ROOT & STEM

A STEAM Resource for Educators in a Digital World

SPRING 2020 • ISSUE 1

Technology in a **Changing Climate**

SmartICE & SIKU

The power of tech and traditional knowledge

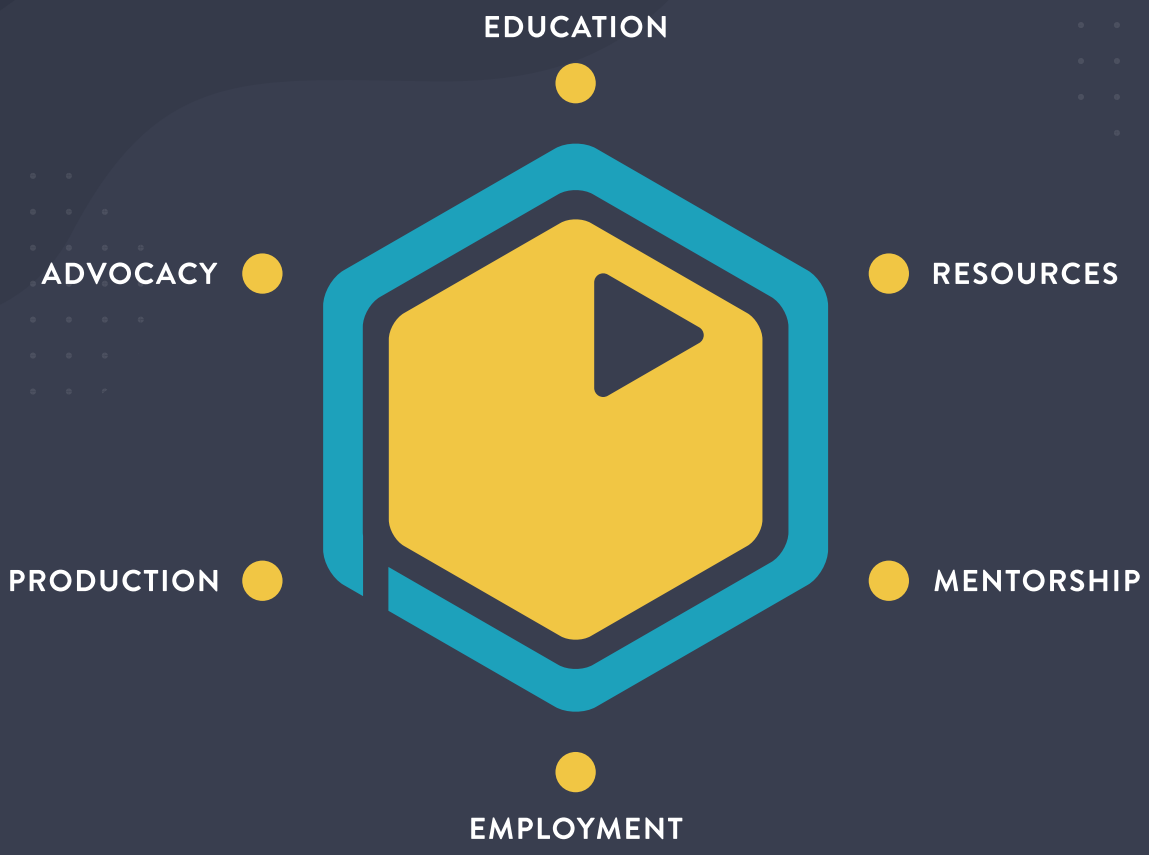
Tuk TV

NWT teens tell their own story

Beading

The original tech

+ Plus comics, games and over 10 pages of teaching resources!



PINNGUAQ
LIFE CYCLE

Pinnguaq follows a life cycle model to support the core phases of a person's learning journey in STEAM education. We strive to provide educators and students with opportunities and resources each step of the way.

To learn more about what we do, visit our website at

www.pinnguaq.com

ROOT & STEM

About the Pinnguaq Association

The Pinnguaq Association, a not-for-profit organization, incorporates STEAM into unique learning applications that promote storytelling, health, wellness and growth with rural and remote communities. At its core, Pinnguaq embraces diversity and creates opportunities in order to empower all people.

Digital Taxonomy

Computer Science Education is more than just coding. A comprehensive approach to it includes learning skills and competencies from each of the following areas. See these icons at the top of each article to find out how our content fits into your curriculum. *Reference: Working Document 2, Teaching for the Digital Future: Developing a Pan-Canadian Computer Science Framework. 2020*


CODING AND PROGRAMMING


COMPUTING AND NETWORKS


DATA


TECHNOLOGY AND SOCIETY


DESIGN

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Canada

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What we talk about when we **talk about tech**

Welcome to the first edition of *Root & STEM*, a resource for educators in rural and remote communities who want to bring educational opportunities in Science, Technology, Engineering, Arts and Math (STEAM) to their students. *Root & STEM* merges heart and head, while pushing the boundaries of how Canada thinks about STEAM. Our goal is to provide a platform for more diverse STEAM stories, lesson plans and shared resources. Our hope is that educators will see the unique needs of their communities and classrooms reflected in the stories we tell.

The irony of reading about innovation in Canada on printed paper is not lost on us, but it speaks to the reality of why a resource like this needs to exist. In the rush to promote and encourage education in "21st-century skills" in Canada, much of the country is being left out. As schools in major cities debate the ethics of embracing Google Classroom and the productivity risks of allowing cell phones in class, Canadians in rural and remote communities are still waiting for working cell service and Internet access that functions consistently enough to allow for online learning. Meanwhile, the realities of a changing climate reach them first, bringing new challenges.

Founded in Nunavut with the goal of bringing technology and technological opportunities to rural and remote communities, the Pinnguaq Association develops and promotes coding education, and publishes resources to try to level the playing field between urban and rural communities when it comes to accessing technology. Sometimes this means we bring resources to people in a way that doesn't rely solely on digital tech. When your Internet can be taken out for hours by the position of the sun in the sky, a magazine can keep the conversation going.

The conversation we're all having now is about the climate crisis. Technology helped get us into this mess; can it also get us out? In some communities, the answer hinges on combining digital skills with traditional knowledge and the voices of the communities most affected—recognizing that the experiences of those who live on the land are equally as valuable as the data we collect about it. The stories and lesson plans contained in this first issue of *Root & STEM* engage with people in our communities who are working on ways to address a wide range of climate-related challenges, from unstable sea ice, to degraded watersheds, to the very way in which we understand the meaning of "technology." This issue showcases SmartICE and SIKU, two tech-based projects running in Arctic communities, which embrace the spirit of Qanuqtuurniq—being innovative and resourceful. Our lesson plans were designed by Aqqiumavvik, the Arviat Wellness Society in Arviat, Nunavut, and are focused on Inuit Qaujimajatuqangit. In making these teachings available here, we hope to show that the solutions we need have been there all along. We just need to listen to the people who know them.

Too often, solutions for problems in northern or rural communities are developed in urban centres, framed by people who don't always understand the balance required among land, people and technology. This is not, then, a conversation about what technology can bring to rural and remote communities: at *Root & STEM*, we want to change the thinking on how innovation flows. Let's talk about what ideas and innovations our communities can bring to the rest of the world.

– Ryan Oliver

Jerry Kobalenko

SmartICE: Tracking Ice Safety in a Changing Climate • *Page 18*

Jerry Kobalenko specializes in writing about the Arctic. In 2018, he was awarded the Polar Medal by the Governor General of Canada for his work in increasing awareness about Northern Canada and its peoples.

Dez Loreen

Tuk TV: Inuvialuit Youth Take Their Story Global • *Page 30*

Dez Loreen is an Inuvialuit writer, husband and father born in Inuvik, Northwest Territories. He has spent his adult life working in media and communications in the north, and enjoys writing and producing his own short films.

Courtney Milne

Decode STEAM: Spirit Berries • *Page 14*

Courtney Milne is a Digital Steward, and a beadwork artist who uses her cultural knowledge and teachings to guide her artwork and tell stories. Courtney is of mixed Anishinaabe, Haudenosaunee and Scottish heritage, and currently resides in Nogojiwan-ong (English name: Peterborough) with her family roots in Kahnawake Mohawk Territory and Chippewas of Nawash First Nation. She holds an Honours Bachelor of Arts in Psychology and a Masters of Education in Language, Culture and Teaching.

Jack Hoggarth

Community Showcase: STEAM Education in Curve Lake • *Page 38*

Jack Hoggarth is the Cultural Archivist at the Curve Lake Cultural Centre in Curve Lake First Nation. The Centre works to increase access to education in the visual and performing arts, culture and humanities for Curve Lake residents of all ages, with specific concentration on youth development and professional growth.

Kate Craig

Comic: Bearanormal Activity • *Page 34*

Kate Craig lives in Stratford, Ontario, and is an artist working in the video game industry. She creates comics, illustrations and 3D environments (like houses and spaceships) for players to snoop around in. In her free time, she makes things out of wood.

Alana McCarthy

STEAM Play: Race for Change • *Page 36*

Alana McCarthy is an illustrator, letterer and designer from Toronto. She is an honours graduate from OCAD illustration and spent eight years in-house as a senior designer in Nelvana Animation's Creative Services department.

Shirley Tagalik

Inuit Principles of Conservation • *Page 40*

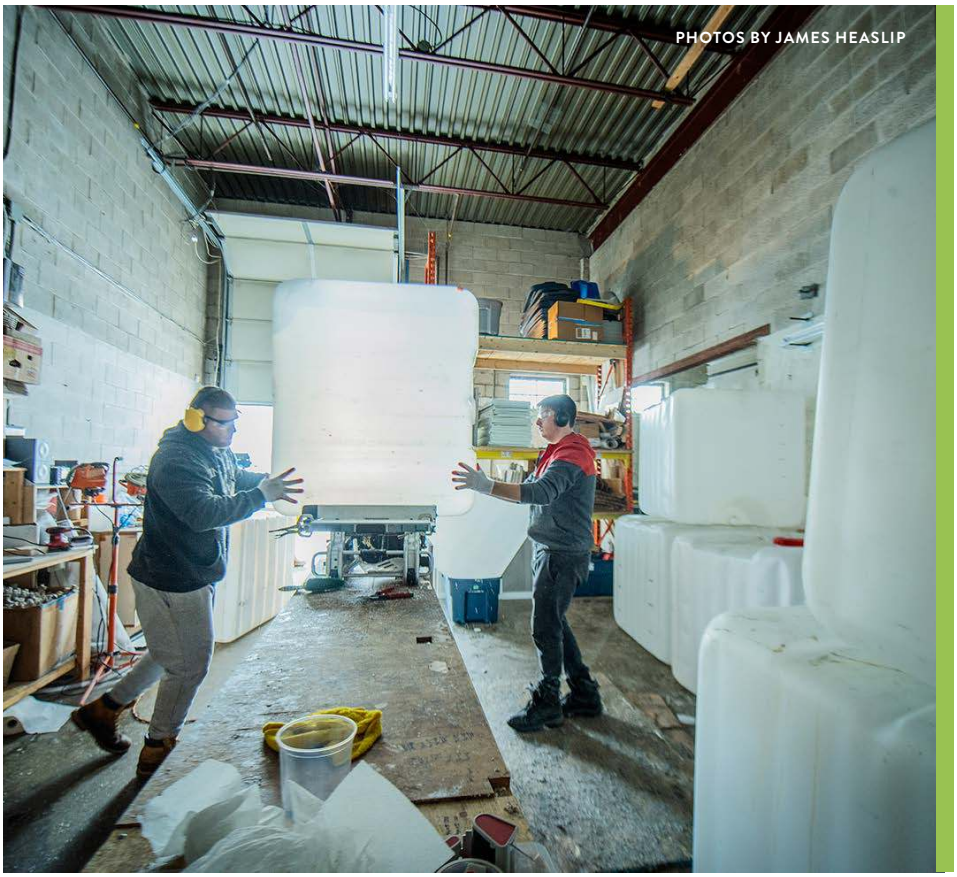
Shirley Tagalik is a former educator for the Nunavut Department of Education and the author of *Inuit Qaujimajatuqangit: What Inuit Have Always Known to Be True*. In her time as an educator, she was tasked to assist in the redesign of the education system within the framework of Inuit Knowledge. Shirley now volunteers her time in her community of Arviat, Nunavut, promoting research, youth engagement and mental health programmes.

To Save the World, Grow Insects

BY JOEL MCCONVEY

If you live in North America, bugs probably aren't the first thing that comes to mind when deciding what to eat for lunch. According to the Food and Agriculture Organization of the United Nations (FAO), insects are part of the traditional diet of as many as two billion people around the world. Yet in Western countries, they're often regarded with disgust.

Jakub "Kubo" Dzamba at his cricket farm in Mississauga, Ontario



PHOTOS BY JAMES HEASLIP

Third Millennium uses large water storage containers to build their cricket habitats

However, as the climate crisis forces us to look at the ecological impact of large-scale agriculture, we'll need new ways to produce enough food to feed the planet. In the future, lunch might have to look different. It might have six legs.

Meet Jakub Dzamba—"Kubo" to his friends. This 37-year-old entrepreneur and visionary wants to change the way we think about agriculture, by designing systems and technologies for sustainable edible-insect farming. Our creepy-crawly friends, it turns out, are packed with protein—and they have a smaller environmental footprint than other livestock, as they require significantly less feed. For this and other reasons, Kubo believes insects are a food of the future.

Kubo's Third Millennium Farms uses novel farming methods to grow crickets at its warehouse and design studio in Mississauga, Ontario. The bugs grow in insect habitats, made of 1.2m×1.2m plastic bins outfitted with cardboard structures for housing the crickets. The bins can be stacked using a racking system. (Imagine a dresser filled with chirping insects.) WiFi sensors and smart thermostats maintain an optimal temperature throughout the space. Watering systems are automated. For harvesting, the crickets are cooled—which, because they are cold-blooded, puts them into a sleep state—then frozen.

Using Kubo's methods, each habitat can produce about 30,000 crickets a month, or about seven kilograms of raw bugs. Depending on the batch, that's roughly one kilogram of protein—the equivalent of about 17 eight-ounce sirloin steaks. Start stacking the habitats, and the numbers add up.

Third Millennium sells some of its product for human consumption (primarily in the form of cricket powder), but the company's ultimate objective is to grow a network of like-minded farmers, by offering clients their habitat designs, or selling their turnkey bug-farm trailer, the Chirp Box. They're using machine learning to analyze all the data they collect from harvesting, which they can pass on to others. By enabling farmers to grow crickets in locations that are typically inhospitable to agronomy—urban centres, for example, or northern communities—Third Millennium aims to decentralize the food system. Less centralization would mean greater food security in instances when changes in the climate cause major disruptions in the industry.

"The really important work is going to come in integrating edible insect farming with other types of micro-farming," says Kubo. "Crickets and other bugs are better at eating stuff that [traditional] livestock doesn't. So, we need to start finding ways of using organic waste streams and upcycling them as feed for insects."

Kubo admits that using things like algae and mushrooms to feed bugs that will then feed us is a project for the long-term. In the meantime, you can learn to farm your own crickets at home or in the classroom. That part is relatively easy.

What will be tougher is convincing people who are used to steak and potatoes that creatures we usually think of as gross actually belong on the dinner plate. How will you take your bugs? &

The formal name for the consumption of insects is **"entomophagy."**

The Indigenous **Social Media App**

BY PINNGUAQ STAFF

Siku is the Inuktitut word for "sea ice." It's also the name of a new app: an Inuit-led social media project, developed by the Arctic Eider Society, that is designed to help hunters and other community members navigate and share knowledge about a northern landscape in flux.

