A STEAM Resource for Educators in a Digital World
SPRING 2023 • ISSUE 7

ROOT & STEM

Language and Literacy: Digital Dialogues

LISTENING TO OUR LANGUAGE

Bringing Inuktitut into the spotlight

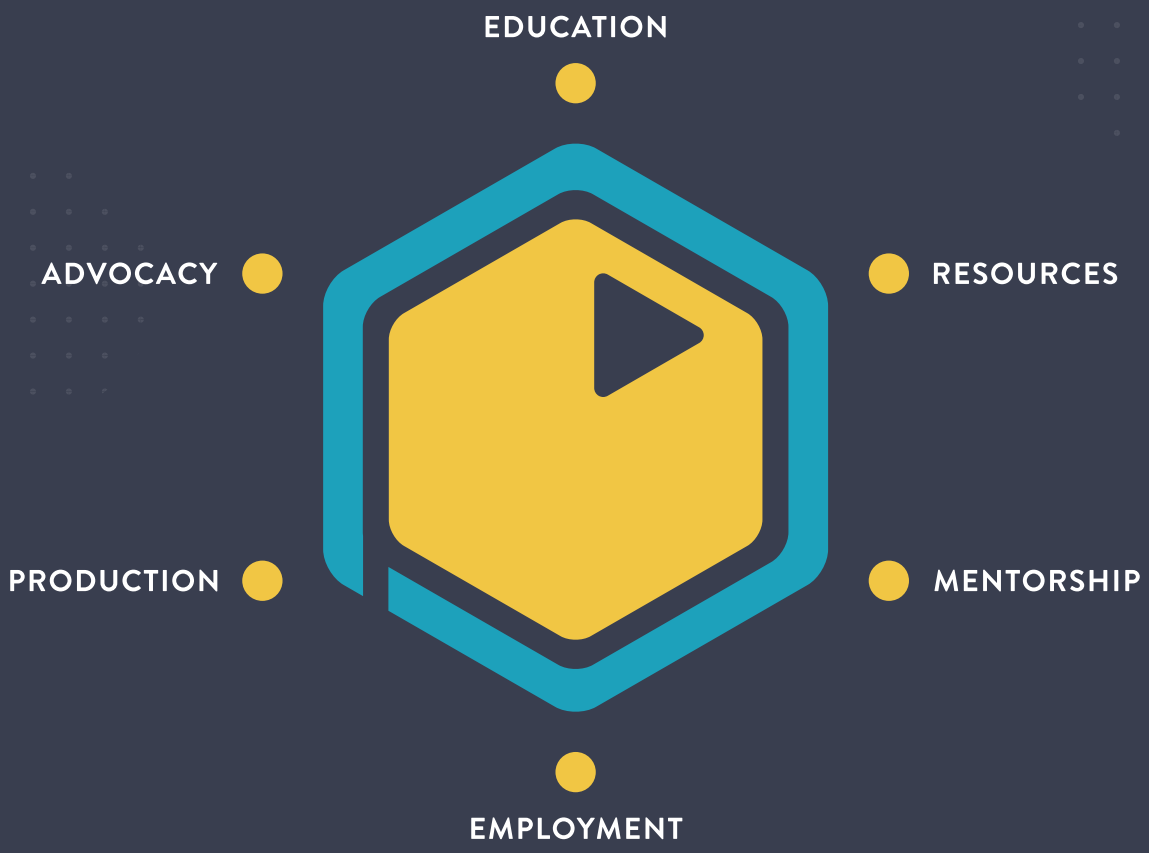
LANGUAGE IS THE ROOT OF STEM

Looking back for a better way forward

FROM ORAL TRADITIONS TO THE DIGITAL AGE

How unique digital initiatives are putting Inuktut on every screen

+ Plus comics, games, and over 10 pages of classroom-ready 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

pinnguaq.com

Contents

Scan Me!

Using a smartphone, open the camera or a QR code scanning app, point it at the QR code as if to take a picture, and hold your phone steady. Tap the notification that pops up and then point the camera at the cover of this issue.

