the pressure from students and parents on KiHS to offer more academic credits and to expand its program from grades 9 and 10 into a full high school program that allows students to graduate with an Ontario Secondary School Diploma.

Originally, KiHS was designed as a transitional alternative that would allow students with gaps in their elementary school education to "catch up" and be better prepared to complete grades 11 and 12 in a conventional high school in the

urban south. KiHS has succeeded because it has addressed the goals and interests of many stakeholders at the community level. It provides parents with the opportunity to keep their youth at home while they pursue a high school diploma. The leadership are pleased that KiHS allows for more resources to flow to the community level. Most importantly, KiHS provides youth with a learning environment where they have more control over what they learn and how they learn those lessons. KiHS allows students to learn about themselves within their own community or to reach far beyond their traditional territories to other youth across Nishnawbe Aski Nation, across Canada, and around the world. It is a model of community participation in action.

Part 2: Keewaytinook Internet High School Review (2003–2008)

Darrin Potter

Introduction

The purpose of the Keewaytinook Internet High School Review was to examine the outcomes achieved by KiHS in the five-year demonstration project carried out from 2003 to 2008. The review has focused on a number of specific questions seeking to evaluate the results achieved by the school to date, and the opinions about and attitudes of its key stakeholders—students, parents, teachers, and community education leaders—toward the school.

This review is one of a number of evaluative reports done about KiHS. Other reviews include: "Working out the Wrinkles: An Evaluation of the Early Years of Keewaytinook Internet High School," by Wayne Seller (2006); "External Evaluation of KiHS," by Michael Boos (2001); and "KiHS Pilot Project Evaluation," by John Rowlandson (2000). These reviews provide a wide-ranging overview of the KiHS project.

Operational Overview

KiHS delivers Ministry of Education–approved secondary school courses to students in their home communities using a variety of Internet technologies. The school program is offered as four terms per year, and students have the opportunity to earn two credits per term. Courses are delivered in a.m. and p.m. time slots, with several course options offered at each time. A wide range of courses are available at the grade 9 and 10 levels, including courses leading to workplace, college, and university streams. Courses in the workplace stream are offered in core subject areas at the grade 11 and 12 levels. Additionally, a Prior Learning Assessment and Recognition (PLAR) program allows the school to grant credits recognizing life experience to students 18 years and older.

Teachers at KiHS play two roles. Each community classroom is staffed by a mentor, who is in most cases a certified teacher. In the mentor role, teachers provide students with support in completing tasks and assignments for their coursework. In the course teacher role, teachers act as a distributed workforce, designing and delivering courses to students in all KiHS classrooms using Internet teaching modalities. Teachers are in continual contact with students both in their own classroom and in others. Where student numbers allow, classrooms are staffed with an additional assistant, who is also tasked with mentorship and, in some cases, technical support duties.

Most teaching is done in an asynchronous format. Course materials are shared with students using online courseware. Students view course materials and complete assignments electronically. These are then submitted and assessed using the online courseware. Synchronous teaching using one-way audio, whiteboards, shared desktops, text messaging, and in some cases video, supplements the asynchronous course delivery.

Review Findings

Student Outcomes

To assess the overall success of KiHS at achieving its goal of providing high school education to First Nation students, credits earned are examined in the context of the number of students funded through nominal roll. This provides an assessment of the efficiency of KiHS and its return on the investment made by the funder. Because the overall figures obscure the processes that underlie the earning of credits, student success at passing courses is also examined. Student retention, student participation, and student-to-teacher ratios are also reported.

Common wisdom suggests that evaluating success based on a six-course load per student rather than an eight-course load more accurately reflects the realities for northern First Nations students. The review found that during the five-year pilot project students averaged a 43% success rate based on a six-course load. In other words, each nominal roll funded student earned, on average, 2.58 credits per year.

Although the credit-earning efficiency of the school appears to be low, it nonetheless represents a substantive success. According to parents, education directors, and teachers, many students have been sent home or have voluntarily returned from urban schools where the challenges of the school, living, and non-family environment were overwhelming for 13- and 14-year-olds. The profile of the typical KiHS student is one who may lack the school-oriented self-efficacy, study skills, prior knowledge, and life skills required to succeed in a conventional bricks-and-mortar school in an urban largely non-Native setting. The credits earned must be seen as significant achievements for students who would otherwise be earning no credits at all.

Data on credits earned was also broken down by community in the review. This data reveals a large range in credit-earning efficiency between communities. At its extremes are Saugeen with a 95% success rate and Kejick Bay with an 8% success rate based on a six-course load. These communities have earned over the time of their participation in KiHS, respectively, 5.68 and 0.46 credits per nominal roll funded student. Kejick Bay ended its participation in KiHS in January 2006, a decision which may reflect its poor performance. One value of this data is to allow comparisons between communities and to identify best practices from communities with higher credit-earning efficiencies. Additionally, communities with poorer results can be more closely followed by KiHS to determine the causes of, and to suggest solutions for, a lower number of credits earned.