Available on both mobile and web platforms, SIKU provides tools and services to support ice safety, language preservation, knowledge exchange, safe travel and self-determination.

Joel Heath, Executive Director of the Arctic Eider Society, explains that Inuit were already using social media platforms like Facebook to trade knowledge—but that meant giving away their intellectual property. Furthermore, limitations on those platforms made them inadequate for sharing knowledge over time.

"With SIKU, we can allow people to own their own data, develop a privacy policy, and control how their data is shared." Users can post photos and share hunting stories, which are presented along with news feeds, satellite imagery and climatic data on tides, marine forecasts and sea ice. *[SIKU pulls some of its ice-thickness data from the SmartICE project; see page 18 for a feature on SmartICE –eds.]* Privacy settings are tailored specifically for Indigenous knowledge, to ensure no one can use the data without permission.

The app features profiles of wildlife, sea ice and traditional place names, all of which can be tagged to create cumulative knowledge banks—as SIKU's website puts it, "Living wikis of Indigenous knowledge."

"It's time for the computer and the harpoon to work together."

"The classic approach was that elders would share knowledge [of what they saw happening on the land] with scientists," says Heath, "and then the scientists would say, 'That's cool,' and then spend five years trying to do a study to prove what the Inuit had already told them was true." With SIKU, the continuous data stream coming from hunters in the field—which, until recently, was only shared orally—can be recorded, added to and owned by Inuit.

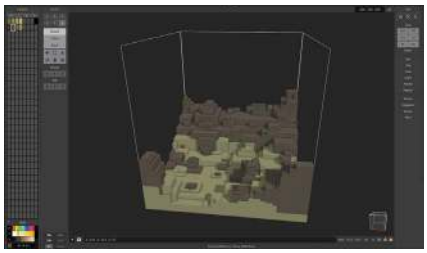
This approach is reflected in the app's guiding principles: respect, self-determination, ownership of intellectual property, and integrity—all centred on protecting and mobilizing Inuit knowledge.

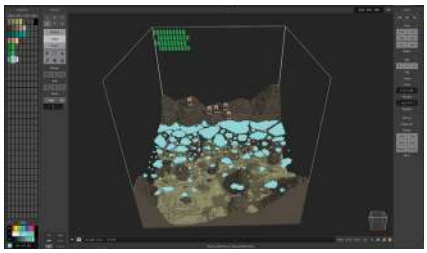
One of the early stewards of SIKU was the late Piita Kattuk, an elder from Sanikiluaq. He passed away in November 2019, but his words continue to inspire SIKU's mission to bring together tools and technologies from both traditional Inuit culture and the contemporary digital world: "It's time for the computer and the harpoon to work together." &

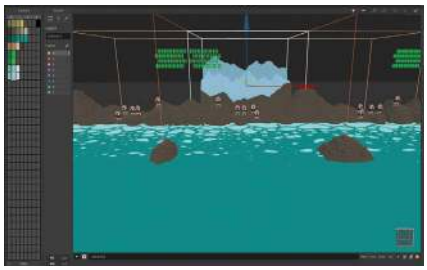
Visit **siku.org** to learn how to use **SIKU** in classrooms and workshops.

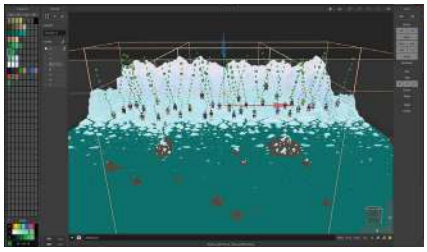
Our Cover: Using MagicaVoxel and Krita

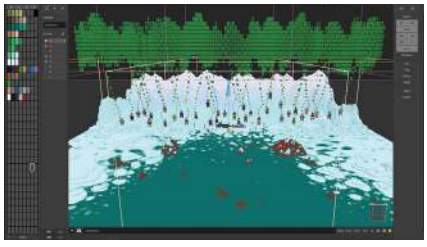
Artist Ian MacLean explains how he designed the cover for the first issue of *Root & STEM*











These screenshots show how the environment was developed in layers

The cover for this issue of *Root & STEM* was developed using free, open-source software. The majority of the development was executed in MagicaVoxel (ephtracy.github.io), a voxel editor that allows the user to create images with volumetric pixels. The process is similar to creating pixel art, but in three dimensions and with additional tools for applying different materials and effects to the scene.

Some additional post-processing was done in Krita (krita.org), a program with tools similar to those commonly found in Adobe Photoshop, but with more of a focus on drawing and painting.

To start the process, I sketched out a series of thumbnails—small rough compositions—to connect the cover image to the main themes of the issue: climate change and technological solutions. For an image, I decided to focus on receding sea ice in the Arctic. I began with a single scene, defining some colours for the palette and roughly blocking in the seafloor and bedrock.

At this point I used the "box" brush to click and drag out large clusters of voxels. I switched to the "voxel" brush to sculpt and detail the area, and began to drop in some human characters.

Because the brush requires a surface to attach to, and I wanted to include some floating blocks of ice, I used the upper surface of the scene (essentially the ceiling) to draw out the ice forms, then selected them and dragged the whole area down to the level of the sea surface. Once I had dragged it into place with a box brush, the material type was changed to glass with varying opacity, to give the appearance of water and ice.

It became clear at this stage that the complete image would require more than a single scene, so I copied the base scene and mirrored it to the sides, extended the sea forward, and placed a series of scenes in the background, with "flats" of mountains reducing in contrast. In total, the image contains nine scenes combined to create the sea, people, land and sky, and six additional scenes to handle the information cloud that hovers above, fed by the data streams from smartphone and tablet devices in the characters' hands. I wanted the data cloud to resemble an aurora, so I varied the edges and depth, and duplicated the entire thing so I could apply a couple of different materials. I expanded the area depicting sea ice to help the composition, and added a snowmobile with a SmartICE monitor suite and some data buoys to tie into the feature article.

Once it was complete, I rendered the scene to a series of 2D image files. To add some effects to the data cloud, I rendered the scene three ways—with the cloud removed, with the background removed, and in its entirety. To illustrate the light emitted by the cloud, I arranged those images in Krita, adjusted levels and colours, and applied some blur effects. The images were merged, final adjustments were made, and the cover was prepped for publishing.

Both free to use, MagicaVoxel and Krita prove that you can create effective, professional artwork without paying for professional tools. **&**

To learn more about **Krita**, watch Ian's video series about comic creation using Krita at **www.pinnguaq.com/learn/krita-for-comics**.

A screenshot from *Be Earth 13*

Using VR to Drive Home the Climate Crisis

BY JEREMY GILMER

At the World Economic Forum in Davos, Switzerland, this past January, the movers and shakers of the financial, government and tech worlds discovered a novel addition to the usual meetings, lunches and presentations: a fully immersive virtual tour of the destructive fires affecting the Amazon Rainforest.

The Virtual Reality experience is called *Be Earth 13*. Produced by the non-profit organization XR Impact in association with Oculus and the Swedish International Development Cooperation Agency (SIDA), it uses immersive technology to create projects based on UN Sustainable Development goals—and, just maybe, to change some people's perspectives.

"As a participant, you embody Earth on a journey from space, to the Amazon rainforest, witnessing the ongoing deforestation," explains Ylva Hansdotter, founder of XR Impact and one of the minds behind *Be Earth 13*. Over the course of between 10 and 20 minutes, participants move through burning jungle to experience the sights and sounds of the world on fire, and then through the aftermath, walking over scorched, smouldering earth and feeling the scope of the destruction.

"During the journey, you transform; you can see your hands changing and becoming air, water, tree, ash. As you are Earth, you can use the elements to help fight further deforestation."

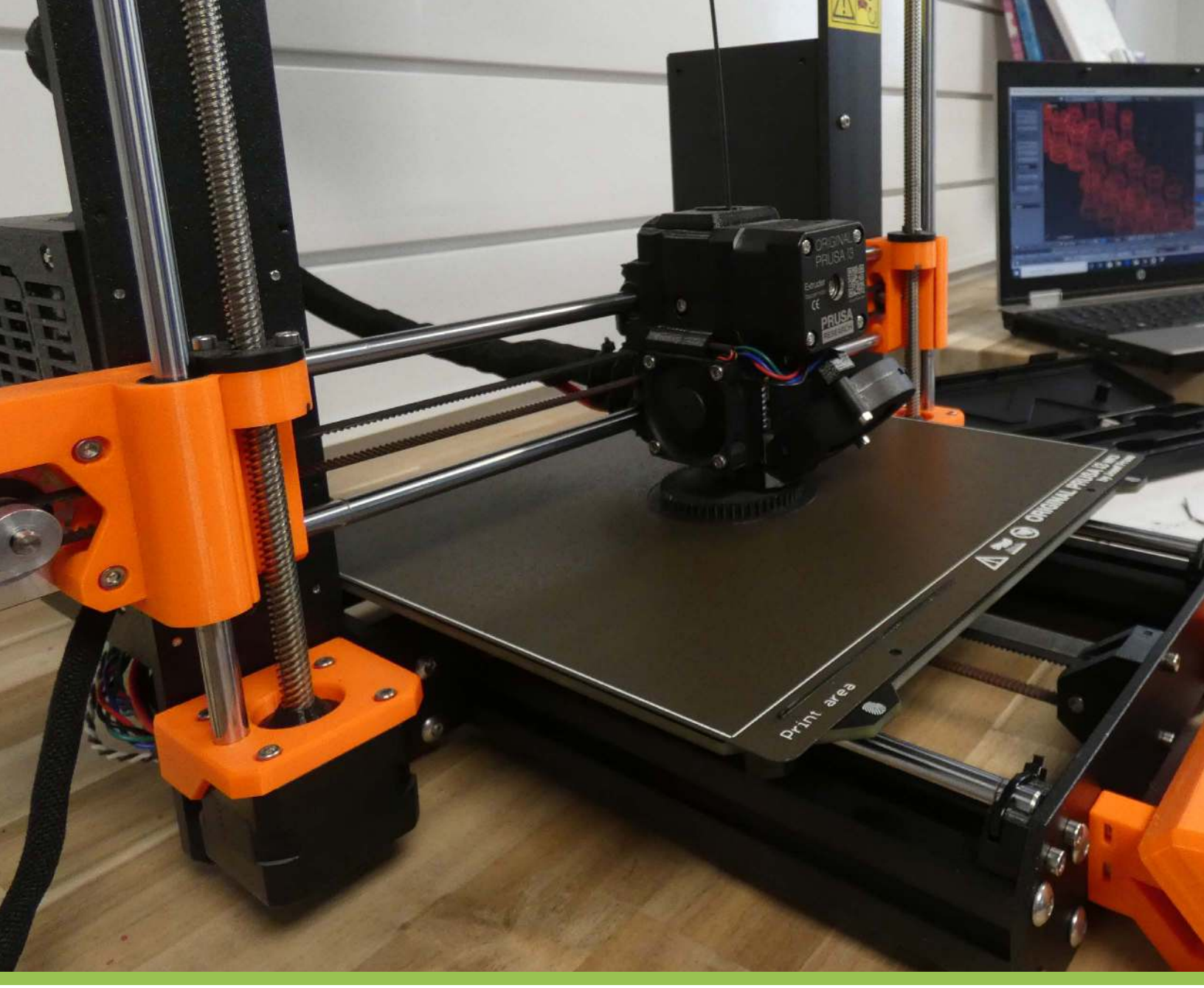
The images and sounds are designed to create empathy, as well as a connection between the event and the user. Hansdotter says this type of experience has particular qualities that, when harnessed for the social good, can change the way people think about the world. In her words, VR is a great tool for bringing the perspectives of other people and beings to you, via a medium that allows you to experience their actions in a meaningful way. Hansdotter refers to the concept of embodied cognition—the instant and powerful mind/body connection that this level of sensory input produces. You can feel the motion and hear the sounds, so your mind fills in the gaps the system doesn't provide.

"During the journey, you transform; you can see your hands changing and becoming air, water, tree, ash."

The XR Impact team is keen to point out that some studies have shown a direct correlation between VR programs and concrete changes in behaviour, attitude and empathy. Post-experience interviews at the Davos event pointed in this direction. Participants spoke of feeling connected to the jungle and the fires, and were emotionally moved by being dropped into the heart of the fires and their aftermath.

As the climate crisis escalates, access to these kinds of experiences, and the technology required to create and view them, could be instrumental in helping people understand the gravity of the situation and respond with urgency. The creators of XR Impact believe VR has huge potential as a tool for change: whether walking over the melting permafrost of the Canadian North, or witnessing the swirling gyre of plastic waste that covers hundreds of square kilometres of the Pacific Ocean, this system can bring people up close and personal with the flashpoints of the unfolding climate emergencies that are facing all of us worldwide.

In the world of VR, which continues to emerge and evolve, it can be tough to get projects to market: to date, there are no confirmed details on timing for the official public release of *Be Earth 13*. (To watch it now, you need an Oculus Rift S with Leap Motion hand tracking.) But XR Impact hopes to have the experience available in cities around the world by 2030, with parts of the program available to schools and museums by the end of this year. Because the climate crisis may be a rare instance in which our technology can't move fast enough to keep up with a changing Earth. &



Another **Dimension**

Using the Prusa MK3S 3D Printer

BY BRANDON BUNNIE

Increasingly, 3D printers are showing up in digital classrooms and makerspaces. As a tool for education, a 3D printer provides the capacity to teach design and manufacturing skills in the comfort and convenience of a makerspace or classroom.

It can also support the development of problem-solving skills. Digital industries often frame products in terms of the problems they can help solve. Learning to use a 3D printer is a useful prompt for getting students to identify challenges in their communities, and further to consider how they might use 3D-modelling software and fabrication to design solutions.

For example, if a piece of equipment breaks, students can learn how to design and print a replacement component. Or, if they have an idea for creating something that benefits their community, they can generate an accessible prototype in a short period of time. This real-world approach to sharing digital skills helps to root students' use of technology in the environments they know, and encourages engagement with their communities.

Pinnguaq's Lindsay Makerspace in Ontario decided to purchase a 3D printer to test and explore how the technology might be used, choosing the **Prusa MK3S**, an entry-level 3D printer that costs around $1,000.

The Prusa proved to be a great model for learning about 3D printing, because it is remarkably simple to use. It takes about a day to build, has a start-up wizard that detects if it has been assembled incorrectly, and it self-calibrates. You don't need to adjust anything—just switch it on.

Getting Started

You'll need an **SD card**, which comes with the printer, and access to a computer with an SD reader.

The 3D object to be printed must be saved as an **STL file**. There are various digital art programs that create STL files. We use **Blender**, a free, open-source software platform that is great for students, because of its accessibility, easy installation and ability to run on a wide variety of computers.

TinkerCad is another popular 3D-modelling program. It too is very simple to use—but is less customizable than Blender.

Another bit of required software is a **slicer**, which translates STL files into instructions called g-code that the printer can understand. Prusa has a free slicer that is easy to use, and which fixes or compensates for design errors. It's available from www.prusa3d.com.

The printer uses spools of filament for printing. For refills, use any **PLA**, **AB** or **PTEG** filament, all of which are easy to find online. (Prusa sells its own on its website.)

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If you want to learn more about creating 3D objects, visit www.pinnguaq.com for lesson plans on Blender. **&**

Workshop Idea

Recently, I ran a successful eight-week workshop introducing the basics of how to create and print digital 3D models to students who had no previous experience with the technology. The assignment was for each student to create a personal die. We encouraged them to work together and learn from each other; those who got through the lessons quickly helped their friends.