ROOT & STEM

ABOUT PINNGUAQ

The Pinnguaq Association, a not-for-profit organization, incorporates STEAM into unique learning applications that promote storytelling, health, wellness, and growth in 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 areas listed below. Look for the following icons at the end of each article for suggested curriculum connections. *Reference: Learning for the Digital World: A Pan-Canadian K-12 Computer Science Education Framework. 2020.* ***k12csframework.ca***

- CODING AND PROGRAMMING
- COMPUTING AND NETWORKS
- DATA
- TECHNOLOGY AND SOCIETY
- DESIGN

The Pinnguaq Association acknowledges the support of the Government of Canada in developing this educator resource.

Root & STEM is printed on certified Forest Stewardship Council paper, to reduce our impact on the natural world.

Canada

Root & STEM (ISSN 2563-6979) is produced twice yearly by the **Pinnguaq Association**
87 Adelaide St N, Lindsay, Ontario K9V 4L4
STEAM@pinnguaq.com

Printed in Oshawa, Ontario, by Maracle Inc.

Publisher
Ryan Oliver

Editorial Lead
Chelsea Kowalski

Copy Editor
Nicholas Davies

Design & Layout
Stephanie Amell, Emily Canfield, Kelly Eng, Mariana Fernandez, Alyssa Rowe

Cover Illustration
Quinn Hopkins

Logo Design
X-ing Design

Contributors
Ayesha Akhlaq, Stephanie Amell, Olivia Chislett, Jon Corbett, Alina Eyamie, Quinn Hopkins, Inhabit Media & Inhabit Education Books, Meral Jamal, Chelsea Kowalski, Adriana Kusugak, Christopher Martin, Andrew McConnell, Sherisse Richards, Caroline Whittle

Follow Us @**Pinnguaq**

QUINN HOPKINS

Cover Illustration

Quinn Hopkins is a multidisciplinary artist of Anishinaabe, Métis, and British ancestry. He sees his work as a collaboration with technology to perceive the world in new ways, actively seeking out what it means to be a mixed Indigenous person in an increasingly digital world. He hopes augmented reality will connect digital works to the land in a more harmonious manner.

ADRIANA KUSUGAK

Guest Editorial: Inspiring Inu-vation • Page 6

Adriana Kusugak is Executive Director of Ilitaqsiniq in Iqaluit.

CAROLINE WHITTLE

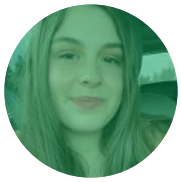
Listening to Our Language • Page 7

Caroline Whittle was born in Iqaluit (formerly called Frobisher Bay), where she resides with her husband and three children, who have really shaped the direction of her life, career, and interests. Caroline's biggest dream is that one day there will be Inuktitut schooling in all the communities in Nunavut, with a curriculum and focus of Inuit culture and heritage.

JON CORBETT

Cree Coding • Page 12

Jon Corbett is an Assistant Professor with Lived Indigenous Experience in the School of Interactive Art & Technology at Simon Fraser University. His research focuses on Indigenous forms of expression through "Indigitalization," which he describes as a computational creative practice that braids together Indigenous and decolonial computing practices facilitated through traditional and computer-based expressive media art forms.



ALINA EYAMIE

When Physical and Digital Worlds Collide • Page 14

Alina Eyamie is a video resource producer with a love of creative design. She is currently studying at Algonquin College, majoring in legal administration. She has a background in graphic design, marketing, and animated resource creation.

CHRISTOPHER MARTIN

Learning the Hodinohsó:ní Language through Gaming • Page 16

Chris Martin works at Six Nations Polytechnic STEAM Academy as its Indigenous Program Facilitator. In this role, Chris is dedicated to helping teachers decolonize education through braiding Indigenous Knowledge with the Ontario Secondary Curriculum, and initiates hands-on learning experiences for students.

OLIVIA CHISLETT

Sivunivut • Page 20

Olivia has lived in Iqaluit all her life. She has a great love for stories and for portraying them in her drawings.

STEPHANIE AMELL

Adventure Research • Page 24

Stephanie Amell is a graphic designer for Pinnguaq. She's had a passion for art and creative writing since she was young. She loves taking her creative writing and ideas and applying them in her designs.