The cost per nominal roll funded student for delivering the KiHS program was also addressed along with the cost per credit granted. The data indicates that the five-year mean in annual per student cost is $10,740. This figure is significantly larger than the band-operated nominal roll funding rates, and represents contributions from other funding streams. Additionally, this per student cost is much lower than for other schools that serve the same population. These schools have access to additional funding streams for student services, guidance, special education, and others, which KiHS does not receive. KiHS also does not incur costs associated with student transportation or housing outside of the community. From this perspective, KiHS is delivering comparatively efficient and cost-effective services to regional communities.

The pass rate of students in all KiHS delivered courses offered during each year of the pilot project is outlined in the review. The pass rate, or proportion of students at the end of each course who earn the credit, is 62% on average, with very little variation around this mean. The pass rate reveals much more about the success of the KiHS course delivery modality and curriculum than does the credit-earning efficiency. The pass rate data is not obscured by variations in nominal roll funding or by the inclusion of PLAR and maturity credits (which are administered by KiHS using course material purchased from a third party). Further, as noted above, the typical student enrolled in KiHS may lack the school-oriented self-efficacy, study skills, and prior knowledge required to succeed. Seen within this context, a 62% pass rate indicates that the course delivery modality and curriculum is meeting the needs of many students, and doing considerably better than the conventional school alternatives that these students have left behind. Refinements to the course delivery modality, however, are recommended to meet a greater range of student needs, and secure a higher pass rate among committed students.

The pass rate also varies considerably between communities. In Saugeen, 90% of students finishing the course earned the credit, while in Kejick Bay, 32% of students passed. The pass rate is not completely correlated with credit-earning efficiency. Communities such as North Spirit Lake and Keewaywin that have relatively poor credit-earning efficiencies have relatively high pass rates (70% and 72% respectively), while Bearskin Lake, which much more efficiently earns credits based on its nominal roll funding, has a relatively poor pass rate (65%). As with credit-earning efficiencies, a closer look at the communities with higher pass rates may reveal site-specific best practices that are contributing to student success.

The proportion of nominal roll funded students retained at the end of each term, or the student retention rate, is also documented in the review. During the pilot project, in each year, on average, 73% of funded students were still enrolled by the end of Term 1A (early November). The proportion retained drops to 64% by the end of Term 1B (late January), and again to 55% by the end of Term 2A (mid-April). In most years, additional students enrol for Term 2B, resulting in slightly higher proportions retained. On average, retention increases to 60% by the end of Term 2B (late June).

Attrition may be high initially during Term 1A as students discover that they are not personally suited for KiHS, its course delivery modality, or that they are not ready for regular school attendance. As noted previously, the typical student enrolled in KiHS may lack the school-oriented self-efficacy, study skills, and prior knowledge required to succeed. Many students are parents or young adults with other critical responsibilities that draw them away from school early in the first term. Term 2A is also typically a term with poor enrolment and retention. Enrolment drops because some students leave the community to go out to school for the start of the second semester. Poor retention during the term may be associated with frequent interruptions caused by the one-week February teachers' conference, and the two-week March break. Additionally, the absence of coordination with NNEC programs may mean that students who finish the first semester at another school and are sent home for any of a variety of reasons, often miss the critical enrolment dates for the term.

In the review, several independent measures were used to examine student participation, as a simple examination of attendance defined in the manner of conventional schools may not be sufficient for schools with Internet course delivery (Dr. Terry Anderson, personal communication). Students at KiHS may work from computers at their homes during the school day or they may complete work at community e-centres in the evenings or on weekends. From this perspective, a classroom body count may underestimate the actual participation by students in the program. Thus, the logs automatically generated by the online courseware (Moodle) were used to examine participation. The courseware records and time-stamps every action taken by all users of the system. The logs of the online courseware reveal an average of 56% of active students logging in each day. Alternative estimators of attendance find students online 52% of expected days, and 34% of expected hours. This level of participation represents an achievement given a student population that faces significant barriers to regular school attendance. It should also be noted that this data does not capture the reality that students at KiHS may work efficiently to complete a week of assignments in several days, leaving the rest of the time available for other commitments.

Student-to-teacher ratios for both community classrooms and KiHS-delivered courses are also examined in the review. For community classrooms this would be more properly termed student-to-mentor ratios, applying the terminology in use at KiHS. The student-to-mentor ratio in community classrooms is 5.85 students per mentor. The student-to-teacher ratio for online courses is 13.00 students per teacher. Teachers, parents, and other community stakeholders emphasize that the presence of a certified teacher in each community is an essential element for student success.

Governance

The KiHS has a board of directors and a community-centred steering committee. The board of directors consists of the KO Chiefs, who also form the board of the

Keewaytinook Okimakanak First Nations Council. During the KiHS pilot project, the KO Chiefs directed that a community-centred steering committee be formed to oversee KiHS and to ensure that stakeholder communities were integrally involved in its governance. The steering committee is advisory to the principal and is composed of members appointed by the chief and council or education authority of each participating community. The principal receives feedback from the steering committee, which meets at least twice a year, regarding what is working and not working at the community level. Thus, the steering committee is a critical community governance mechanism. The steering committee recommends changes in policy, procedure, and protocol, which the principal is responsible for carrying or bringing forward to the board. The principal reports to the KO board through the executive director on a regular (quarterly) basis. The KO Chiefs are ultimately responsible for KiHS and its financial management.