To watch videos from the workshop, visit **www.pinnguaq.com/learn/blender-print-a-piece**.

Spirit Berries

Beading, Technology, and the Art of Barry Ace

BY COURTNEY MILNE

The Importance of Beading

In order to understand beading as a technology, it is necessary first to have an understanding of the historical importance of traditional beadwork.

Beading has always been a very important element of the culture of Indigenous Peoples in what is now Canada and the United States. Some beadwork was made to be traded at trading posts, while some was made for ceremony or special events. Prior to contact, Indigenous people would bead with materials found on the land, such as shell, bone, pearl and stone. It wasn't until after European settlers arrived that more modern, brightly coloured materials such as glass and ceramic came into use.

Beadwork played a significant role in the inception of "Canada," especially in formalizing the agreements between Indigenous nations and European settlers. Many original treaty agreements were solidified in beaded Wampum Belts such as the Two Row Wampum and the 1794 Canandaigua Treaty Belt.

Although Wampum Belts are widely known for their role in the creation of treaties, traditionally, they were used for many purposes, such as nation-to-nation meeting requests, symbols of titles within communities, and during ceremonies, to name just a few. Wampum are held in extremely high esteem by Indigenous communities, particularly the Haudenosaunee. They carry important responsibilities that must be honoured by those who walk with them.

Wampum beads are especially significant because they are made from quahog and white whelk clamshells, and are therefore considered a living record. When creating a Wampum Belt, the maker intentionally speaks their words into the beads. This allows each speaker thereafter to remember the original agreement and the history to date, and they are expected to honour the original words.

In **Anishinaabemowin**, there are animate and inanimate nouns.

"Manidoomin" is an animate noun, meaning spirit berry; therefore, when we speak about beads and beadwork, we talk about them as if they are alive.

Barry Ace: Beading in the 21st Century

Barry Ace is pushing the boundaries of traditional beadwork and is connecting tradition with innovation in the 21st century. He is Odawa Anishinaabe from M'Chigeeng First Nation on Manitoulin Island, lives in Ottawa, and has been an artist for 25 years.

Ace uses reclaimed and salvaged electronic components and circuitry to create traditional woodland-style beadwork on important items of Anishinaabeg regalia, such as the Bandolier Bag. He creates this artwork to show that Indigenous culture has never been static; it is always evolving, and Indigenous peoples are always looking for new forms of cultural expression. According to Ace, traditional beadwork and technology have a relationship, as is reflected in the Anishinaabemowin language. Manidoomin—the word for "bead"—translates to "spirit berry" which is known to give power; therefore, dancing in regalia releases power to the community. This is similar to electronic circuits, whose components store energy, which they release when a drop in

Bandolier for Water and Plant Life (2019). Collection of the artist

external energy is detected, thereby increasing the supply.

Ace's work is a brilliant example of the way cultural evolution has always taken place. Too often, Indigenous communities, traditions, cultural practices and ways of knowing are misunderstood as "outdated" for modern times, and are therefore considered to be unimportant or invalid. Ace's work connects traditional knowledge and practices to contemporary technology, which provides a powerful statement about the resilience of Indigenous communities. His artwork exemplifies the strength required not only to learn traditional knowledge that was taken from Indigenous Peoples, but also to use that knowledge in contemporary ways, to continue building for future generations. Ace's artwork is a beautiful representation of the limitless innovation of Indigenous people and communities when they are given equal opportunities to learn science, technology, engineering, art and mathematics.

Beading + Technology

In recent years, Indigenous communities have seen a resurgence of beading that is directly related to the use of technology. Opportunities for Indigenous people from all over Turtle Island to connect and learn from each other has dramatically increased because of modern communication technology. Increased access to shared cultural knowledge, community support, and traditional art forms has had a positive impact on the lives of countless Indigenous individuals.

Social media, online streaming platforms, video platforms and apps have been particularly important to the resurgence of beading. Apart from providing access to skills and patterns, they have been used to create

welcoming, open and supportive online communities where individuals can easily share cultural knowledge and tips, and ask questions without fear of judgment.

Communities are created through online interactions on Facebook, Instagram and YouTube, and contribute to the success of Indigenous people personally, professionally and economically. Technology has allowed more Indigenous artisans to market, sell and trade their work, as well as to support and celebrate other Indigenous artisans. These online communities also encourage the next generations to find power in traditional Indigenous art forms such as beadwork.

For many Indigenous people, beading is seen as a medicine in itself; it is a deeply healing ceremonial practice that has the ability to connect individuals to their ancestral roots. Learning the traditional art form of beading is an act of resistance against the historic and ongoing oppression experienced by generations of Indigenous people in this country. This act of resistance is an extremely powerful example of cultural revitalization, identity re-formation, personal and community healing, diversity, resilience, and communal strength among Indigenous communities.

To learn more, visit www.onondagana-tion.org/culture/wampum. &

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__Courtney Milne__ is a Digital Steward, and a beadwork artist who uses her cultural knowledge and teachings to guide her artwork and tell stories. To read Courtney's full bio, see our featured contributors page.

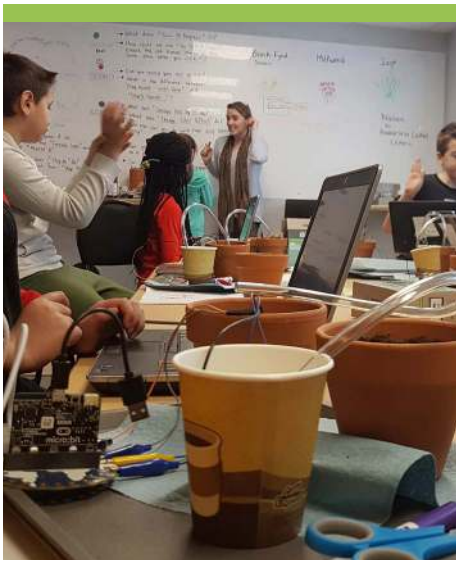
Online Tools for Beading

For beading apps / web pages (pattern making):

- Bead Tool 4
- EasyBeadPatterns.com

Free digital art software for freehand pattern creation:

- Autodesk Sketchbook
- Krita
- Inkscape
- GraphicsGale



Making Space for the Natural Environment

Where: Pinnguaq Lindsay Makerspace in Lindsay, Ontario

BY MARIA ALEJANDRINA COATES

The Lindsay Makerspace, as its name suggests, is based in Lindsay, Ontario. This central hub of the Trent-Severn Waterway connects 386 kilometres of lakes, rivers and canals on traditional Michi Saagiig territory, and on lands included in the Williams Treaty and Treaty 20. Bounded by watersheds—areas of land where surface water converges, such as shorelines—the region's naturally occurring ecosystems include forests, wetlands, grasslands and river habitats.

Lindsay's economy is supported by the Sturgeon Lake watershed through a variety of industries, such as fishing, tourism, recreation, small businesses and other enterprises, including the Lindsay Makerspace. However, the growth of shoreline and urban development, together with the combined impact of agriculture, climate change and invasive species, have increased pressure on the watershed's aquatic and terrestrial ecosystems. This is affecting the overall health of our community.

Within this context, at the Lindsay Makerspace we see an opportunity to emphasize the role of technology in supporting environmental stewardship. With a mandate to provide a community space for people to gather and explore the connections between thinking, making, playing and sharing, we see the potential to provide young people with agency in the use of technology, to learn as well as to unlearn our role in changing the systems within which we live.

Specifically, we are conscious of the gaps in access to learning and technology that exist for rural and remote communities, especially Indigenous communities and communities of colour. We provide a platform for youth to engage with technology in a participatory and active way, by giving them opportunities to gain skills that are relevant for a future that will be both increasingly digitized and faced with the realities of a changed climate. We seek to create and promote connections among people, technology and the environment.

Coding Roots

One project that sets this in motion is an ongoing, applied community project that is being developed in alignment with the Kawartha Conservation Stewardship Strategy for the Lake Sturgeon Watershed. For the Lindsay Makerspace, we purchased a set of Climate Action Kits, a collection of curricula designed by the tech-ed company Inksmith to work with the BBC micro:bit (a handheld, programmable microcomputer). Our goal was to begin exploring projects connected to the UN's Sustainable Development goals.

During a Saturday drop-in session, a group of 13 children, ages 4 to 11, planted flowers that are native to the Kawartha Lakes region, such as black-eyed Susan and milkweed. They experimented with coding the micro:bit and connecting the Climate Action Kit's breakout board and DC water pump to build an automated watering system for their plants. A different version of this project is planned for spring and summer, for which we will conduct coding and electronics activities to support the indoor growth of tree seedlings in the makerspace, leading up to a community planting event in the fall.

For this reforestation project, we are focusing on trees that are considered "advancing species," which are usually found a little farther south in Ontario. Holly Shipclark, the Stewardship Coordinator at Kawartha Conservation, points out that "it is expected that these tree species, and the organisms that rely on them, will thrive in our ecosystems of the future due to the changing climate. Among others, they include the tulip tree and the swamp oak." Holly explains that this strategy is termed "assisted migration," and that it involves acknowledging that, as our environment changes, a different range of species can be integrated into local ecosystems to help them adapt. In Holly's words: "Future-proofing, but for forests instead of communities!"

With community-based educational projects like these, we hope the Lindsay Makerspace can collaborate with other organizations to channel individual and collective action on issues affecting the local environment, while contributing to strategies meant to safeguard our present and future ecosystems. **&**

Sources

Our Kawartha Lakes Healthy Environment Plan—2019 • Our Kawartha Lakes Integrated Community Sustainability Plan—2014 • Sturgeon Lake Management Plan—2014, Kawartha Conservation • Sturgeon Lake Watershed Characterization Report—2014, Kawartha Conservation

SmartICE: **Tracking Ice Safety** in a Changing Climate

STORY AND PHOTOS BY JERRY KOBALENKO

In 2010, Labrador endured what became known as the "Year of No Winter." Temperatures were between eight and ten degrees warmer than usual. Three hundred millimetres of rain fell in February. The sea ice—the winter highway used for centuries by Inuit for hunting and travelling—formed imperfectly, when it finally formed at all. It's estimated that one in twelve people fell through the ice on their snowmobiles.

Things had been increasingly strange for years. Every winter, it seemed, the sea ice formed a little later and thawed a little earlier. Some winters were almost normal, but this had become the exception. Violent storms were more frequent. Some years had too little snow; others, too much. In Labrador, climate change was experienced rather than debated. "I used to be able to clean two fish in the ocean before having to warm my hands," said one local in Nain. "Now I can clean four."

The unpredictability was the worst element. Regular sea ice routes that had always been safe in the past could no longer be trusted. Neither could people rely on technology from further south to lend a hand. The Canadian Ice Service, for example, does not produce ice charts in winter, because its role is to help ships, not snowmobilers. Scientists have tended to focus on the big picture, not the local experience—not the number of fish you can clean.

"No one gets promoted at university for measuring sea-ice thickness off an Arctic community," says Trevor Bell. The Memorial University geographer admits that, at first, he had a somewhat clinical approach to Labrador. "I was your typical scientist," he says, "flying in and out of communities."

Originally from Ireland, Bell chose to do his postgraduate work in northern Labrador, studying the more than 100 remnant glaciers that still cling to shadowed cirques in the Torngat Mountains. With money for Arctic research proving scarce, Bell worked in Newfoundland for more than a decade, studying how changing landscapes affect communities and human movement. When climate change and the problem of unpredictable sea ice brought the funding back to Labrador, Bell "returned as a different geographer, more community focused."

Bell developed two elements of technology to study the now-erratic sea ice. The first was a stationary ice sensor—essentially a long cylinder with protruding, temperature-sensitive nubs called "thermistors," which is inserted into the ice like a giant thermometer. The lower third of the cylinder records the temperature of the water; the middle third that of the ice; and the top third protrudes like a periscope, registering the temperature of the snow and air. Once a day, a battery-powered SmartBuoy sends a signal of these various temperatures to a satellite. This data is converted into graphs displaying sea-ice thickness—an easy conversion, because of the considerable difference in temperature between water, ice and air—and beamed to a website that is accessible to anyone.

The second device, a kind of ground-penetrating radar, sends out electromagnetic signals that register the difference in electrical conductivity between sea water and sea ice. (It doesn't work on lake ice, since in that case ice and water have the same conductivity.) Placed on a kamutik—a wooden sled—behind a snowmobile, Bell reasoned, the apparatus would provide a mobile, real-time reading of sea-ice depth as the snowmobile moves around—a SmartKamutik, as it came to be called.

Get SMART

Inuit, of course, have always had their own ways of testing the safety of sea ice. "If you can give three smacks with a harpoon without breaking through, the ice is safe to walk on," says Derrick Pottle of Rigolet, Labrador. "Five smacks, it's safe for snowmobiles." Experienced hunters like Pottle can even tell from the sound the harpoon makes if the ice is good.

Bell's idea was not to replace such time-honoured knowledge, but rather to add tools to the modern sea-ice traveller's kit. Young people may spend less time on the land than previous generations, but they

Securing the SmartBuoy

can navigate flawlessly around an iPad, so an online portal can shorten their path to knowledge. The technology could even serve elders like Pottle, who has lost four snowmobiles through the ice over the years .

This thinking was the beginning of SmartICE—**S**ea-Ice **M**onitoring **A**nd **R**eal-**T**ime **I**nformation for **C**oastal **E**nvironments. After successfully testing prototypes in Nain, Labrador, and Pond Inlet, Nunavut, SmartICE received both encouragement and funding when it was a co-winner of the 2016 Arctic Inspiration Prize *[full disclosure: Pinnguaq was the other winner that year. —eds.]*. A year later, it won the United Nations Momentum for Change Award, and last year, the Governor General's Innovation Award.

SmartICE currently employs 13 people, including grassroots workers in each community serviced by the technology, who drive the SmartKamutiks and set up (and remove at the end of each season) the stationary SmartBuoy sensors in potentially unstable areas.

In 2020, SmartICE went online. Now, after each SmartKamutik run or daily SmartBuoy measurement, the sea-ice readings appear automatically on SmartICE's partner site, siku.org *[see page 9 for more on SIKU—eds.]*, for each of the communities involved.

Sea Ice Through the Seasons

While freshwater ice starts off as a thin pane of glass that thickens gradually, sea ice freezes in a more complicated way because of its salt content. Needle-like frazil ice crystals form when the water temperature reaches -1.5°C. These cluster into a greasy grey film, which eventually thickens into nilas—a rubbery membrane that is totally unlike freshwater ice. Even when it's safe to walk on, nilas flexes spookily beneath you like a waterbed. As a ski glides forward, sometimes ripples even pass through the flexible ice.

Eventually, this rubber ice thickens and becomes white and rigid. For the first several months, sea ice retains its salt content, so it is not drinkable. On early-season journeys, some prehistoric Inuit carried chunks of iceberg ice on their kamutiks for drinking water. But by late winter, enough salt has leached out that sea ice is potable.

Even where there is smooth, landfast ice, a tidal zone of rough ice guards the shore. The width of this band of ice blocks depends on the magnitude of the tide and the depth of the water at the shoreline. Small tides around cliffs may produce an almost negligible tidal zone. But in shallow areas where there are high tides, such as near Iqaluit in Nunavut or Kangiqsualujuaq in Nunavik, the tidal barrier is vast, chaotic and as difficult to pick through as a large field of overturned furniture.