ANDREW MCCONNELL

Language Is the Root of STEM • Page 26

Andrew McConnell is a member of Nipissing First Nation, living in the Toronto area. He is the coordinator for Indigenous education at the York Region Board of Education and has been teaching for almost 20 years. Before becoming a teacher, Andrew worked in media, first at *Aboriginal Voices*, an Indigenous arts magazine based in Toronto, and then at CTV News, where he worked in production for seven years.

MERAL JAMAL

From Oral Traditions to the Digital Age • Page 32

Meral Jamal is a journalist in Nunavut via Ottawa. Originally from the United Arab Emirates, she is a graduate of Carleton University's School of Journalism and a reporter with Nunatsiaq News.

› **Program planning focused on Inuktitut language and literacy in the workplace**

Inspiring Inu-vation

This issue of Root & STEM *explores stories and lessons at the intersections of language, literacy, science, and technology. A collaboration with Ilitaqsiniq, the publication celebrates culturally relevant pedagogies and innovative approaches to bridging STEAM knowledge with language and literacy education. You'll find stories and teachings from artists, educators, and communities engaged in promoting the power of language and making literacy skills a bigger part of STEAM education. From advocating for language revitalization to the use of augmented reality as a literacy tool to the integration of Indigenous languages in the digital world, this issue flips through the intersectional ways that language and literacy are strengthening the way we learn.*

Inuktut, like any language, evolves over time and must adapt to its environment to ensure its survival. Languages need sustenance—speakers, writers, readers, and creators—to continue their existence, just like many living things need water, air, and sunlight. Language is also enriched when it is supported with tools that extend its reach and use. When language thrives, culture is preserved and it blossoms. Language is a thread that connects us to both the past and the future. It allows us to look back on our traditions and where we came from. And it enables us to look forward in a way that keeps our culture vibrant and strong.

Over 20 years ago, Ilitaqsiniq was founded with a goal that still continues to support us today: to support the development of language and literacy skills in Nunavut's official languages. We believe in the right for all Nunavummiut to live and learn in Inuktut and in ways that affirm their culture.

Languages cannot be taught as relics from the past. They must be part of our everyday, modern lives. Ilitaqsiniq takes a holistic approach to our programs and in the ways we work with participants and communities. As a result, we do not separate or silo the aspects of language preservation, literacy skills, and skills development within our programs. Instead, the holistic approach allows

COURTESY OF JAMIE GRIFFITHS/CHICKWEED ARTS

us to braid these three elements to offer a wide range of positive outcomes. Inuit Qaujimajatuqangit has taught us that we must take a holistic approach to our programs to best serve our participants.

That's why we build our programming around the concept of Inu-vation. Inspired by Inuit Qaujimajatugangit (Inuit Traditional Knowledge), Ilitaqsiniq's concept of Inu-vation represents our integrated method of program design and infuses vitality into all our initiatives. While conceptualized into six core elements, the elements of Inu-vation are always realized holistically, as is its impact.

This approach, and its collective benefits, are lived out in our various projects, which are designed for learners of all ages. For us, Inu-vation means ensuring our programming meets our learners where they are and takes a heart-centred approach. Often, this requires thoughtful integration of digital tools and technology to ensure Inuktut and its use remain relevant and active in the modern world. Whether it's interactive literacy games that can be downloaded from an app store, or assembling and installing solar panels in Nunavut communities, we understand that doing our jobs well requires being at the intersection of language and technology.

This is why we're so excited to collaborate on the publication of this issue of *Root & STEM*, and to contribute to the conversation about how and why language and technology need each other to survive.

— **ADRIANA KUSUGAK**
Executive Director, Ilitaqsiniq

For more information about Ilitaqsiniq, please visit **ilitaqsiniq.ca** or follow **@Ilitaqsiniq** on social media.

Listening to Our Language

BY CAROLINE WHITTLE

Top Left: Making a kakivak (traditional fishing spear) in Iqaluit Kuunga.
Top Centre: Learning to clean sealskin in a cultural session.
Top Right: Iqaluit Kuunga.
Bottom Left: Suputiit (Arctic willow) is best picked in September for the wick of the qulliq (stone lamp).
Bottom Right: Participants learning about traditional plant uses in Kimmirut

Born and raised in Iqaluit, I grew up speaking both Inuktitut and English at home. I was always reminded to speak Inuktitut as much as possible as a child. My mother would refuse to speak in English—and still does to this day—unless necessary. When I was younger, I couldn't understand why, but today, I see her perspective clearly, having lived in a world in which Inuktitut is hardly spoken. As an Inuk, I have always been proud to speak my language; simply speaking Inuktitut, however, is not enough. A language requires maintenance by the individual as well as by the community at large.