Another accountability mechanism is the partnership agreement that outlines the responsibilities of each party (KiHS and the community) to deliver the service. This mechanism contributes to a culture of equality among the partners and ensures, in part, the integration of KiHS into the community education system.

An additional aspect of the accountability framework is the relationship between the KiHS program and the Ministry of Education, which sets guidelines for KiHS to follow as a credit-granting private high school. These guidelines concerning course selection and curriculum must be adhered to, and recommendations made following school inspections are to be acted upon. INAC is another important partner of the school, with the accountability relationship between the principal and the department.

Community Satisfaction with KiHS

KiHS is, in general, very positively regarded by the education leadership in the communities in which it provides services. Of steering committee members surveyed, 80% indicated a high or very high level of satisfaction with the KiHS program.

A huge majority of community education leaders (83%) feel, and some strongly, that KiHS responds well to the specific education needs of the students in their communities. Those who do not feel KiHS responds well to student education needs cite their sense that KiHS is a Balmertown-centred institution that does not have enough contact with the communities on the ground.

Of the steering committee members who were interviewed, 89% feel that KiHS is adequately directed by the communities that are part of the program, and more than one-third of those feel strongly about this. Of those members who do not think KiHS is adequately directed by the community, one director feels that there is a lack of community ownership of the program, viewing KO as another "layer" of bureaucracy, which may lead to a lack of community support and pride in KiHS.

Almost all current steering committee members feel very confident that KiHS will continue to meet the education needs of their communities in the future. One of these members was looking forward to having a number of graduates in the next year and pointed out that the community has to play its part in KiHS as well. One director was not confident about the future role of KiHS.

Almost all education directors feel that they could influence change at KiHS, another indicator of the strong sense of engagement in KiHS at the community level. When asked what changes they would seek to make in the future, many pointed to the need for better visibility and promotional strategies for the program in the community. There was a suggestion for more intensive on-site and professional guidance counselling, and more community visits by the KiHS principal. Suggestions about improved infrastructure, including facilities (classrooms), computer equipment, and Internet access were also made.

The creation of, and continued commitment to operate, a community-based steering committee as an advisory part of the governance structure accounts, in part, for this sense of inclusion. It is evident, however, that the management philosophy and style of Keewaytinook Okimakanak and KiHS have also greatly contributed to the strong sense of community participation in the program. The steering committee may only meet twice a year, but there are frequent informal and open exchanges between education directors and KiHS management that greatly enhance the community responsiveness of the program.

Parent and Student Satisfaction with KiHS

This section explores student and parent satisfaction with KiHS, drawing on parent interviews and student surveys. It covers such topics as: what is expected of KiHS by parents and students, the demand for KiHS services, satisfaction with the learning modalities offered by KiHS, student self-efficacy, and student satisfaction with course offerings.

A clear message conveyed in the parent interviews was that students need a valid option that will allow them to stay in their communites and complete high school. Nearly all parents (90%) feel that students should be able to finish high school without ever leaving the community. Despite the greater selection of courses available at the grade 11 and 12 levels in conventional high schools, most parents (70%) do not think it is essential for students to take courses outside of the community in order to have the full benefit of high school. Most parents (90%) feel that KiHS should offer more than a grade 9 and 10 program, suggesting strong support for a full high school program and a validation of the new expanded mandate of KiHS.

In support of these results from parents, 39% of students feel that it should be possible to graduate by taking only KiHS courses through high school; however, when asked to reflect on their own decisions, only 19% of students would want to complete high school exclusively in the community, with 53% preferring to have a mixture of high school experiences both within and outside of the community.

KiHS is the first choice for 40% of parents interviewed; the majority of parents, however, would prefer to send their children to schools outside the community. Students echo this pattern more strongly, with 90% preferring to go to other schools outside the community. The information obtained indicates that the majority of students at KiHS are attending because they feel they have no other choice.

This finding reinforces the opinion of community stakeholders that KiHS is a fallback option for students who have been sent home from Northern Nishnawbe Education Council (NNEC) programs. This underlines the need for KiHS to rethink its how it is perceived by parents and students. Indeed, one education director reports, "in our community it's hard to convince people that this is a real high school, and these are real courses." This viewpoint appears to be prevalent and suggests that a strong marketing response is needed. Nonetheless, almost all parents (90%) see KiHS as an important way for students to stay connected to their communities while completing high school.

The learning modalities offered by KiHS involve asynchronous course delivery using Moodle online courseware and, to a lesser extent, synchronous course delivery through Elluminate and video conferencing. Teachers report that asynchronous course delivery allows students the freedom to complete work when they have the opportunity to do so. This flexibility, teachers note, is a critical part of the service, allowing KiHS to cater to the diverse social needs of its students. Students can work according to their own schedules, and can work around frequent absences that, for many students, may be uncontrollable. Teachers note that they have fewer classroom management interruptions, and students have fewer distractions when working independently. Teachers also note, however, that asynchronous course delivery is most appropriate for courses requiring extensive reading and writing, or for courses where digital media artwork is the product. Teachers find that math and science presents many more challenges for students in an asynchronous format, noting that they are unable to watch students perform calculations and assist them in real time.