Near the floe edge—where firm sea ice meets open water—ice can break off as a result of currents or storms, and this is always a hazard for hunters. Many have perished when the ice they were on broke free and drifted out into the open water of Baffin Bay. On the island on which Igloolik is located, it is said that if the parkas of all the men who have been lost on the ice were laid side by side, they would reach from Igloolik to the mainland.

As spring advances, melt pools form on the ice, although secure ice rests beneath the shin-deep water. This melting occurs from April in southerly regions like Labrador through early June in the High Arctic. Meanwhile, thinner ice near shallow shores melts, forming a lead of open water that is difficult for travellers to bridge to the secure ice that lies beyond.

Eventually, the melt pools drain through seal holes, leads and cracks in the surface of the ice. Snowless due to warmer temperatures that have yet to affect the sea ice, this frozen surface makes for excellent travel for a time. However, the pools thin the connections between the drier areas of ice. Eventually, they break apart to become free-floating ice floes, which may still be up to a metre thick—solid enough to stand on, but with only open ocean between them.

As summer progresses, the floes drift, shrinking, breaking up into smaller pieces and sometimes melting altogether. In this warmer era, first-year ice usually disappears entirely. But in the past or during a rare cold summer, some floes remain when the fall freeze-up sets in. This evolves into multi-year ice, whose sharp peaks have melted into rounded knolls. Multi-year ice used to be prominent in the High Arctic and the Arctic Ocean, but it has now largely disappeared.

Tidal ice (top) and first-year ice in the final stages of melting (bottom)

Calibrating the SmartKamutik

Although still in its early stages, the SIKU site is rich and rewards exploration. For example, the default view on the right-hand panel is a topographical map of the region selected. But clicking the drop-down menu gives a choice of satellites, each of which imparts its own view. Particularly useful are Sentinel 1, an infrared view that shows rougher ice as grey and smooth ice as black; and Sentinel 2, which, on clear days, gives crystal-clear photos of the sea ice from orbit, showing the precise location of patches of open water and obviously weak ice. For those who may be less well-versed in digital navigation, colour printouts of these views will be posted in community centres such as post offices and grocery stores.

North to Nain

With its distinctive angry-bee sound, the Twin Otter reverses its props as it touches down on Nain's dirt airstrip. I have come to witness the deployment of northern Labrador's first SmartBuoy. My visit was supposed to have taken place much earlier, but it has been another of those winters that are becoming all too familiar. While it has been cold enough—perhaps because of the warmer, four-fish water, perhaps due to something else—the sea ice has been slow to form. Even at the end of January, it had not been safe. This was the latest anyone could remember it freezing. Now, in late February, the open ocean looms disturbingly close, especially near Nain and Natuashish. On the flight in, patches of open water, known as "rattles" in Labrador, stood out like eyes on the white ice.

Ice, and the lack of it, are not the only topics of conversation along the coast. More than one person comments that there has been so little snow, they haven't needed snowshoes to go "wooding"—gathering firewood. The snow is barely ankle deep. Meanwhile, the winter before, so much early snow had fallen that it hindered ice formation. Every year, it seems, something is screwy.

After settling in, I go to the SmartICE office and meet Rex Holwell, the northern operations head. After 14 years working for the Voisey's Bay mine, Holwell, 45, wanted a new challenge. Not only does he manage SmartICE in Nain—the practical centre of the project, with St. John's as its administrative headquarters—but he also travels around the Arctic, training operators and introducing the technology to other communities. In a few days, he is flying to Kinngait, Nunavut. So many towns want to adopt the technology that there is a waiting list.

The main part of the SmartICE office is a simple workshop where the SmartKamutik components are stored and the SmartBuoys are assembled. The walls are adorned with a

To access the **SmartICE information with a tablet or computer on the web,** hover the cursor over the SmartICE button in the left-hand panel of the SIKU dashboard.

mixture of tools and encouraging homilies. Trevor Bell had not wanted the technology he developed simply exported here from Mississauga or Shenzhen. Instead, four young people in Nain were trained for six weeks on how to put the buoys together. The latest group assembled seven: one for Nain, the rest bound for other partnering communities. (To keep up with the demand, some are now assembled in St. John's.)

Holwell also teaches the trainees, aged 18 to 30, first aid and soft skills such as writing résumés and cover letters for job applications.

While this community involvement is not directly related to making sea ice safer for travel, it is a vital part of the broader SmartICE mission. Of the youth who went through Holwell's first edition of the training program in 2019, two moved on to study at a college in Goose Bay. Another works full-time at Voisey's Bay.

The SmartBuoy we are to deploy was assembled here in Nain by SmartICE trainees. It lies on the long workshop table, about three metres long and weighing almost 70 kilograms. It consists of two long plastic cylinders joined in the centre. At one end, encased in the watertight plastic compartment, 16 D-cell batteries power the unit. Small metal studs, 60 in all, erupt from the plastic cylinder every two centimetres. These are the thermistors, hooked up to a motherboard contained in the housing. Each SmartBuoy costs in the range of $20,000, most of that for the custom-molded plastic tubes. The SmartKamutik instrument costs significantly more.

On the floor, in a long wooden box, lies a device Bell likens to bat sonar. Consisting of two long tubes, fused in the centre by a metal box, it is lashed to a kamutik behind a snowmobile, and gives real-time readings of the thickness of the ice it travels over. It has no batteries, as it is powered by the snowmobile. A small, tablet-sized LCD screen attaches to the handlebars of the snowmobile and displays graphic readings of ice thickness, similar to what will later appear on the SIKU site. The SmartKamutik instrument costs just a little more than a SmartBuoy. By the end of this winter, 19 Arctic communities will have one.

In the evening, Holwell briefs the Nain Town Council on SmartICE. Reasonably, they want to know who is paying for it all? The town? The Nunatsiavut Government? Newfoundland and Labrador? The feds? It seems to be a mix of all arms of government. Part of SmartICE's mandate is to find sources of funding to make the project sustainable.

Farther south, Canadians often think of cold as something to endure. But in the north, the ice season is everyone's favourite time of year.

Holwell announces that, as of this week, everyone is able to check out the SmartICE ice data for themselves on SIKU. They also discuss at length where to moor the buoy. For the future, the idea is to plant several—the Council is interested in four more, to begin with—in well-trafficked areas where the ice has been problematic in recent years. However, it would be best not to place them in unstable ice that might break up without warning. Although the buoys float and GPS indicates their position for retrieval, grinding ice might still damage them, despite their formidable, waterproof plastic housing.

In the end, they decide to moor their buoy about 40 kilometres east of Nain, near some small rattles. Many hunters come to this area, because seals like these small, nutrient-rich areas of open water. And everyone likes seal—boiled, fried and raw.

Upon hearing Holwell's presentation, I wonder about the usefulness of the buoys versus the kamutiks. The SmartKamutiks can go anywhere, including those places where the buoys are moored. They provide readings of ice thickness over dozens of kilometres at a run. Meanwhile, the buoy sits in one spot, in solid ice. It is mainly in mid-spring that it might indicate thinning to

the point of danger. For the cost of the four extra SmartBuoys Nain was considering, they could pay a couple of young trainees to drive a SmartKamutik on all the regular routes several times a week. From the perspectives of economics and safety, the SmartKamutiks seem to offer more value, even at the higher price.

However, a stationary sensor in the same place every year, gathering daily data over a period of several months, will indicate whether the ice is thinning overall, and so has both scientific and safety applications. And as the SmartBuoys are built in Nain, while the SmartKamutik technology is not, the buoys serve SmartICE's social enterprise efforts.

By the end of February, the winter sun has gained strength, and an air temperature of -17°C does not feel particularly cold. But on the morning Holwell is to deploy Nain's first home-built SmartBuoy, 70 kilometre-an-hour west winds are ripping over the ice. The ride out, with the wind at our backs, will be OK, but standing around, and especially driving back into the teeth of the wind, will require serious layers.

Joining Holwell for the deployment are three trainees. David Kohlmeister, 30, enjoyed his experience with the initial SmartBuoy program so much that he has come back on the second as a mentor, while Ama Harris, 22, and Suzie Kohlmeister, 21, who helped to assemble this particular buoy, are driving support snowmobiles.

The wind funnels through the islands off the shore from Nain, and little snow covers the flat, nubbly sea ice. This makes for fast going, but the lack of a snow-padded surface is hard on the snowmobiles.

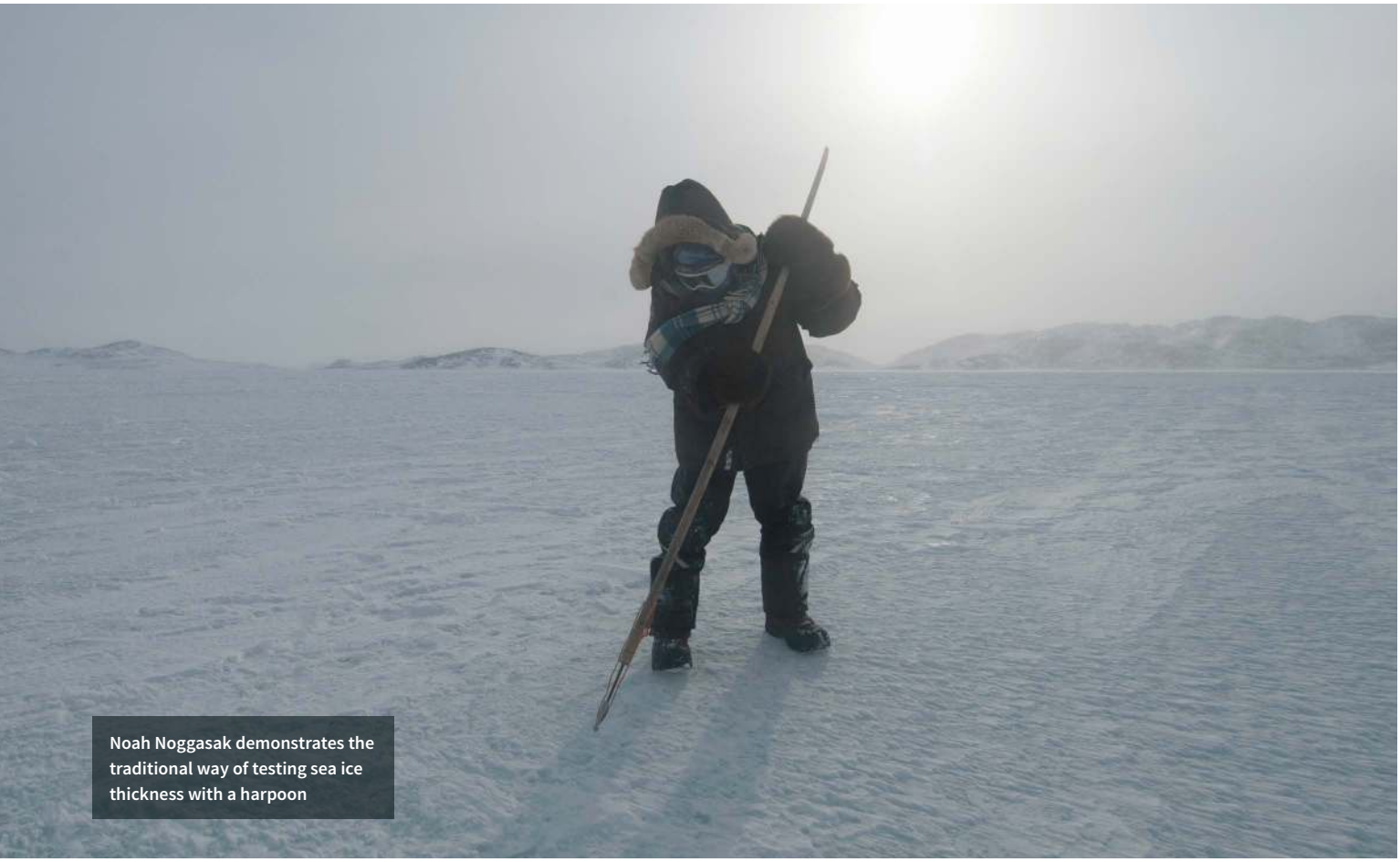
When we first touch sea ice, Holwell fires up the SmartKamutik's sensors. Later, we stop a second time and drill a small hole in the ice to make sure the sensors have been properly calibrated. The radar reading of the ice's thickness comes within two centimetres of a manual tape measure: all is well.

After about an hour, we reach the designated site. The open water, less than a kilometre away, is invisible because of the ground blizzard. Holwell drills two holes, side by side, with a battery-powered auger. Then Kohlmeister chisels away the ice between them. Together, they insert the SmartBuoy in the hole. It sinks, bobbing a little at first, and eventually leaves a little less than a metre of the tube protruding above the ice. Holwell wedges it firmly in place with foam blocks. Done. Across the Arctic this spring, 22 new SmartBuoys will undergo similar initiation.

Farther south, Canadians often think of cold as something to avoid or to endure. But in the north, the ice season is everyone's favourite time of year. It's when travelling and hunting are easiest. "White men think of ice as frozen water, but Inuit think of water as melted ice," the great Inuit explorer Nukapinguaq once said. "To us, ice is the natural state."

Even today, of the 51 communities in the four Canadian Inuit regions, 48 are on the coast. "That tells the value of sea ice to us," says Derrick Pottle.

But whether that surface will persist is in serious doubt, especially in more southerly regions like Labrador. With the climate crisis, the greatest danger is not a slow, linear decline in the thickness of sea ice,



Noah Noggasak demonstrates the traditional way of testing sea ice thickness with a harpoon

or an incrementally shorter season every decade. It's what scientists call a tipping point: when climate change crosses an invisible line and precipitates a sudden cascade of events—an unforeseen shift in ocean currents, for example.

Even without telltale numbers, the tipping point is a palpable threat to the traditional Inuit way of life. When a four-fish sea water temperature becomes six- or eight-fish temperature, the sea might be simply too mild to create ice that is safe for travel. Or it might freeze for only a couple of weeks each winter, making a $20,000 snowmobile a poor investment. Parts of the Canadian Arctic might soon go the way of areas of western Greenland, where year-round fishing has replaced sea-ice culture.

In the meantime, these new tools to monitor sea ice, together with traditional knowledge, will extend this way of life as long and as safely as possible. "SmartICE will definitely help," says Pottle, "but I need to be smart out there, too." &

Nain, Labrador

Although people have lived in Labrador for at least 8,000 years, almost since the retreat of the last ice sheet, Nain is both the northernmost settlement on the Labrador coast and the oldest still in existence. The Moravian Brethren, a sect of German missionaries, founded Nain in 1771, largely thanks to the diplomatic help of an Inuit woman named Mikak.

At first, the Inuit did not take kindly to European interlopers. In 1606, John Knight was slain when he landed near the site of Nain to repair his ship. And in 1752, when the Moravians first tried to establish a settlement named Hoffenthal near present-day Makkovik, they were killed by Inuit.

A Moravian named Jens Haven, who had already conducted missionary work in Greenland, believed the Brethren's cause still had potential in Labrador, and enlisted Mikak to aid in smoothing the way. A gifted woman, Mikak first met Haven in 1765. She was interested in the culture of the newcomers, learned English, and it seems she was not even disillusioned when she was kidnapped and taken to England as a curiosity, as were so many Inuit in that early settlement era. She forged royal friendships, had her portrait painted, and, later, when she returned to Labrador, advocated on behalf of the Moravians.