In 2021, I completed a Certificate in Indigenous Language Revitalization at the University of Victoria. This program explored Inuktitut and Inuit history since we used oral methods of representation and storytelling to the time of colonization, when Inuit were forced to adopt a writing system of syllabics, which is still in use today. This was a place to dig into the roots of our ancestral background and it allowed us to picture the world our ancestors lived in with just Inuktitut as their language. I felt regret that I missed out on an opportunity to thrive in an environment imbued with Inuktitut and even more regret for the next generation who are separated from our language even more. Learning traditional words—that only our Elders knew—was a revitalizing experience that pushed me to preserve what Inuit have and promote what we can learn for the future.

Classrooms are not the only place this kind of learning can be achieved. From 2015 to 2022, I worked with the Parks and Special Places division of the Government of Nunavut. I was a part of the "Learn to..." programming, which held outdoor programs about Inuit culture in the summer and fall in Iqaluit Kuunga (formerly called Sylvia Grinnell Territorial Park). This was the most popular programming, which taught participants the importance of knowing the Inuktitut names of local plants, as well as their

PHOTO CREDIT: JAMIE GRIFFITHS MEDIA ARTS | ARCTIC STOCK

An Elder tending to a fire

medicinal and nutritional uses. The opportunity to pass down this knowledge promoted and preserved Inuit culture alongside our language. Having Elders pass down years of knowledge proven to be beneficial over and over is what brought us here today as Inuit. There is such a hunger to learn from Elders, and in a place like Iqaluit, it's important to make that learning accessible. These outdoor lessons were a way for us to bridge science education, Inuit culture, and language learning. Everything is connected to nature and to science, and this is represented in our language. Everything is connected.

As an educator, I see that there is a real struggle when learning Inuktitut. For a while, the question has been, "What are we doing to change this?" But I believe this question should be: What *aren't* we doing? Those growing up today are facing a very different world than before, even in our own territory. Everything we see and hear is in English first. Support for English-language education, as opposed to Inuktitut, is far greater and publicly acknowledged despite both English and Inuktitut being recognized as the territory's official languages. Our government, our schools, and our community leaders need to push for better representation so we see and hear Inuktitut everywhere. We need to look through an Inuit lens and offer support in getting our language back into the minds and mouths of our people. We need to come together as Inuit educators and leaders to promote our language through programs and courses like those I've mentioned here. The power of learning is something no one can ever take away. We are living in a fast-evolving world, where it can feel like there is no place for our language. We need to speak it anyway—and loudly. Speak it, sing it, read it, write it, use it, and be proud of it. &

"We need to look through an Inuit lens and offer support in getting our language back into the minds and mouths of our people."

TECHNOLOGY AND SOCIETY

DESIGN

DATA

STEAM Engines Run on Books

BY THE INHABIT MEDIA & INHABIT EDUCATION BOOKS TEAM

Science, math, and art are all around us! From animals to technology, there's a lot for students to get excited about. STEAM education has been shown to have many benefits, from enhancing problem-solving skills to encouraging teamwork. So, why not use it to help strengthen students' literacy skills, too?

Incorporating books about animals, nature, storytelling, and Inuit culture into lessons can help reinforce STEAM concepts as well as engage reluctant readers. When students read books about subjects that interest them, they are more likely to stay engaged. Stories can also be a great way to spark a life-long passion for learning about the world.

Check out the amazing Inhabit Education Books and Inhabit Media titles below for some great recommendations, all of which are available in both English and Inuktitut.

A WALK ON THE TUNDRA

By Rebecca Hainnu and Anna Ziegler
Illustrated by Qin Leng
Ages 5–7

Inuujaq, a little girl who travels with her grandmother onto the tundra, soon learns that the tundra's colourful flowers, mosses, shrubs, and lichens are much more important to Inuit than she originally believed. This informative story teaches that Arctic plants have many uses, and the book also includes a field guide with photographs and scientific information about a wide array of plants found throughout the Arctic ecosystem.