An asynchronous learning modality, where a significant degree of student independence and self-motivation is required, is not favoured by all students. The student survey results indicate that only 14 of 26 students surveyed learn well when they are working by themselves on assignments. And, only 7 of 26 students reported that they learn well when taking courses at KiHS. Thus, while asynchronous delivery may work very well for a significant proportion of KiHS students, there are many for whom it does not; these are students who may not be ready, or do not have the study skills, to work in a context where considerable self-motivation is required.

Elluminate and Adobe Connect represent an attempt to bring a more social constructivist learning modality into play. This online courseware has a limited synchronous capacity. Students can listen to their teacher speaking while viewing an interactive whiteboard, or the contents of their teacher's computer screen. Due

to bandwidth limitations, they are unable to respond using audio, although text messaging can be used.

Teacher's concerns with this type of course delivery include the following: the amount of work required to prepare an Elluminate lesson given the low student participation; Elluminate is not a stimulating medium for students because it lacks video; Elluminate requires more bandwidth than is available in some communities; and, importantly, Elluminate sessions begin at a scheduled time, which is not compatible with the flexible arrival and departure times of students.

Although Elluminate has only been in use since the beginning of the 2007 school year, video conferencing, a second synchronous modality, has been in use at KiHS to a limited extent throughout the pilot project. Video conferencing is seldom used for instructional purposes at KiHS. Teachers cite equipment malfunction, or lack of understanding of operation as barriers.

Student self-efficacy or a student's own impression of his or her ability to succeed is a very important predictor of student success. Students who believe they can succeed in school, do succeed in school. Students at KiHS believe they can succeed in a computer-mediated learning environment, but are less confident with the non-traditional classroom setting. Student satisfaction with a computer-mediated learning environment is high, with most students (81%) declaring that they can learn well with computers. This is echoed by teachers who note high student enthusiasm for computer use. This finding points to the value of KiHS in terms of developing computer and network literacy amongst its students.

Students were most motivated to select "I learn well when I am using a computer," a statement which reveals positive self-efficacy towards the KiHS computer-mediated learning environment. However, lower enthusiasm for the statements, "I learn well when I am working by myself on assignments," and, "I learn well when I have no one telling me what to do," do not reveal strong self-efficacy for the KiHS asynchronous course delivery model, which requires significant self-motivation and independence. Additionally, students had low enthusiasm for the statement, "I learn well when I am taking KiHS courses," a result that should be tempered with the observation that students had equivalent lack of enthusiasm for a regular high school classroom; many students may, indeed, feel that they do not learn well at all in school.

Although these results are by no means definitive in their assessment of student self-efficacy at KiHS, there is evidence that the KiHS delivery model may not be aligned with most students' beliefs about where and in what context they are able to succeed.

KiHS began the five-year pilot project by offering courses only at the intermediate (grades 9 and 10) level. The first senior courses at the grade 11 level were offered in the 2004 school year, with additional courses (including grade 12) added in subsequent years. In the 2007 school year, KiHS began to offer academic-level courses leading to college or university entrance, making it the only First Nations school in the district presently doing so.

A majority of students surveyed indicate they would like more course options in all categories given. Of note is student interest for more course options at the grade 11 and 12 level and at the college and university level. All senior courses currently offered are at the workplace level. KiHS may be well-suited to offering upper-year courses for college and university entrance, as the learning modality is likely to work well for students who have the maturity and motivation to earn credits independently, and have the desire to proceed to higher education.

Recommendations from the Review

A number of recommendations were made in the KiHS review. In conclusion, a few of these recommendations are highlighted:

1. KiHS should embark on a public awareness campaign and employ engagement strategies aimed at key community stakeholders, namely, students, parents, and education leadership to re-image KiHS as a valid and exciting high school option for a wide range of learners of various ages.

2. To the extent that it is possible to transfer practices from one community to another, KiHS should continue to identify best practices from communities that have higher credit-earning efficiencies, course success rates, and participation levels, and apply these, as much as possible, to communities that have been less successful.

3. KiHS should expand its offering of courses for students of the maturity and academic readiness who are most likely to benefit from the KiHS learning modality. The school should offer more courses at the senior level, experiment with college and later university preparation courses, and continue to develop its academic-level program. Also, to meet the needs of more mature students it should increase the profile of its PLAR offerings.

4. A certified teacher with guidance qualifications should be hired to fill the role of guidance counsellor; s/he should advise current and prospective students on educational issues, career planning, and personal development, and coordinate the provision of counselling services to students and parents.

5. Many students cited a need for better high-speed Internet in their surveys. There is no doubt that student participation and performance would be improved if there was consistent access to high-speed Internet in all communities. It was suggested that communities devote bandwidth exclusively to KiHS. Bandwidth issues may also contribute to student and teacher frustration with Elluminate.

6. As an Internet high school, KiHS requires adequate resources to provide and maintain the highest quality hardware and software to meet the learning needs of students. It is recommended that sufficient resources be dedicated to replacing and repairing equipment and software and to providing regular maintenance, troubleshooting, training, and technical support for mentors and students.