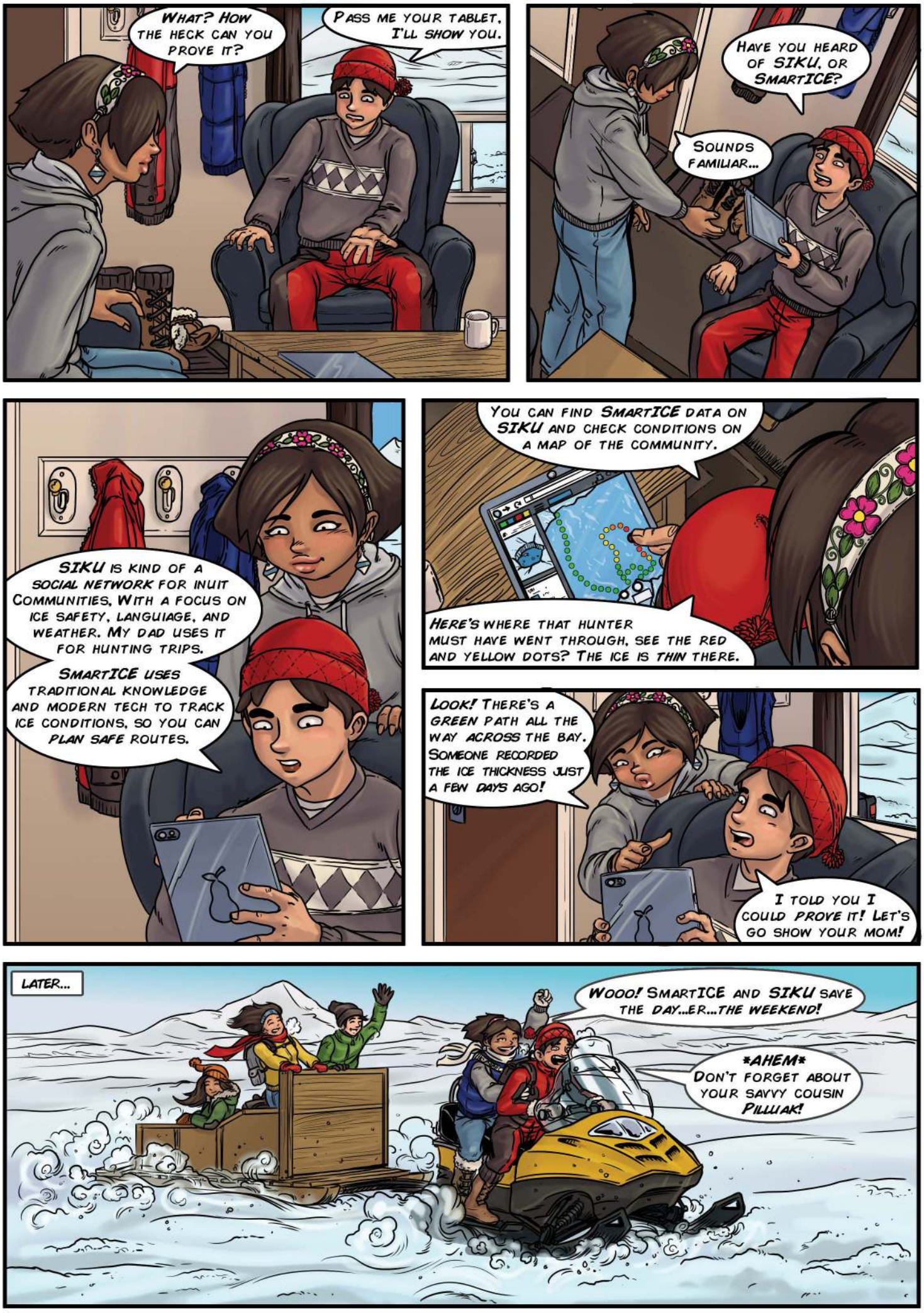
Named after the biblical village in Galilee, Nain was the first of several missions along the Labrador coast. Those Inuit who disliked the subtle (and not-so-subtle) pressures within these missionary settlements moved north to the Torngat Mountains to live as nomads and follow their own spiritual traditions.

Well into the 20th century, there were Moravian communities farther north than Nain. Then, in 1918, the ill-named supply ship Harmony introduced the Spanish flu, which decimated the towns of Okak and Hebron. Okak was shut down; Hebron survived until 1957, when, in an attempt to centralize access to institutional services, the colonial government shuttered it and forced its residents to resettle in towns to the south.

When the Inuit regional government of Nunatsiavut was established in 2005, Nain became its administrative capital. Still 600 kilometres north of the nearest road, the town is serviced by small planes, as well as a coastal ferry in summer and seasonal snowmobile routes in winter. Although Nain is only as far north as Edinburgh, the cold North Atlantic current makes Labrador the most frigid place in the world at its latitude. While trees linger around Nain, the Arctic tundra is not far away.

A license plate mural in Nain, Labrador (bottom)


bytesized
Sanak! Sanak! Guess what?
My cousin finally learned how to knock? Oh, wait...
Very funny. No, Tomson, Janah, and Deena are all going to Sirmilik Park this weekend.
You want to come?
Oh, I'd love to, Pilluak, but there's no way my mom will let me go. A hunter went through the ice last week and now she's all freaked out.
With the sea ice becoming so unpredictable, she doesn't want me anywhere near the bay.
Hmmm... that is a problem...
Aha! What if I can prove the ice is safe?


WHAT? HOW THE HECK CAN YOU PROVE IT?
PASS ME YOUR TABLET. I'LL SHOW YOU.
HAVE YOU HEARD OF SIKU, OR SMARTICE?
SOUNDS FAMILIAR...
SIKU IS KIND OF A SOCIAL NETWORK FOR INUIT COMMUNITIES, WITH A FOCUS ON ICE SAFETY, LANGUIAGE, AND WEATHER. MY DAD USES IT FOR HUNTING TRIPS.
SMARTICE USES TRADITIONAL KNOWLEDGE AND MODERN TECH TO TRACK ICE CONDITIONS, SO YOU CAN PLAN SAFE ROUTES.
YOU CAN FIND SMARTICE DATA ON SIKU AND CHECK CONDITIONS ON A MAP OF THE COMMUNITY.
HERE'S WHERE THAT HUNTER MUST HAVE WENT THROUGH, SEE THE RED AND YELLOW DOTS? THE ICE IS THIN THERE.
LOOK! THERE'S A GREEN PATH ALL THE WAY ACROSS THE BAY. SOMEONE RECORDED THE ICE THICKNESS JUST A FEW DAYS AGO!
I TOLD YOU I COULD PROVE IT! LET'S GO SHOW YOUR MOM!
LATER...
WOOO! SMARTICE AND SIKU SAVE THE DAY...ER...THE WEEKEND!
AHEM DON'T FORGET ABOUT YOUR SAVVY COUSIN PILLIAK!

Tuk TV: Inuvialuit Youth Take Their Story Global

STORY AND PHOTOS BY DEZ LOREEN

A group of Inuvialuit youth in Canada's High Arctic have a message for climate change deniers across the world: **"It's happening to us!"**

For as long as she can remember, Carmen Kuptana has been travelling across the wind-packed snow of the Beaufort Delta with her family. At the age of 17, she has already seen more of the surrounding area than the animals that call the region home. Using the land to access traditional hunting and fishing grounds, Carmen says it's becoming easy to spot the changes in the environment around her.

"We still go to the same places, but it's [for] like less and less time each year," she says.

Tuktoyaktuk is located in the Northwest Territories, on the coast of the Beaufort Sea. One of six communities in the Inuvialuit Settlement Region, it was a hub for oil and gas activity in the 1970s. Fewer than 900 people call it home, and they are all seeing the obvious changes to the land.

Just down the road from where Carmen lives is her cousin Nathan's house. As is the case at many households in Tuk, snow has drifted over the old snowmobiles in his yard. But Nathan is always ready to hunt when the call comes.

Nathan says his hunting trips take longer than they used to, due to changes in the ways he can travel. Warmer weather patterns mean shorter ice seasons. Some channels and rivers are no longer accessible.

"It's becoming harder to predict the weather at certain times of the year," he says. The people of the region aren't the only ones affected by the changing lands and weather conditions: Nathan says the migration patterns of local animals have also been shifting—another reason his family needs to travel farther out to hunt.

Each of the seasons has been changing; Nathan watches to see how the animals are affected.

"We see it all over—like, we are getting salmon around Tuk now," he says. He explains that trout and char are the fish typically found around the community. Salmon wouldn't usually be found this far north.

Many things are changing.

Top to bottom: Nathan Kuptana, Darryl Tedjuk, Carmen Kuptana (L), Eriel Lugt (R)

The Start of Something New

Historically, the Inuvialuit have shared their stories orally within their communities. But in recent years, northern society has seen a shift to sharing knowledge with a wider audience, through video and online outlets. Both Carmen and Nathan are interested in learning new skills and sharing their stories, so, when Tuk's Mangilaluk School offered an opportunity to learn filmmaking, they jumped at the opportunity.

The cousins were joined by a few youths from around town, and what started as a school-based media program soon grew into a full video workshop aimed at teaching young people technical skills in camera operation, video editing and interviewing. Darryl Tedjuk and Eriel Lugt were two of the others who joined together to form a new art collective. Working with the help of visiting professionals Maeva Gauthier and Jaro Malankowski, they found a name—Tuk TV.

Now that these talented young minds were gathered together and had defined a purpose, they needed a direction.

"We started by identifying issues and problems we see in our community," Nathan explains.

They identified a few social issues as possible topics—like microplastics in the ocean and cultural differences—but the one

that they all agreed would come first was climate change.

With the help of Gauthier and Malankowski, the collective learned how to operate cameras, capture proper sound levels, conduct interviews for documentary films, and edit and produce a short doc.

For Eriel Lugt, who is also 17, the workshop provided some much-desired technical background, to complement her growing interest in photography and art.

"I've always liked taking pictures, so learning how to edit was really fun," she says. Once the group finishes their current projects, Eriel plans to take her new interests and expand her work to tell her own stories from her perspective. "I want to show the beauty of other places and learn more about journalism."

Once the youth had started to learn new techniques, they found they wanted to meet more and more, to take in as much information as possible. They began meeting a few times a week during the last spring session of their school. When classes were done for the summer, they met even more often.

In late 2019, *It's Happening to Us* screened during the COP25 United Nations Climate Change conference in Madrid.

In order to get the shots they needed for the documentary, which they had decided to call *It's Happening to Us*, the group needed to get a better view of the whole region. Before long, they found themselves flying over Tuktoyaktuk and the coast of the Beaufort Sea in a helicopter.

"I got to see different parts of the land I didn't see before," Carmen said about the experience.

Learning from researchers and other professionals in the field was one of the more hands-on elements of making the film for the group, as they saw the slumping effects of erosion firsthand. Not all the information on the changing conditions of the land came from academia, however, as many of the stories they tell in the documentary come from local elders who have spent their lives travelling in the region, and who shared their traditional knowledge for the project.

Northern Exposure

It's Happening to Us has already brought Tuk TV international success. In late 2019, the filmmakers were invited to screen it during the COP25 United Nations Climate Change conference in Madrid. The trip to Spain was unforgettable—Eriel said it was the farthest she had ever travelled, and that she enjoyed seeing more of the world.

"Our families were very proud that we showed our film there, and it showed multiple times," she said.

The group insists that, even though the film has been screened, it is still not complete. There are plans to expand the 20-minute version into a feature-length documentary, and to include more stories from across the Inuit region. Tuk TV has already been in contact with other youth across the Arctic who share similar stories.

This project, and the workshop that started it all, are just the beginning for this group of bright young minds from the coast of the Arctic Ocean. The experience has left all of them with an invigorated sense of motivation to do big things in their lives, and empower their own communities.

Carmen and Eriel agree their new skills will help make them better leaders in their community.

"I see kids who don't care, but I want us to live how we used to," says Carmen. "I want more youth to get into hunting and speaking our language." Carmen wants to tell stories about the Inuvialuit way of life, to promote it to others, but also to those who live in her community. "I just want to make a difference, and I think filmmaking is a good tool for that," she says.

Nathan, meanwhile, sees a future for himself in journalism and will take his new interests as far as he can. "I want to bring this filmmaking further," he says. "I see myself at the CBC or something."

For Darryl, the workshop is a way to grow his leadership skills and use them in his hometown to strengthen his relationship to his culture. "I see myself as a leader here," he says. Looking over the harbour from his house, Darryl says the traditional ways are still very important to him and hopes he can continue his way of life, while using his new confidence and ability to tell stories in ways only he can.

For now, the group has returned to their studies to finish off another year at Mangilaluk School in Tuktoyaktuk—but only time will tell where their next projects take them.

Tuk TV is ready for action. &

Inuvialuit of the Western Arctic

Up in the Northwest Territories, scattered across the Beaufort Delta, are the six communities of the Inuvialuit Settlement Region. Two of these—Sachs Harbour and Ulukhaktok—are on islands, while Paulatuk, Inuvik, Tuktoyaktuk and Aklavik are on the mainland.

Originally from what is now Alaska, the Inuvialuit made their home on the coast of the Arctic Ocean. Each community has a distinct style of clothing and dance, with dance groups consisting of members of all ages.

The dances are tied to stories that have been passed on from generation to generation. Each song accompanying the performances describes activities or events in the community. Hunting, fishing and whaling are all recurring subjects.

Inuvialuit carving is a staple of northern art. Many contemporary carvers use soapstone, because its softness makes it easy to shape. Today, a large number of carvers come from families who have been practising the art for many years.

There are three dialects of the Inuvialuktun language, and efforts are being made to continue their use in each community through the education system and in collaboration with local elders and government bodies.

Hunting is still a significant element of traditional life, with many young people living on the land, and owning and operating businesses that showcase Inuvialuit culture.

Arctic sports are popular; locals hold competitions as well as gatherings to stay strong and to teach youth about the games that have been passed down for generations.


Bearanormal Activity
OH HEY, INTERNET'S BACK!
COOL, YEAH. MY MOM JUST EMAILED ME SOMETHING.
SAY HI TO HER FOR ME.
SURE, WILL D-
OH NO!!!
WHAT!!!
BIG NEWS AUSTRALIAN WILD FIRES!
ALL KOALAS R GHOSTS NOW!!!
LOOK AT ALL THESE PHOTOS, AND THIS BIG MAP? IT'S ALL ON FIRE!
SCARY!
OH MY
LOOK AT ALL THOSE LITTLE GHOSTS, THEY WERE JUST MINDING THEIR CUTE BUSINESS! OH, I WANTED TO PET ONE EVENTUALLY-
WAIT A SEC.
HUH?
IT'S AN IMAGE SHE SENT?
YA.
GIMME YOUR PHONE.
KAY.
PASS


IT'S SCARY, BUT HM, SOMETHING'S NOT QUITE RIGHT.
THIS LOOKS CONVINCING, BUT NO ONE ELSE IS REALLY TALKING ABOUT IT.
OH HEY... YEAH. LET'S SEARCH IT.
ARE ALL KOALA BEARS GHOSTS NOW?
?
...
...
WHAT DOES IT SAY?
"WHILE THE WILD FIRES IN AUSTRALIA ARE VERY SEVERE THIS YEAR, ALL KOALAS ARE NOT, AS RUMOURED, GHOSTS, AND THE FOOTAGE VIEWABLE ONLINE IS FROM A 1995 MOVIE."
OH THANK HEAVENS!!
I WONDER WHY SHE SENT IT TO ME IF IT'S NOT REAL?
SHE WAS PROBABLY UPSET LIKE WE WERE!
THERE'S A LOT OF STUFF FLOATING AROUND ONLINE, NEXT TIME I'M GOING TO LOOK AROUND A LITTLE AND SEE IF IT'S TRUE.
GONNA LOOK UP A FACT-CHECKING SITE OR SOMETHING. LOOK, WIKIPEDIA HAS A BUNCH LISTED. MAYBE I'LL START THERE.
GOOD IDEA.
I WAS GOING TO LOSE IT ABOUT THOSE BEARS, YOU KNOW?
ME TOO!
YOU KNOW THEY AREN'T REALLY BEARS THOUGH, RIGHT?
LET'S FACT CHECK IT AND SEE!
KC

RACE FOR CHANGE

Learn about what is causing the climate crisis and how we can work to prevent it.