ANIMALS & NATURE COLLECTION FROM INHABIT EDUCATION BOOKS

Various authors
Ages 5–12

These books explore the environment, sustainability, and life systems. Many of the titles support science units on the environment, animals, and seasons. They also teach about the Inuit traditional value of environmental stewardship.

ANIMALS ILLUSTRATED SERIES

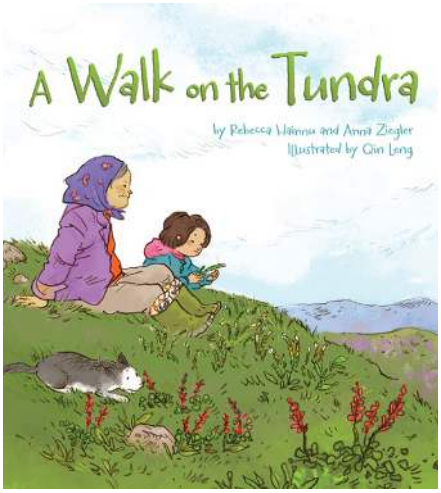
Various authors
Ages 6–8

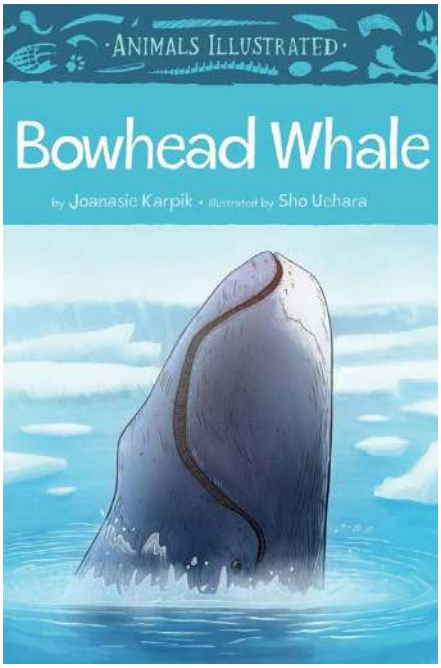
This series mixes fun-filled facts about animals with detailed illustrations and diagrams to create a unique collection of children's non-fiction books about Arctic animals. Each volume contains first-hand accounts from authors living in the Arctic, along with interesting facts on the behaviours and biology of each animal.

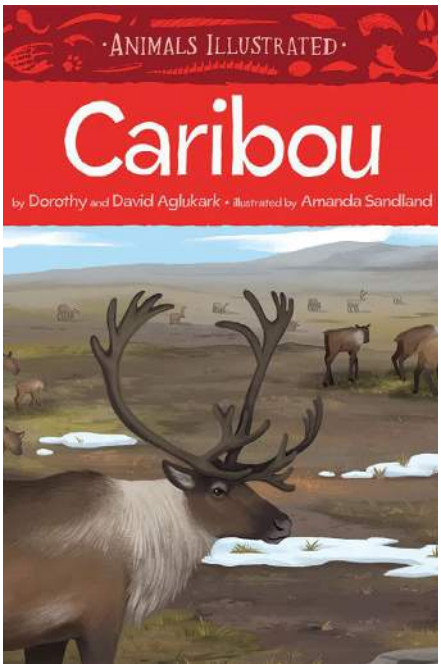
SPENCER THE SIKSIK SOLVES A PROBLEM

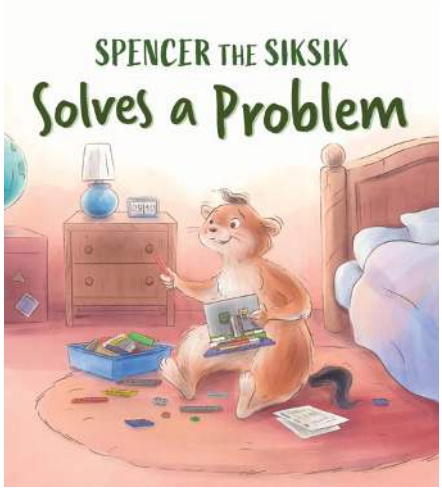
By Nadia Sammurtok and Shawna Thomson
Illustrated by Valentina Jaskina
Ages 6–8