Case Study 3

The K-Net Approach to Water Treatment

Barry Strachan

Introduction

The delivery of safe potable water to individual community members is a priority for First Nations throughout Canada. The Keewaytinook Centre of Excellence is committed to meeting the needs of its clients through the quality delivery of affordable technical and academic training programs.[1] Keewaytinook is a one-stop source for certification courses, academic upgrading, and continuing education units.

Qualified trainers at the Keewaytinook Centre of Excellence provide operators with excellent foundation skills (specifically in mathematics, communications, public health/microbiology, and water chemistry) and hands-on water plant operator training. The centre's services also extend to the private sector, the municipal sector, and to provincial and federal government utility workers.

The purpose of the remote-monitoring initiative, known as Anishinaabeg Kakenwaydemiwatch Nepi,[2] with 18 partner First Nations and their 3 tribal council technical services departments in northwestern Ontario, is to facilitate the installation and delivery of an affordable and sustainable remote-monitoring system in the water and waste water plants in each of these First Nations where such a plant exists. This service will fulfill the unique needs of these First Nations and will be a partnership that will also take into consideration the training, support, and sustainability issues of the project, as the operation of this service is transferred to the First Nations and their second-level support organizations. This service will be, at a minimum, equal to what is available in water and waste water plants located in municipalities that meet provincial requirements for the production and maintenance of environmentally and locally operated safe water operations in each community. The final solution will be capable of providing and offering a long-term system for managing and sustaining safe water systems in each community.

This service will allow access to plant monitoring services not previously available in these facilities. A 24-7 monitored operation employing local and regional qualified technicians is required. Training utilizing distance education, and ongoing data collection for research and reporting will now be possible for those that use the service.

The goal of the remote plant monitoring project is to identify and select a vendor to bring the necessary infrastructure and services to support remote water

and waste water plant monitoring in the communities that best meet the requirements as identified in this RFP (request for proposals). The remote plant monitoring vendor will:

- Provide remote plant monitoring infrastructure for water and waste water plant equipment located in the partner rural and remote First Nations;
- Deliver in each First Nation a water and waste water monitoring service equivalent to those available in other centres that meet provincial and federal monitoring requirements;
- Provide an online, high-speed data connection from each of the plants to a centralized monitoring system that is capable of identifying and distributing messages to qualified plant technicians who are scheduled to cover a 24-7 troubleshooting service;
- Create a three-year transfer strategy that will ensure all the partners have the capacity and resources required to sustain the ongoing operation and support for all the partner First Nation water and waste water plants;
- Connect each plant to a broadband service capable of supporting online training and troubleshooting services using video conferencing equipment; and
- Work with the local First Nation plant technician(s) to ensure the water and waste water plants are operating and maintained to provincial and federal standards and are available for all local businesses and residents.

Endnotes

1 See <**http://watertraining.ca**>.

2 See <**www.wateroperations.ca**>.

Case Study 4

Telehealth/Telemedicine Services in Remote First Nations in Northern Ontario

Donna Williams

Introduction

Keewaytinook Okimakanak Telemedicine (KOTM) is Canada's busiest and largest First Nations telemedicine service, encompassing more than 25 sites as of fall 2008. KOTM works in partnership with the Ontario Telemedicine Network (OTN) to provide integrated access to the provincial and federal governments through the Ontario Ministry of Health and Health Canada's First Nations and Inuit Health Branch (FNIHB) service providers to deliver health programming on-reserve. For the past eight years, KO Telemedicine has designed, implemented, and refined a First Nations service model that supports and sustains telemedicine services in Ontario's most remote and northern communities.

KO Telemedicine developed as a pragmatic response to community demand for access to quality health services closer to home. By the late 1990s, most First Nations in the Sioux Lookout Health Zone felt that the regional health service delivery model, in which physicians, nurses, and allied health professionals inter-mittently fly in to communities to triage and treat clients, and clients fly out to secondary and tertiary facilities to receive specialized care and support, was not— on its own—able to meet the holistic health needs of their members.

Specifically, First Nations noted that the itinerant medical model was not well-suited to building and sustaining health teams, that it contributed to signifi-cant discontinuities in care, and that it disempowered local health workers by marginalizing their capacity to acquire new skills and transfer health knowledge to their community client base. At the same time, the model tended to reinforce health dependencies between medical "experts" and people living in remote and isolated communities. First Nations gained access to health expertise when the doctor visited or during a nurse's clinic. Consequently, diffusion of disease self-management strategies and uptake of self-care protocols were dismal (Health Council 2005).

KO Telemedicine Services

Telehealth can be defined as "the use of advanced communications and informa-tion technologies to exchange health information and provide health care services

across the geographic, time, social, and cultural barriers" (Reid 1996). KO Tele-medicine's connectivity service—the Kuhkenah Network (K-Net)—provides the turnkey technology management and connectivity services needed to operate the program. K-Net leverages integrated technical and service support resources to address broadly based information and communications technology needs in First Nations on a pan-regional basis. Accordingly, the telemedicine network is extensive. It reaches from the isolated Beausoleil First Nation on Georgian Bay's Christian Island in southern Ontario to the Fort Severn First Nation, Ontario's most northerly community, and from the Winnipeg Health Sciences Centre in the west to James Bay's Weeneebayko General Hospital on Moose Factory Island to the east.