RULES

YOU'LL NEED

- 2 or more players
- Buttons or playing pieces
- Coin

HOW TO PLAY

- All players put their pieces on START. Youngest goes first
- Flip a coin.
  HEADS moves +1 space
  TAILS moves +2 spaces
- Squares with + move forward
  Squares with - move back
- First player to FINISH wins

https://www.canada.ca/en/services/environment/weather/climatechange.html
https://pm.gc.ca/en/news/news-releases/2019/06/10/canada-ban-harmful-single-use-plastics-and-hold-companies-responsible

STEAM Education in **Curve Lake First Nation**

STEAM Gikinoo'amaagowin O'shkiigmong Maa

BY JACK HOGGARTH • CULTURAL ARCHIVIST, CURVE LAKE FIRST NATION

Traditionally recognized as Wabaskamag or O'shkiigmong, Curve Lake First Nation is a Michi Saagiig Anishnaabeg community in southeastern Ontario. The community prides itself on preserving its unique dialect of Anishnaabemowin (i.e., the Ojibwe language), along with its diverse traditions and ceremonial practices. Over the past 100 years, Curve Lake has faced many challenges, including, but not limited to, transmitting its language and ceremonies to the younger generations, maintaining its cultural identity—and, of utmost importance, protecting its territorial lands and waters in perpetuity for future generations to enjoy as those before them have. Unfortunately, through various legislation and government-sanctioned projects, our lands and waters have drastically deteriorated.

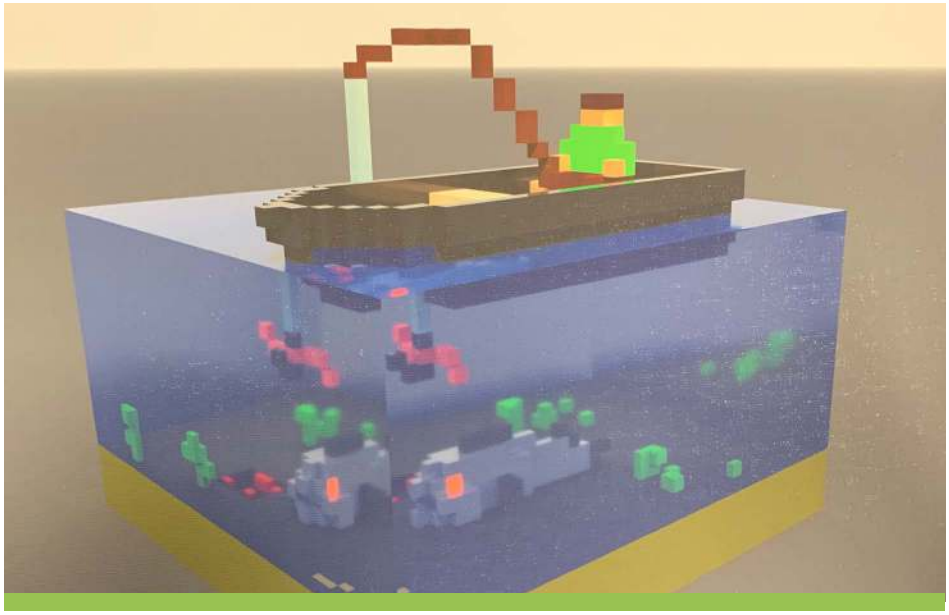
During a two-week camp hosted by the Pinnguaq Association and Curve Lake First Nation with the help of the Ontario Trillium Foundation (OTF), the state of the bodies of water that surround us was portrayed by young people using a variety of art media. Over the course of the camp, youth from our community were involved in several computer-related programs that relate to STEAM education. The predominant theme expressed in the artwork the youth produced was directly linked to the degradation of the water systems throughout Curve Lake territory.

One hundred years ago, our lakes were so pristine that our Elders remember drinking from their waters. With the increase of tourism in the region, the water quality started to deteriorate. During hot summers, we cannot even swim in the lakes, due to various pathogens and algae blooms. Curve Lake First Nation has been under a boil-water advisory alert for the past 50 years: we have to outsource clean drinking water, even though the municipalities that surround us have access to it.

Throughout the images that were created by Curve Lake youth, the socio-political aspects of the state of the water within our territorial lands will become apparent. As Michi Saagiig Anishnaabeg, we have been tasked with acting as the natural stewards of this land. But ask yourself this question: How can we all come together and work collaboratively and in unison to ensure future generations can enjoy this water as we have done in the past? After all, without water, all life as we know it would perish. It is extremely unfortunate that today's youth must face this issue, but this is the harsh reality we are leaving our future generations to deal with if we do not do something about it now.

Curve Lake First Nation and Pinnguaq are currently in the process of developing a makerspace that will utilize the components of STEAM education to educate our youth in the knowledge of these subjects. We are certain we will be giving young people the tools and resources that will allow them to combat the cultural and environmental issues in the near future, as they are the leaders of tomorrow. &

~ Ni Kina Ganaa – To All My Relations ~



Voxel art created by Tomson Knott

Digital Kit

We have developed additional digital resources for educators to use in their classroom including lesson plans, video tutorials and handouts. They can all be accessed online at the following links.

Video Series

Our Cover: Using MagicaVoxel and Krita • Page 10
Create comics with Krita
pinnguaq.com/learn/krita-for-comics

Video Series

Another Dimension • Page 12
Video tutorials to get started with Blender and learn how to navigate and apply its tools for the purpose of designing a custom set of dice for printing in 3D
pinnguaq.com/learn/blender-print-a-piece

Lesson Plan

Our Cover: Using MagicaVoxel and Krita • Page 10
Create voxel art with MagicaVoxel
pinnguaq.com/learn/creating-voxel-art-with-magicavoxel

Resource Kit

Inuit Principles of Conservation • Page 40
The resource kit with handouts and additional support material can be found on our website
pinnguaq.com/root-stem

Message to Educators

Inuit Principles of Conservation

Avattimik Kamatsiarniq • Respectful Stewardship

The modules that follow provide you and your students with opportunities to explore Inuit values and cultural beliefs. We hope they will also allow you to explore the diverse value and belief systems your students bring into the classroom. Inuit say that the purpose in life is to live a good life. The information presented here will help you begin to make meaning of Inuit expectations for living a good life, especially in a changing environment where we face new challenges on many fronts.

Inuit Elders say that although the context we live in is always dynamic, our beliefs never need to change, and this is why it is so important to clarify values for youth. Inuit also say their teachings are helpful to anyone, and are not just for Inuit. With this in mind, we hope you will explore these Inuit understandings of how to live well in a dynamic world and that, in doing so, they will help you and your students set personal goals as agents of change in effectively meeting life's challenges in order to live a good life.

– Shirley Tagalik

Module 1
Inuit Values

Grade Level: 1 to 3
Subjects: Science, social studies, health, language arts

Topic: Setting expectations for becoming respectful stewards

It is important to recognize that the Inuit worldview is highly holistic. As such, its topics resist organization according to curricular subject divisions. The units presented here are cross-curricular in nature and aim to provide an understanding of **Inuit Qaujimajatuqangit** (worldview—IQ) and how Inuit beliefs and perspectives set the stage for respectful stewardship of all life and the guiding principle of **avattimik kamatsiarniq**. A short PowerPoint document is provided as background (visit **www.pinnguaq.com/root-stem** to access the PowerPoint in the Resource Kit).

Introduction

Students will learn that **the values we hold help to determine the way we live our lives.** Therefore, it is important to examine our understanding of our values, as well as the beliefs that underpin them. Our values are usually set and reinforced by the teachings of our parents. To Inuit this is known as **inutsiaqpagutit**. These teachings provide lifelong expectations for our behaviour.

Learning Goals

Students will understand that **a value is a belief.** They will begin to examine the values that are most important to them, and to understand how holding these values has an impact on their behaviour. Values, therefore, are critical to building personal character.

Vocabulary

- **Inutsiaqpagutit**—That which enables you to have a good life

Guiding Questions

- **What do I believe?**
- **How do I behave according to my beliefs?**

Curriculum Links

This is an interdisciplinary unit of study suitable for a thematic approach to learning about values, the self, social expectations and interactions, and the impact our values have on who we become and what we choose to do in life.

Materials Needed

- Outline of a child PDF (visit **www.pinnguaq.com/root-stem** to access this PDF in the Resource Kit)
- Inutsiaqpagutit statement (visit **www.pinnguaq.com/root-stem** to access this PDF in the Resource Kit)
- IQ Principles Large Size Posters (visit **www.pinnguaq.com/root-stem** to access this PDF in the Resource Kit)
- Printable Inuit Values booklet and value cards (visit **www.pinnguaq.com/root-stem** to access this PDF in the Resource Kit)
- Game board spinner, empty bottle or something similar

Activity 1: Introduction

Provide each student with the outline of a child and have them use it to create a self-portrait. As much as possible, students should include accurate details. While they are working, circulate and ask each child to provide some words that describe what they would like to be known for. Write these words around the drawing. Encourage students to find words that indicate positive characteristics such as kind, helpful, a good friend, etc.

Have the students share some of the words that are written on their papers with their classmates.

Ask:

- **How did you become** ...(kind)**?**
- **Why do you think you are** ...(kind)**?**
- **What things does a** (kind) **person do?**
- **How do we learn these things?**

Explain that our parents often tell us how they want us to become. They might say things like: *"Don't fight if you want to have friends"*

Ask: **What are some things you have heard your parents say?**

Inuit call these teachings **inutsiaqpagutit**. Parents say the things they want a child to remember over and over so that the words of the parents will always be in the child's mind.

Some examples of inutsiaqpagutit:

- *If you want to be happy, forgive others*
- *If you want to avoid trouble, never talk about another person behind their back*
- *If you want to have friends, always look for ways to help others*
- *If you want to have things, share what you have first*

Give each student a copy of the blackline master for inutsiaqpagutit. Have them fold it in half. Each child should think of their own inutsiaqpagutit. On the left side, they should illustrate the goal: **If you want to ...** On the right side, they should illustrate the behaviour required to reach the goal. Circulate and help students write their inutsiaqpagutit sentences.

When completed, these can be posted and reviewed each day as a reading activity. Remind students that these inutsiaqpagutit refer to ways we all want to behave. Have them contribute examples of these behaviours that they have observed in the classroom or school that day. Celebrate those who are meeting the goals for behaving well.

Activity 2: Computer Project

Provide a link to the Inuit Societal Values posters. Have the students look through the posters and select between three and five they like best. Discuss what they like about the illustrations. What do they think value means?

Have them print the value cards that match the posters they have selected as their personal values to explore.

Activity 3: Using Personal Values

Have the students sit in a circle with the Inuit Value cards face down in a single pile in front of them. One student is designated the spinner. Using an old game-board spinner, a bottle, or even a pencil, the spinner spins the object and the student to whom it points when it comes to rest selects the top value card and reads it aloud. They should then do one of the following:

- **Explain what this value means to them**
- **Identify how they demonstrate this value in life**
- **Tell about a time when they used this value**
- **Ask others in the group to tell the others what they think is important about this value**

Conclusion

What is important to me?
Have each student refer to their selected values to develop a poster or collage that describes why these particular values are important to who they are. Encourage students to bring digital photos to help illustrate and personalize their posters.

These can be used to create large wall art, or become personalized booklets or short PowerPoint presentations that can be looped, shown and used for reading activities for the entire class.

Additional Resources

Different Ways of Teaching Values:
www.tandfonline.com

The Virtues Project provides similar resources: **www.virtuesproject.com**
Note there is a fee to access this article.

Teaching Core Values. Getting Smart.
www.gettingsmart.com/2017/07/teaching-core-values

Helping Your Student Identify Their Values:
www.edutopia.org/blog/helping-your-students-identify-their-values-maurice-elias

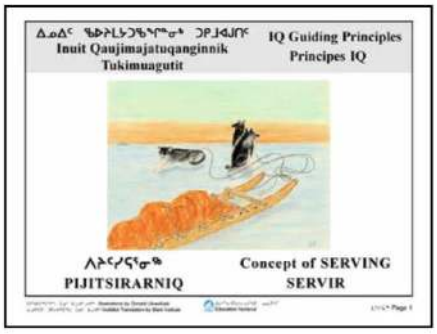
The *Stories of Tuktu* Series.
National Film Board of Canada.
onf-nfb.gc.ca/en/our- collection/series/?ids=170648&nom=The%20Stories%20of%20Tuktu
This series of films documents Inuit family life and interactions before forced relocation moved families off their land.

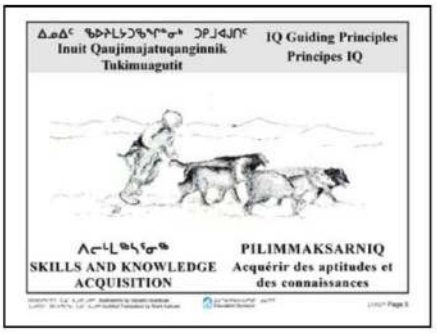
Social Media Resources

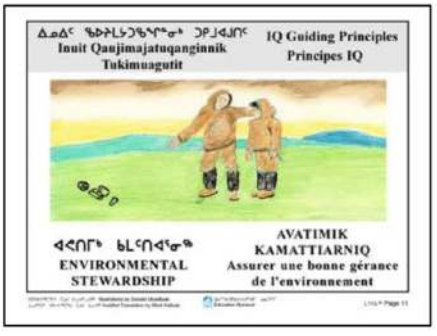
The class could create its own closed chat where students can share their selection of values or examples of how they are applying those values in their lives. Parental permission may be required depending on school policies.

Suitable closed sites might be:

- **WhatsWhat.me** (2011) Age7+ ...
- **Yoursphere** (2009) Age 9+ ...
- **Franktown Rocks** (2009) Age 10+ ...
- **GiantHello** (2010) Age 10+ ...







Module 2
Serving Others

Pijitsirniq—Serving others, working for the common good

Grade Level: 4 to 6
Subjects: Science, social studies, health, language arts

Topic: Respecting authority and accepting responsibility

It is important to recognize that the Inuit worldview is highly holistic. As such, its topics resist organization according to curricular subject divisions. The units presented here are cross-curricular in nature and aim to provide an understanding of **Inuit Qaujimajatuqangit** (worldview—IQ) and how Inuit beliefs and perspectives set the stage for respectful stewardship of all life and the guiding principle of avattimik kamatsiarniq. A short PowerPoint document is provided as background (visit **www.pinnguaq.com/root-stem** to access the PowerPoint in the Resource Kit).

Introduction

Students will learn **the Inuit perspective on serving others through pijitsirniq** and how this is linked to the concept of **becoming a respectful steward in life through avattimik kamatsiarniq.** Inuit are known as a resilient people who live in harmony in a harsh environment through innovation and resourcefulness. Students will understand how **living according to these cultural principles has helped Inuit to succeed over generations**, as well as to protect the environment they depend on for successful living.