When Spencer's parents won't buy him a tablet holder, he must find a way to keep his tablet upright. This book encourages the skill development of problem-solving and engineering by teaching readers about the Inuit Qaujima-

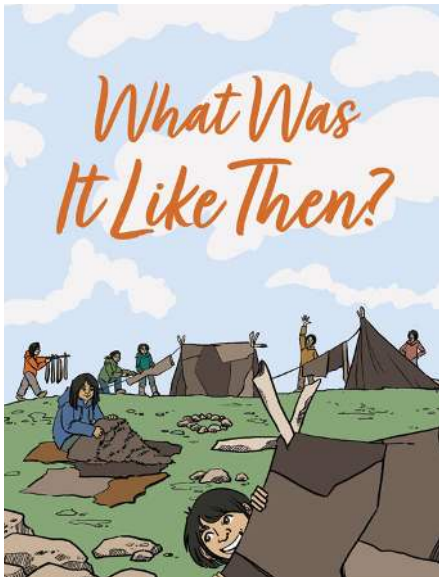








"Incorporating books about animals, nature, storytelling, and Inuit culture into lessons can help reinforce STEAM concepts as well as engage reluctant readers."

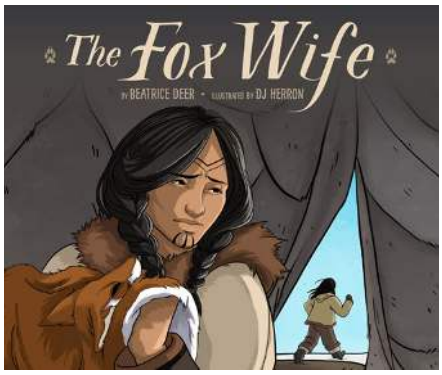


jatuqangit guiding principle of Qanuqtuurniq: being innovative and resourceful. How will Spencer solve his dilemma?

• •

WHAT WAS IT LIKE THEN?
By Nadia Mike
Illustrated by Lenny Lishchenko
Ages 7–9

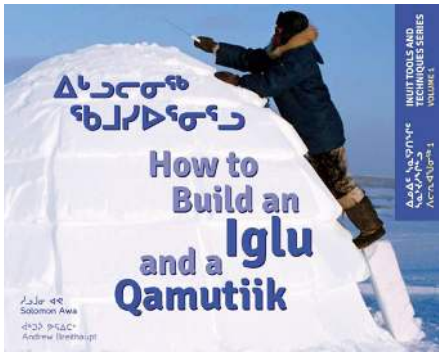
Miali loves spending time with her anaanatsiaq (grandmother)! Anaanatsiaq has lots of stories to share about her past. Miali loves listening to Anaanatsiaq's stories and learning about what life was like long ago.



• •

THE FOX WIFE
By Beatrice Deer
Illustrated by DJ Herron
Ages 7–9

One cloudless night, a fox falls to Earth and comes across a family of humans. As the seasons change and they move their camp, the fox follows them, growing ever more intrigued by human ways—and especially by the oldest son, Irniq. When Irniq grows older and sets out hunting on his own, he is surprised to enter his tent one day and find the lamp lit, the tea made, and a strange woman who says she is his wife. Tired of being alone, Irniq welcomes the woman. But soon he grows curious and cannot stop himself from asking too many questions.