The practical innovation that KO Telemedicine contributes in the Sioux Lookout Health Zone is its ability to enhance and improve existing services. Simply put, telehealth does not suppose a radical restructuring or reinvention of the health system. Rather, telehealth proposes a way to manage regional change and to integrate previously distinct jurisdictional health programming at the community level. Accordingly, telehealth has enabled timely evidence-based decision making and improved communication between families, clients and service providers. Similarly, telehealth supports health professionals and health workers by providing access to targeted training and educational programming at the point of care.

Telehealth engages the broader spectrum of community well-being. It brings with it high-speed community Internet access to online health resources, shares in the cost of local broadband services, contributes to the local economy through job creation, and leverages new opportunities for community development. Telehealth also respects the cultural diversity and practice of First Nations. Community tele-health coordinators translate video conferences between clients who speak their native language and distal service providers; telehealth facilitates local access to elders who have had to leave their communities to reside in urban-based long-term care facilities; and telehealth expands community choices by enabling access to traditional healers and caregivers.

The developmental rationale for KO Telemedicine is important because it describes conditions not unlike those experienced in most regions of Canada, and illustrates scenarios familiar to service providers in far-flung First Nations. Whether the community is located on the northeast coast of Labrador, within the Hudson's Bay watershed, or tucked into a cove in British Columbia's Broughton Archipel-ago, the logic and wherewithal that informs KO Telemedicine proposes a scalable approach to longstanding First Nations health service challenges in Canada, and engages a service model that is based on tripartite collaboration, regional integra-tion, and community capacity to influence health service delivery.

A number of benefits tied to the use of telemedicine can be identified. These include:

- Improved access to and utilization of comprehensive telemedicine services that address community-based health and wellness priorities;

- Increased coordination and integration of federal and provincial First Nations health services programming;
- Enhanced scope of regional health-professional retention and recruitment strategies;
- Increased community participation and influence over access to the health system;
- Full integration with the Northern Ontario School of Medicine's community-based learning model, supporting medical student learning and practice needs during community placements;
- Reduced patient and health system travel burden—particularly for the elderly and parents with young children who have to travel long distances for access to medical services;
- Improved peer-to-peer interaction and team-based approaches to regional care;
- Decreased isolation for patients at distant points of care using tele-visitation services; and
- Improved community-based health service training and education capacity.

Telehealth Development in Keewaytinook Okimakanak First Nations

Telehealth development in northwestern Ontario is closely tied to the infrastructural groundwork laid by Keewaytinook Okimakanak's telecommunication service—the Kuhkenah Network (K-Net). Network implementation anticipated community-based demand for broadband services and developed the community and regional capacity required for implementing and managing a regional telemedicine service.

In May 1999, K-Net's broadband consultation demonstrated widespread interest in telehealth services by community members and health staff. People agreed that improved access to health services and information would be an important network service. At about the same time, Keewaytinook Okimakanak's health director identified mental health services as a priority application for telehealth. Over the next year and a half, KO Health designed a telepsychiatry pilot project and implemented services in two Keewaytinook Okimakanak communities. Despite significant technical and logistical challenges, community members responded enthusiastically to the new service and the project's final evaluation signalled the opportunity to continue and expand this service model.

In January 2000, Health Canada announced funding to support a regional telehealth consultation in northwestern Ontario. Keewaytinook Okimakanak was asked by Health Canada to participate in the consultation and to represent First Nations in the regional development of telehealth services. The consultation

engaged regional and community-based health workers and professionals and reflected local needs and priorities. The final report supported implementation of telehealth in the KO First Nations and became the basis for a working partnership between Keewaytinook Okimakanak and the provincial telehealth service provider, NORTH Network (changed to the Ontario Telemedicine Network in 2007).

Keewaytinook Okimakanak Telemedicine is witnessing how the introduction of clinical, educational, and wellness services is helping First Nations communities change their approach to health service practice and delivery. Increasingly, nurses and community health representatives, for example, are consulting validated health web resources that facilitate early intervention and preventative measures for managing chronic illness. Similarly, people living in remote communities have access to self-care and self-management information to help them negotiate lifestyle changes in order to modify their individual and family health statuses.

In these and many other minute ways, telehealth is supporting a change management strategy for improving the well-being of First Nations communities. As a fully implemented e-health network, KO Telemedicine is the most advanced indigenous telemedicine network in the Americas. It provides comprehensive access to health and wellness services for the province's most vulnerable populations by removing longstanding social and geographic barriers and by placing quality health care closer to home. At the same time, the accelerated access plan (AAP) enables a shared network environment, defined both by the cultural character of its communities and by the local and regional capacities of the provincial and federal health systems.

Benefits of KO Telemedicine

There is increasing evidence of compromised health status and reduced quality of life among rural and remote First Nations populations. While differences exist among First Nations, Inuit, and Métis populations (for example, rates of diabetes are highest in First Nations communities whereas rates of tuberculosis are highest in Inuit communities), access to health care services is an issue for all Aboriginal communities. Although much effort has been devoted to improving delivery of First Nations health services, the standard of care is still far below baseline services in the rest of Canada. Telemedicine and telehealth provide a new opportunity to address service imbalances in the health system and to contribute to community well-being.