Learning Goals

Students will understand **the Inuit described concepts of avattimik kamattiarniq** (respectful stewardship), **pijitsirniq** (serving) and **qanurtururangniq** (being resourceful and innovative). They will gain insight into the cornerstones of **being respectful** and **taking responsibility in terms of serving a shared purpose and the common good.**

It should be noted that the spelling of Inuit terms often differs according to dialectal differences. The concepts remain shared despite spelling differences.

Vocabulary

- **Avattimik kamattiarniq**—stewardship
- **Pijitsirniq**—service/responsibility
- **Qanurtururangniq**—creative/deep thinking
- **Panangitsuq**—resourcefulness
- **Akaujumiiqatigiinniq**—maintaining harmony

Guiding Questions

- **How do the beliefs and principles you are raised with help to determine your behaviour and the decisions you make?**
- **Why is the ability to be resourceful and innovative important to success in life?**

Curriculum Links

This unit of study lays the groundwork for understanding Inuit perspectives on environmental stewardship. It is interdisciplinary and suited for use in social studies and science classes. It is best incorporated into an integrated thematic approach to environmental stewardship, socially responsible action, and citizenship.

Materials Needed

- Elements of Inuit Culture handout (visit **www.pinnguaq.com/root-stem** to access this PDF in the Resource Kit)
- Inuit Laws information – avattimik kamattiarniq and pijitsirniq (visit **www.pinnguaq.com/root-stem** to access this PDF in the Resource Kit)
- Inuit Societal Values (ISV) poster, available at **www.gov.nu.ca/information/inuit-societal-values**
- ISV handout (visit **www.pinnguaq.com/root-stem** to access this PDF in the Resource Kit)
- Assessing Inuit Life charts handout (visit **www.pinnguaq.com/root-stem** to access this PDF in the Resource Kit)

Activity 1: Introduction

A) Exploring Inuit Societal Values
Provide each student with the Elements of Inuit Culture handout. Have them work on this task in groups of two or three.

• • •

The first task is to identify all the aspects of social life that Inuit have to consider. Students should write their ideas inside the first circle.

Ask: **What would Inuit have required in the past in order to live well together? What systems do we have in our communities today that help us live well together?**

Provide an opportunity for students to share their ideas. They can add comments to their circles that they have not already recorded.

• • •

In the second circle, students should identify all the resources Inuit would have had in their environment in the past to help them provide for their daily needs.

Ask: **In the past, what things were available to Inuit in the environment that they could use to meet their needs?**

Provide an opportunity to share ideas. Add any new ideas to the circle.

Ask: **When we think about the environment Inuit lived in, did they have many resources available?**

Ask: **Having so few resources at hand, how do you think Inuit would have taken care of their environment?**

• • •

Move to the third circle. Students should think of all the things Inuit were able to do with the limited resources available to them in the past.

For example, they built igluit using snow blocks. How did they build sleds without

wood? What else were they able to do so they could hunt and live well in their environment? Record these ideas in the third circle.

Provide an opportunity to share ideas. Add any new ideas to the circle.

Ask:

- **In order to be able to survive and live well, what skills would Inuit have needed?**
- **How important would it have been for people to share their abilities and help each other?**
- **Given what we see in the three circles, can you predict what some of the core beliefs or expectations for Inuit might have been?**

List these on chart paper. Compare the students' ideas with the Inuit rules for avattimik kamattiarniq identified by Elders (see below).

Avattimik Kamattiarniq—Stewardship

Careful attention to the environment is an important part of survival and sustainability. The care we take and the importance we give to this stewardship also has an impact on our personal health and well-being. For these reasons, it is important to think about the environment we provide for future generations to grow up in.

We also need to think about how we train them to become good caretakers of their surroundings and good contributors to a healthy and positive environment. Over the course of our lives, we are interdependent—on each other, on animals, on the weather, on the water, on the land. Encourage children to notice things around them at all times—changes in the weather, the movement of animals, the changing seasons.

Discuss what it means to be a good steward with the students.

Some suggestions for these discussions:

- Set expectations about how we treat the land, the animals and each other. Remember: we are interdependent
- Watch everything that goes on around you carefully so you will have a better understanding of it
- Make people feel welcome when they come into your home, school or community
- Never tease or harm animals or people. Do not cause suffering for any reason
- Never waste or destroy the land, plants or animal parts. Never destroy a friendship
- Always leave a place clean so no one would know you had been there
- Carry out your non-biodegradable garbage. This includes plastics, cans, diapers and other garbage that cannot be reused, recycled or composted
- Clean up around your house, playground, school and streets. Never litter
- Never let things that have not come out of the water sink in it. The water is home to many creatures
- Don't waste water in the house or at school
- Don't tear up the land with machinery. Stay on trails as much as possible
- Never spill gasoline into the water or onto the land

Teachings from the past

Long ago, the land was kept clean so the animals would have secure and safe migration routes. Even bones were not to be disposed of in the water. The health of fish was always a consideration. In order to ensure that the fish thrive, the water was always to be kept clean.

Areas of land used for long-stay camps were left to rest before a group would make use of them again. For example, the land had to be allowed time—usually at least a year—to get rid of the scent of humans before people returned for another stay. Bones were gathered and placed in one area before leaving the camp.

Ittuqtarniq or **anijaarniq** is a daily routine for young children during which they observe the weather early in the morning. This experience can provide the first steps toward becoming environmental stewards. If we fail to be keen observers, we will be less able to adapt to conditions that are always changing.

Pijitsirniq—Training children to serve others

Pijitsirarniq is the concept of serving others. The degree to which one demonstrates pijitsirarniq in life indicates a personal level of maturity and wisdom. It is taught from a very early age and applies to almost every aspect of life. This powerful concept provides guiding principles for raising children, as well as for how adults are valued by the group. Each person has a contribution to make and is valued according to that contribution.

Inuit children have always been expected to serve others willingly. Serving means doing something for someone else. This is taught throughout childhood. Inuit have always been encouraged to be good servants to others. Serving a neighbour often meant offering something for them to use. This involves forward-thinking vision, recognizing that the benefit of sharing what one has available may not come immediately but rather later, when it is needed. Ongoing, genuine concern for other people is a way of life. Serving others means to lead others with a vision that will benefit your neighbour through putting aside your own interests for the sake of helping someone else.

Character is developed over time as part of the pijitsirniq process. The activities we rely on when first beginning to develop pijitsirnaq in our children might appear to be unrelated to the core value, but this is because we begin with activities that are at the initial stages of development. As children become more skilled, and as attitude and character develop, the activities are more and more directly related to the core value. For this reason, it is important for parents and teachers to pay attention to the process of instilling pijitsirarniq in children.

We hope the following ideas will help:

- Don't allow children to laze around. Give them tasks to accomplish
- Expect children to do their tasks very well and always do their best
- Expect children to notice when something needs to be done and to act without being asked
- Expect children to do jobs when asked even if they are boring or messy
- Provide opportunities for children to show respect and love for others
- Give children responsibilities, especially caring for others

- Encourage children to do these things without expecting to be rewarded. Remind them that by doing these tasks well, they are showing love and respect for others and will be recognized throughout their lives as good people

B) Exploring Inuit Societal Values (continued)

Display the ISV poster in the classroom. The poster shows the societal values that have been identified by Inuit as valuable. Investigate what each one means in order to understand what is important to ensuring Inuit live well together. Have the students form eight groups and assign each group a value to investigate. Provideach group with a Defining Terminology sheet for the specific value and an ISV blackline master. The task is to report back on their assigned value by describing what the value means. Students should predict why this would be identified by Inuit as a core value by answering these questions:

- **Why is this idea important to Inuit society?**
- **What social expectations come from this societal value?**

Use the ISV handout to record the students' ideas.

Activity 2: Computer Project

Go to **www.inuitcontact.ca**. Have the students investigate the Inuit artifacts presented there to get ideas of the kinds of things Inuit made with the resources they had available. Have students select one artifact to report on. They should copy the photo of the artifact, and list all the materials that were used to create it and what technologies would have been required to produce this object. Each student should be prepared to report back to the class on their selected artifact.

Conclusion

Assessing Inuit Life: Provide the chart handout for assessing how successful Inuit were at meeting their basic needs in the past. The chart can be on paper, or on a tablet or computer. Have the students work in small groups to collaborate—piliriqatigiingniq—and provide responses—aajiiqatigiingniq—in the chart. They should define how Inuit were able to provide shelter, clothing, food, transportation, heat, tools and weapons for themselves, describing all the skills that would have been required and the beliefs necessary to sustain this kind of cooperation.

Additional Resources

The Resourcefulness of the Inuit.
Case, R. and Daniels, L., eds. Critical Challenges Across the Curriculum Series. British Columbia Ministry of Education. 2002. ISSN1205-9730
Excellent learning resource directed at Grades 4 to 6. Highly recommended for more detailed teaching about Inuit.

The *Stories of Tuktu* Series
National Film Board of Canada. Available at **onf-nfb.gc.ca/en/our- collection/series/?ids=170648&nom=The%20Stories%20of%20Tuktu**
This series of films documents Inuit family life and interactions before forced relocation moved families off the land.

ISUMA Inuit Studies Reader.
Robinson, G., ed. Isuma Publishing, 2004. ISBN 0-9733297-0-X Exploring Inuit Cultural Curriculum. Teacher Resource Guide. Flynn. **www.isuma.tv/store.ca**

Teach Your Kids About the Inuit People.
Available at **www.thecanadianhomeschooler.com**
Some information and short lesson plans.

Learning with Inuit.
Available at **www.rom.on.ca**
Interactive kit with artifacts, videos, lessons and teachers' guide.

Native Americans, Inuit Peoples.
Available at **www.ducksters.com**
Short, basic overview of traditional Inuit culture.

Deepening Knowledge. Inuit Perspectives.
Available at **www.oise.utoronto.ca/deepeningknowledge/ Teacher_Resources/First_Nations_Metis_and_Inuit/Inuit.html**
Links to National Film Board of Canada videos and other resources.

First Peoples, The Inuit of Canada.
Corriveau, Danielle. Minneapolis: Lerner Publications Company, 2002. ISBN: 082254850.
Describes aspects of the way the Inuit lived in the past and how they live today—their spirituality and legends, transportation, and forms of entertainment—and how political changes have affected them.

The Gift of the Inuksuk.
Ulmer, Mike. Toronto: Thomson Gale, 2004. ISBN: 158536214X.
A story about how the Inuksuk helped the Inuit harvest caribou.

Through Mala's Eyes: Life in an Inuit Community. Available at **www.aadnc-aandc.gc.ca/DAM/DAM-INTER-HQ/STAGING/texte-text/ ach_lr_ks_rrds_mala_1302786861588_eng.pdf**

A Comparative Look at Inuit Lifestyle. Available at **www.learnalberta.ca** › content › ssognc › inuitLifestyle

Explore Our Culture, the Inuit Impact, Inuit Inventions at **www.icor.inuuqatigiit.ca**
Suitable for student research.

Social Media Resources

Nunavut Hunting Stories on Facebook

Inuit Societal Values

INSERT Values poster here

Why is this idea important to Inuit society?

What social expectations come from this societal value?

Module 3
Becoming Capable

Inunnguiniq/Pilimmaksarniq—Becoming a capable human

Grade Level: 7 to 9
Subjects: Science, social studies, health, language arts

Topic: Defining expectations of competency and capability in caring for others in life

It is important to recognize that the Inuit worldview is highly holistic. As such, its topics resist organization according to curricular subject divisions. The units presented here are cross-curricular in nature and aim to provide an understanding of **Inuit Qaujimajatuqangit** (worldview) and how Inuit beliefs and perspectives set the stage for respectful stewardship of all life and the guiding principle of **avattimik kamatsiarniq**. A short PowerPoint document is provided as background (visit **www.pinnguaq.com/root-stem** to access the PowerPoint in the Resource Kit).

Introduction

In the past, Inuit had to ensure that everyone in their community was capable and able to contribute their skills to help sustain and improve the lives of others. **Inunnguiniq** is the process used to train everyone to become capable members of the community. Being capable required that **each person was a contributing member of society with a strong sense of both belonging to and responsibility for the collective.** At the same time, each person was expected to become highly skilled, self-reliant and able to live in a way that would not cause concern for others. The process of training a community member to become capable relied on the aspects of **having the correct sense of group belonging, and on mastering skills in order to assist the collective.**

Learning Goals

Students will be able to describe the processes of inunnguiniq and pilimmaksarniq and how the dynamics between these contributed to forming a capable human being. Students will be able to link the goals of inunnguiniq and pilimmaksarniq to the establishment of perspectives of environmental stewardship among Inuit.

It should be noted that the spelling of Inuit terms often differs according to dialectal differences. The concepts remain shared despite spelling differences.

Vocabulary

- **Inunnguiniq**—becoming a capable human being
- **Pilimmaksarniq**—skills acquisition
- **Avattimik kamatsiarniq**—stewardship

Guiding Questions

- **How is inunnguiniq different from Western styles of education or child-rearing?**
- **How do the expectations for becoming successful in life differ between Inuit and Western society?**
- **What Impact do these differences have on the way one views one's place in the environment?**

Curriculum Links

This is an interdisciplinary unit suitable for social studies, wellness and environmental sciences. The focus is on training youth for their role as cultural and environmental stewards.

Materials Needed

For additional support material for this module, visit **www.pinnguaq.com/root-stem**

- Elder quotes—Definitions of Inunnguiniq (visit **www.pinnguaq.com/root-stem** to access this PDF in the Resource Kit).
- Ulu/Sakku Poster (visit **www.pinnguaq.com/root-stem** to access this PDF in the Resource Kit)
- Becoming Capable Quote (visit **www.pinnguaq.com/root-stem** to access this PDF in the Resource Kit)
- Inunnguiniq Childrearing Advice from Inuit Elders pamphlets, ages 12, 13 (visit **www.pinnguaq.com/root-stem** to access the pamphlets in the Resource Kit)
- 6 Foundational Inunnguiniq Principles (visit **www.pinnguaq.com/root-stem** to access this PDF in the Resource Kit)
- Inuit/Western Perspectives handout (visit **www.pinnguaq.com/root-stem** to access this PDF in the Resource Kit)
- Inunnguiniq Principles Poster for the classroom (visit **www.gov.nu.ca/information/inuit-societal-values**)
- Avattimik Kamattisarniq Stories—Inuit-based stewardship (visit **www.pinnguaq.com/root-stem** to access this PDF in the Resource Kit)
- Computer links to Inunnguiniq Principles (visit **inuuqatigiit.ca/quick- links/inunnguiniq-principles/**)

Activity 1: Introduction

A) Becoming Capable
Have students form two lines facing each other. They must put their right foot forward so that their toes touch the toes of the person opposite them. The task is for everyone to raise their left foot without losing their balance. Have them repeat this activity until they are able to keep from falling for 30 seconds.

Once they are successful, ask them to **identify what strategies eventually helped them to succeed.**

Ask: **What could we say are some of the elements for becoming successful?** (Practice, communication, support, thinking/strategizing, learning from our experiences, etc.)

Divide the students into four groups. Give each group a quote from an Elder that describes inunnguiniq (see Elder quotes—Definitions of Inunnguiniq handout). Have the students read the quote, discuss what it says and collaborate to identify three key messages they take from this quote. Share the definitions of inunnguiniq based on each group's responses.