Access is a principle embedded in the Canada Health Act. It directly addresses demand for portable, affordable, and comprehensive services for all Canadians. Similarly, the access principle anticipates contemporary system migration requirements for integrated service models, team-based practice, and continuous quality improvement. These modern expectations of the health system are captured by KO Telemedicine and the work that it does with First Nations communities and

its system partners. KO Telemedicine's capacity to enable a community-based engagement and learning model for first- and second-year students enrolled in the Northern Ontario School of Medicine highlights connections between access, health innovation, and the institutional development of integrated service models for First Nations communities.

In addition to facilitating local access to new services and service providers, the KO Telemedicine service model also demonstrates a significant capacity to meet community demand for quality health services and provide direct feedback to KO Telemedicine during regular biweekly team meetings. By way of example, an urgent need for speech and language services was identified by coordinators in the Sioux Lookout Zone. KO Telemedicine communicated this need to medical and telehealth network partners. In a matter of weeks, service capacity was identified among an speech language pathology (SLP) group in Thunder Bay and a service delivery protocol was initiated. And though not all service gaps are able to be addressed that rapidly, the health network environment encourages delivery of priority services at community points of care.

Telehealth has also enabled community-based access to complementary services, such as mobile retinal screening programs. Initiated in 2002 as a KO Telemedicine partnership with the University of Toronto and NORTH Network, the tele-ophthalmology pilot project provided retinal screening services in three First Nations communities—Sandy Lake, Keewaywin, and Fort Severn. Over a 12-month period, the project screened 186 persons, finding that 14% of the readings had anomalies that required further follow-up.

An internal partner review validated the benefits of the program and a revised service model was launched in early 2005. The current iteration of the tele-ophthalmology project provides comprehensive diabetic teaching and support services to persons who are screened, and directly engages community health workers as part of the screening team. The results of the new service model show that 78% of the clients were saved a trip out of their communities for retinopathy assessment. Further, the network environment within communities supported the electronic transfer of ocular imaging data to the ophthalmology web server—an innovation that reduced specialist response time to just 48 hours.

Although the range of services provided at community clinics—variously classified as health stations, health centres, and nursing stations—has expanded, access to health professionals has routinely required that the community client fly, drive, or take a bus to the regional referral centre. In the Sioux Lookout Health Zone, these centres are Winnipeg, Thunder Bay, Toronto, and Sioux Lookout. By way of example, there were almost 20,000 medical transports in the Sioux Lookout Zone during the 2002–2003 fiscal year. More than 12,000 trips were made to see medical specialists and almost 5,000 additional trips (one-quarter of all approved travel) were made so that community members could see a general practitioner. Significantly, almost 60% of all medical travel was elective—categorized as consultations and counselling. This information shows the potential

for telehealth services to avoid medical transports and to improve community-based access to elective specialist services.

Uptake and acceptance of telehealth in the remote First Nations across the Sioux Lookout Health Zone is already demonstrating the value of telemedicine as a way to enhance existing services and make more effective use of existing health and human resources. For example, data on the frequency of clinical telemedicine and educational/training telehealth services in the five KO communities shows a 129% increase in clinical utilization of telehealth services from the 2002–2003 to the 2003–2004 fiscal years, and a 44% increase between 2003–2004 and the 2004–2005 periods. Non-clinical utilization mirrors these increases—though in greater numbers. In the 2002–2003 and the 2003–2004 fiscal years, non-clinical utilization increased by 68%. In the following year, non-clinical utilization increased by an additional 38%.

These trends demonstrate community acceptance of telehealth services and suggest continued demand for telehealth services in First Nations communities. Similarly, growing familiarity with telehealth by health service providers will support integration of community-based service delivery, improve the scale and scope of community-based choices, and accelerate adoption of complementary e-health services and technologies, such as electronic health records (eHRs), home-based telemetry, and validated web-based First Nations health resources.

The introduction of telehealth services has similarly contributed to First Nations capacity development. In a direct way, telehealth has opened up new worlds of education and training for health and social service staff in northern and isolated communities. KO Telemedicine coordinates a wide scope and variety of health training and continuous quality improvement programming that is specifically required by First Nations service providers and patients.

The telehealth program has stimulated wide-ranging socio-economic development for First Nations by describing the "realm of the possible." This is made true not only by the fact that the program works, but more importantly, that it works on behalf of each community. Specifically, the community telehealth coordinator workforce—a full-time and highly motivated network of community-based staff—liaises with family members, peers, neighbours, and political leaders to constantly provide feedback on new ways for technology to address local service requirements, fill gaps, and deliver integrated solutions. In this sense, community well-being regards a larger goal than technological innovation—it engages a community-driven capacity to think past longstanding barriers and the cultural wherewithal to make change happen.