Ask: **Are any of the key messages they identified similar to the things they learned from the Touching Toes activity?**

Show students the Ulu/Sakku poster. It can be displayed as a hard-copy poster or as a digital file on a screen. Ask: **Does anyone know what we are looking at?**

Show the students the outline of the ulu (curved women's knife) and the sakku (harpoon head). Ask: **Why do you think the artist integrated these two tools into a single poster?**

- Discuss the traditional roles of men and women in Inuit society
- Discuss the ulu as representing the home/social relations and the sakku as representing the environment/hunting relations
- Discuss the need for balance between these two sets of activities
- Discuss the idea that the ulu represents becoming a human being (social being) and the sakku represents becoming skilled (a capable being)

Brainstorm these two ideas on a chart. Identify what being a social being looks like on the left-hand side of the paper and what becoming skilled looks like on the right. Ask: **What happens if we have one side developed without equal development on the other?**

Read this Becoming Capable quote to the class. Discuss. "Inuit define a capable human being as a person who is able to achieve skilled independence. By this it is meant they are highly skilled and able to be self-reliant to a level of mastery in certain areas in their life. This self-reliance is balanced by a set of core beliefs and attitudes that ensure the person uses their skills to serve and care for others, and to improve the common good. A capable human being does not cause worry to others in the way they live their life. They support others in every way through care for and service to the community."

B) Exploring Inunnguiniq

Divide the students into two groups. Give each student in Group 1 a copy of the Inunnguiniq pamphlet for 12-year-olds; Group 2 the pamphlet for 13-year-olds. The task for each group is to read the pamphlet and review the information it contains. Each group should respond to the following questions:

1. What do you think is important to focus on in your life based on this pamphlet?
2. How would you summarize the value being defined in this pamphlet?

Instruct the students to jigsaw so that they form triads of one person from each of Groups 1 and 2. Have them share some of the things said in their pamphlet and their group's answers for the two questions.

C) Exploring Pilimmaksarniq

Divide the students into two groups. Within the groups, students should form pairs. Provide Group 1 with the text by Louis Angalik #1, and Group 2 with Louis Angalik #2. (The text is available at **www.pinnguaq.com/root-stem** in the Resource Kit)

Students should read the text and take examples from it to identify some of the differences between Inuit and Western perspectives. Use the blackline master to record their responses. Have the groups come back together and share their insights.

Activity 2

Inuit Elders have identified six principles of inunnguiniq. Using the 6 Foundational Inunnguiniq Principles handout assign each group one principle to investigate.

Each group should follow the online links (see below) that outline a selection of the principles. Each group should review the materials they have been provided and report back to the whole group:

- **What they learned about this principle**
- **Why it is important to healthy development for Inuit**
- **How young people can use these principles to make all our lives better**
- **Three ideas for how they will apply these principles to their lives**

Videos available at:

- **Develop habits for living a good life: https://youtu.be/t26cBc8FKbM**
- **Show compassion, serve others and build relationships: https://youtu.be/lpY4cnicnyE**
- **Recognize the uniqueness of each individual: https://youtu.be/RVpkYAtlGj4**
- **Always take steps to make Improvements: https://youtu.be/qXTQNObzzrQ**

Visit **www.aqqiumavvik.com**. Select Programs and Ujjiqsuiniq Young Hunters. Look through the videos to identify some of the ways Inuit youth are being trained today.

Based on these materials, **what does a capable person look like in Inuit society? What societal expectations might you identify for Inuit youth?**

Conclusion

Divide into four groups and provide each group with an Avattimik Kamattisarniq Story. Have each group read their story and answer the following questions: **How does this story apply to life today? What role does a capable person have in terms of environmental stewardship?**

Additional Resources

Labrador Inuit Through Moravian Eyes. Available at **wayback.archive-it.org/6473/20180403142801/https://resource.library.utoronto.ca/inuitmoravian/**
Comprehensive collection of Moravian archives. Includes both a Teacher and Student Toolkit. The Teacher Toolkit contains teaching modules for Grades 7 to 12.

Taloyoak, Stories of Thunder and Stone. Available at **www.taloyoaknunavut.ca**
Module for Grades 7 to 9 about Inuit beliefs and spirituality.

Arctic Peoples and Archaeology.
An interactive look at Inuit culture linked to archaeological evidence. Available at **http://www.ihti.ca/eng/iht-proj-cd.html**
See especially the theme Ancient Arctic Peoples and the interactive migration activity.

Learning with Inuit.
Available at **www.rom.on.ca**

Social Media Resources

Nunavut Hunting Stories on Facebook

Module 4
Inuit Leadership

Qanurtururangniq—Leadership, innovation and seeking solutions

Grade Level: 10 to 12
Subjects: Science, social studies, health, language arts

Topic: Becoming fit for a changing world

It is important to recognize that the Inuit worldview is highly holistic. As such, its topics resist organization according to curricular subject divisions. The units presented here are cross-curricular in nature and aim to provide an understanding of **Inuit Qaujimajatuqangit** (worldview) and how Inuit beliefs and perspectives set the stage for respectful stewardship of all life and the guiding principle of **avattimik kamatsiarniq**. A short PowerPoint document is provided as background (visit **www.pinnguaq.com/root-stem** to access the PowerPoint in the Resource Kit).

Introduction

The Inuit perspective on leadership is different from the Western one in that it is more about stewardship and taking responsibility than about influence, power or governance. Leadership qualities are identified in children and are nurtured throughout the life of the individual. A leader is considered someone who is willing to do the most unsavoury of tasks in order to serve other people. **Inuit leadership is characterized by willingness to serve the common good without the expectation of recognition or reward. It does not require specific expertise or knowledge; it is rather an attitude of the heart.**

Learning Goals

Students will be able to describe the expectations expressed in the Inuit worldview around **stewardship, environmental responsibility and a respectful relationship with nature.** They will understand **how Inuit apply the principle of qanurtururangniq to prepare individuals for this critical role in life.**

It should be noted that the spelling of Inuit terms often differs according to dialectal differences. The concepts remain shared despite spelling differences.

Vocabulary

- **Qanuqtuurniq**—resourceful
- **Avatittinnik kamatsiarniq**—stewardship
- **Pijitsirniq**—responsibility leadership

Guiding Questions

- **In the Inuit worldview, what are the characteristics of leadership and stewardship?**
- **How are these taught and applied as cultural expectations?**
- **What is the impact on the environment when these principles are not applied?**

Curriculum Links

This is an interdisciplinary unit suitable for social studies, wellness and environmental sciences. Its focus is on the training of youth for their role as cultural and environmental stewards. The unit directs students to consider these roles within the context of global action.

Materials Needed

- *Diet of Souls* DVD. Drumsong Communications. John Houston. Available from **houston-north-gallery.ns.ca/diet-of-souls**. *There is also a short clip available on YouTube-Diet of Souls.*
- Elder quote sentence strips (visit **www.pinnguaq.com/root-stem** to access the Resource Kit for elder quotes)
- Dice
- Qanurtururangniq Reading (visit **www.pinnguaq.com/root-stem** to access Qanurtururangniq reading in the Resource Kit)
- Avattimik Kamattiarniq Reading (visit **www.pinnguaq.com/root-stem** to access this reading in the Resource Kit)

Activity 1: Introduction

A) *Diet of Souls*
Have the students watch *Diet of Souls*. As they view the film, students should take note of the significant beliefs about relationships that are expressed. They should list important points in terms of relationship to the land; to animals; to the sila (environment). Discuss their ideas as a class.

Ask:
- **How does being in close and respectful relationship with nature relate to our responsibilities to the environment?**
- **What does this look like in our community?**
- **How are Inuit and Western beliefs different?**
- **What impact might these differences have on how we treat our environment?**

B) Inuit Elders
Have the class form a circle. (If the class is large, conduct the exercise in smaller circles of up to 14 students.)

Cut out and fold the Elder quote sentence strips and place them in a container in the centre of each circle. Provide a die for each circle. Students take turns rolling the dice. When a student rolls a 6, they select a quote and read it aloud. The student should suggest to the group how the view expressed in the quote differs from a Western cultural perspective.

C) Defining Principles
Divide the class into pairs. Provide each pair with readings #1 and 2—one student in the pair assigned to each reading. The task is to read the texts silently, adding ideas to the columns under the reading that help to show how leadership and stewardship are defined by the passage.

When this task is complete, students should share their responses with their partners. Together, they should add any new ideas. If time allows, sets of pairs can share their responses, or all students can share their ideas with the class.

Ask: **From what you have been learning, how do you think Inuit would define leadership and stewardship? Does this way of looking at the world make a difference in how we live our lives?**

Activity 2: Computer Project

Students should visit the website **www.taloyoaknunavut.ca** and investigate the Elders' interviews about animals, then respond to these questions:

- **What do Elders say about the importance of animals in their lives? Provide quotes to support your ideas.**
- **When you read these kinds of stories, what is the predominant feeling you get from the words of the Elders? Explain why you think this is so.**
- **Does anything you have heard about or discussed so far lead you to think Inuit should change the way they hunt and use the land today? Explain your ideas and support them with examples.**

Conclusion

Have students select a climate action program to investigate. The task is to prepare a summary of the program objectives and activities, and to explain how the program may or may not support positive stewardship among youth.

Suggestions:

- **Youth Action on Climate Change**
- **Youth for Climate Change (UNICEF)**
- **Climate Action 150**
- **Youth Climate Lab**
- **Roots and Shoots Alliance for Climate Education**
- **Nature and Youth Power**
- **Shift Network**
- **Youth Climate Movement**
- **Sunrise Movement**
- **Climate Change Education Partnership**
- **UN Climate Change Learning Partnership**

Additional Resources

Learning with Inuit. Available at **www.rom.on.ca**.

Social Media Resources

Taking It Global Global Youth Action Network Youth For Climate Action/UNICEF

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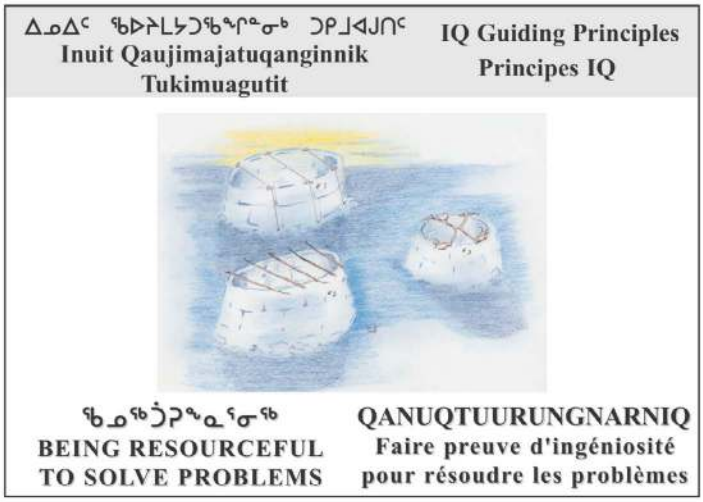
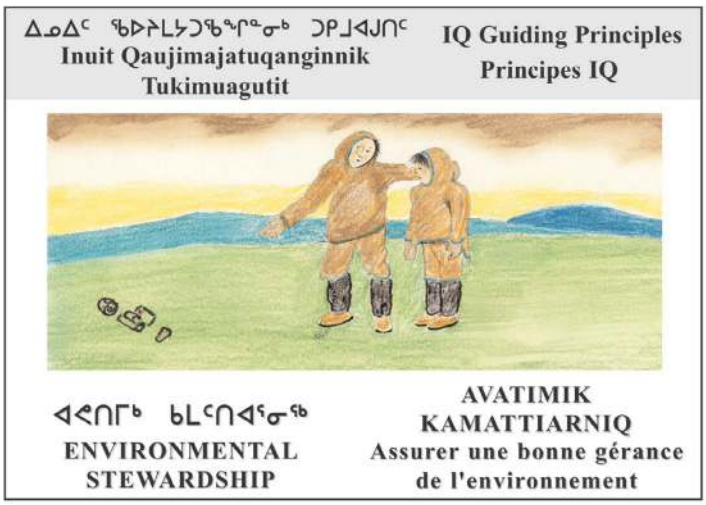
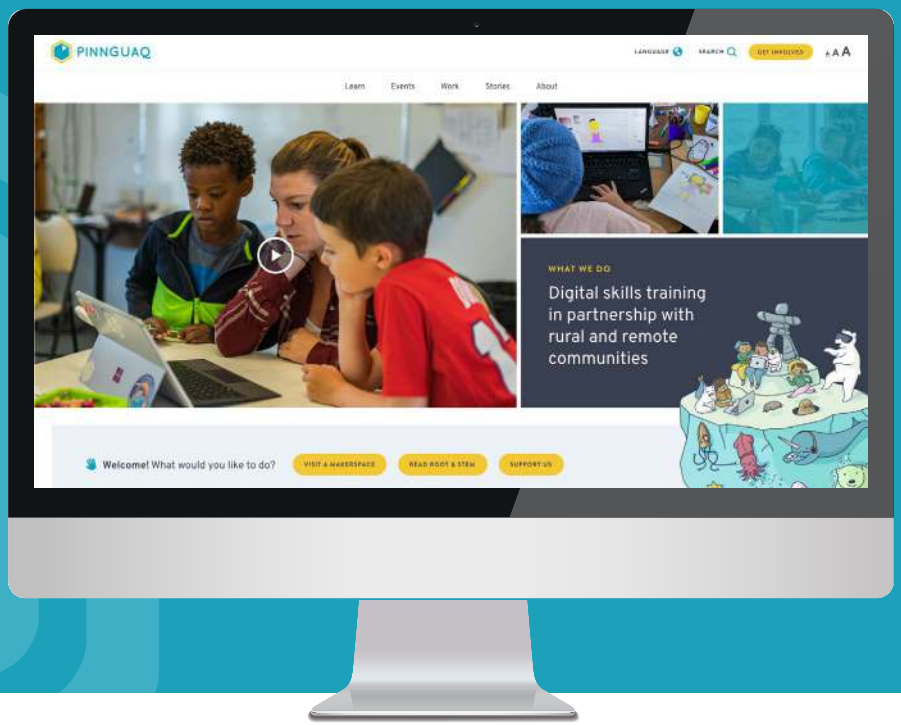




EDUCATOR RESOURCES



LOOKING FOR MORE CONTENT?

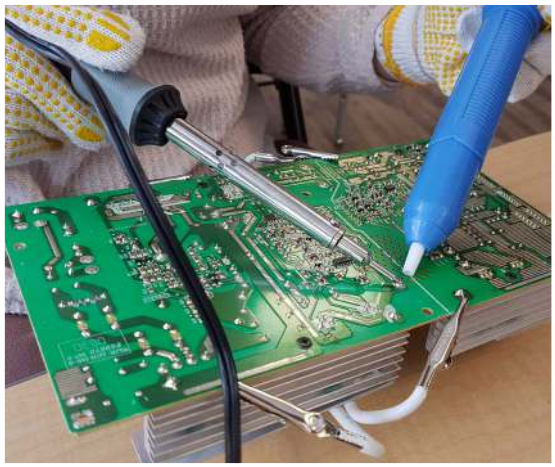
www.pinnguaq.com

Pinnguaq's online learning space encourages educators and students to create and use digital technology to inspire and solve challenges in their community.

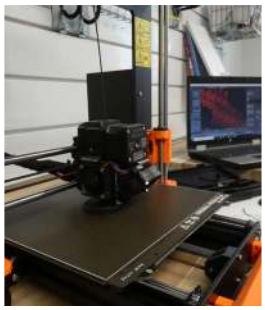
Do you have a resource you would like to share with our community?
Email **STEAM@pinnguaq.com** to share with us.











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www.pinnguaq.com/makerspace