KO Telemedicine has also embedded distributed methods of teaching and learning into its new site training, community telehealth coordinator training, and continuous quality improvement programming. Accordingly, site coordinators learn their job and participate in regular training sessions via video conference. Recently, this approach was recognized by the First Nations and Inuit Health Branch as a national model for First Nations communities. FNIHB funding supports an

education coordinator position. In fall 2004, the education coordinator surveyed community-based health staff and administrators about their learning needs and used this data to program regular teaching and learning events via video conference. Direct learning is being augmented by web streaming. This feature provides health workers with the ability to review teaching events and training sessions that are archived on the KO Telemedicine website. KO Telemedicine also utilizes Adobe Connect Webinar software. This tool enables live and archived presentations and structured learning through the use of individual web browsers.

The KO Telemedicine project has incorporated formative, summative, and dynamic evaluation into its service model from the very beginning. This information has supported a best practices and continuous quality improvement environment, and has also been used to enumerate the start-up and ongoing costs, and the service provider and community benefits associated with the introduction of telehealth services in remote First Nations settings. For example, to evaluate Keewaytinook Okimakanak's first telehealth initiative—a telepsychiatry pilot project—KO worked directly with the Queen's Centre for Health Services and Policy Research to determine client/provider satisfaction with the service, and to unravel the various cost centres within which non-insured health benefits medical transportation funding is distributed. In the 2002 release of the final report, health policy researchers concluded that:

- Clients demonstrated perfect attendance and expressed consistently positive perceptions of the confidentiality and benefits of the service that were maintained over time.

- The distance created by not being face to face with the psychiatrist appears to have helped clients feel comfortable with the psychiatrist.

- While many clients (60%) indicated they felt nervous during their session, the majority (80%) said they felt comfortable with the psychiatrist asking personal questions of them.

- Almost all the clients indicated that the psychiatrist had helped them with their emotional problems and that they would recommend the service to people they care about who have emotional problems (Keresztes 2002).

Community client satisfaction was replicated in the University of Toronto's evaluation of NORTH Network's Canada Health Infostructure Partnership Program (CHIPP). The 2003 report looked specifically at services in the KO communities and concluded that participants in the patient focus groups in the First Nation's communities were very satisfied with their telemedicine experience; they felt that it was increasing access to other health care specialties (e.g., mental health counselling) and was more convenient with respect to time and cost savings. They valued the program and wanted it to continue. This sentiment was reflected in the comment of one participant, who stated: "Please don't take away the telemedicine program."

In 2004, KO Telemedicine launched a community engagement process to determine how the service was working for First Nations communities. During that process a number of elders were interviewed and asked to relate their tele-health experiences. Joseph Leo Anishinabe, a 69-year-old resident of Keewaywin, said he "enjoy[ed] using telehealth to visit my family and friends that can't come home because the doctor has told them they would get better medical care in the city … It's like the person is right there in the room with you. It's that close." KO Telemedicine also launched a more extensive research exercise in 2004. Working in partnership with Laurentian University's Centre for Rural and Northern Health Research and the University of Guelph, KO Telemedicine instituted a process and program evaluation that will determine KO Telemedicine's success in meeting its Primary Health Care Transition Fund (PHCTF) objectives and build community capacity to participate in the research process.

Looking forward, KO Telemedicine has developed an Accelerated Access Plan (AAP) that will link the KO Telemedicine network with the province's Aborigi-nal health access centre infrastructure and extend its unique Aboriginal service model to 50 additional remote and northern First Nation communities in Ontario. AAP will transform health service access for Ontario's Aboriginal communities. It will deliver quality and comprehensive access to federal and provincial health programming within a common point-of-care network, support health profes-sional retention and recruitment in small, isolated Aboriginal communities, and complement local health integration needs and priorities.

Conclusion

KO Telemedicine meets a variety of sustainability tests. It is based on a network services model that provides secure health connections at community-based points of care, distributes the cost of access across a range of users, and provides culturally appropriate technical support to community telehealth coordinators. In addition, KO Telemedicine has anticipated a key change management role for itself and has dedicated human and system resources to enable the integra-tion of programs and providers for First Nations communities. At the same time, KO Telemedicine's service model directly addresses health system principles by improving access to comprehensive and quality care and by meeting longstanding community health and wellness needs. These values are embedded in a commit-ment to make more effective use of existing health resources and to undertake longitudinal cost/benefits analyses.

Finally, KO Telemedicine is successful in its ability to introduce and diffuse telehealth innovations at the community level. Community participation is high—in large part because of the work performed by community telehealth coordina-tors to shape the service to community needs; promote its use among community leaders, clients, and administrative bodies; and facilitate sessions at busy nursing stations. Community members understand the ways that telehealth has positively

changed the local health service access environment and are eager to see the service expand.

Still, telehealth exists in a policy and program vacuum. It is largely sustained by project funding, extensive collaboration among First Nations health service agencies, strategic partnerships, and directly by First Nations who contribute what they can to keep local broadband networks online.

While it meets or exceeds numerous sustainability tests, KO Telemedicine has no programmatic means of ensuring that services will continue at the end of its current project. This reality presents an issue of wide-ranging significance for Ontario First Nations and for Aboriginal communities seeking to "turn the corner" right across Canada. It also signals the need for tripartite collaboration so that investments made in developing, implementing, and integrating First Nations telehealth service innovations are available to address the clinical and social determinants of health for First Nations communities.

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