• •

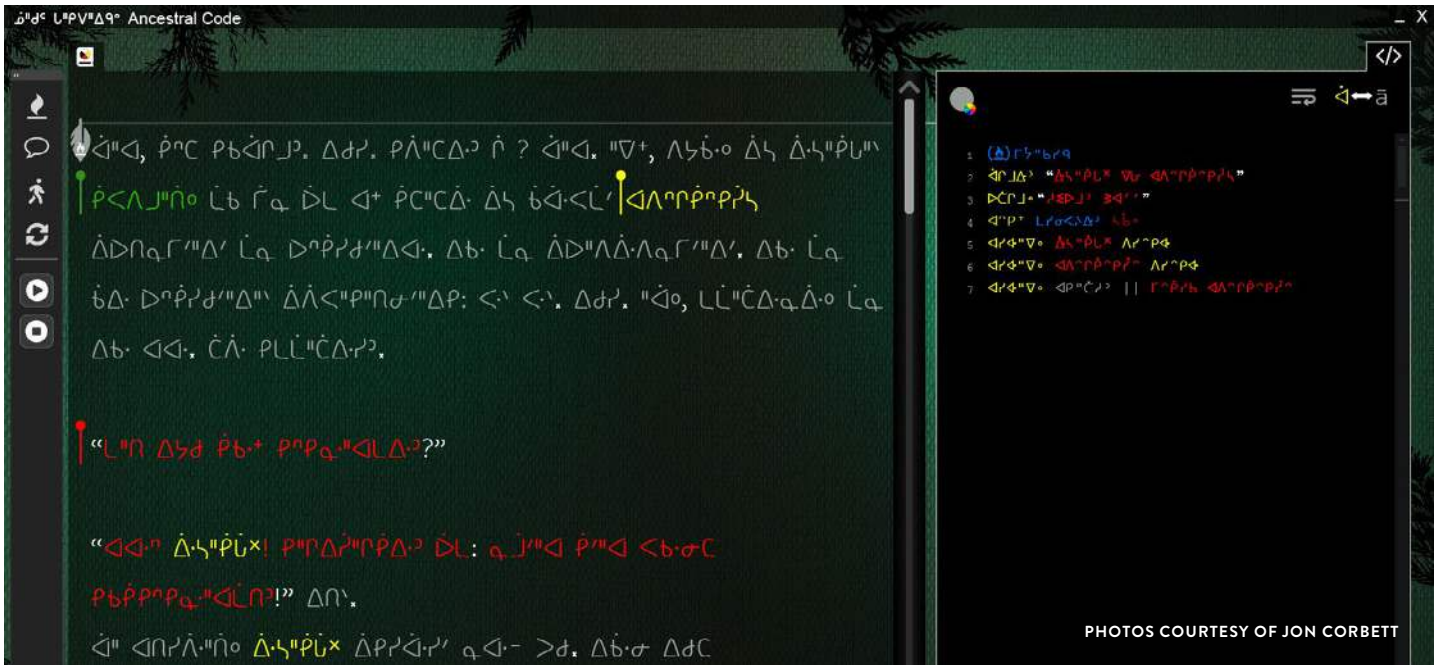
HOW TO BUILD AN IGLU AND A QAMUTIIK
By Solomon Awa
Illustrated by Andrew Breithaupt
Ages 9–12

This book provides how-to instructions for building an iglu and a qamutiik, along with general information on their construction and importance to survival. Complete with detailed illustrations, this valuable resource teaches readers about these structures that are so central to Inuit culture and tradition. **&**

TECHNOLOGY AND SOCIETY

DESIGN

For more incredible titles from Inhabit Education Books and Inhabit Media, visit their websites at **inhabitmedia.com** and **inhabiteducationbooks.com**.



The nehiyaw syllabics for the programming act of smudging in acimow/Cree#, a programming language created by the author

Cree Coding

BY JON CORBETT

Indigenous Peoples have long experienced the effects of colonialism, including displacement, loss of land and resources, and the suppression of their languages, cultural practices, and knowledge. When we think about those effects in the context of the development of computing and other technologies, the current impact becomes clear. Colonial constructions—which include programming languages, like Javascript, Python, and HTML—continue to prioritize the interests of Western cultures while disregarding the perspectives and experiences of Indigenous Peoples. Programming requires a critical examination of the impacts of this behaviour and possible solutions, one of which could be indigenization and decolonization.

The acts of indigenization and decolonization aim to address this legacy of colonialism in two ways. Firstly, by elevating the cultural, economic, and political status of Indigenous and marginalized peoples, and secondly, by dismantling the dominant political, economic, and colonial power structures in contemporary society.

In developing my own programming language for nehiyawewin (the Plains Cree language), I found that it is more than just the hegemony of English in programming that is an obstacle. One roadblock is the way computers are meant to reward speed. Computers follow instructions in a sequential fashion, where efficient code means the actions are performed faster. However, speed and efficiency do not necessarily fit in with Indigenous worldviews of time and order, nor do they reflect the importance of the relationships between the user and the system.

Additionally, I have always seen coding as a way of telling a story that a computer can understand. To tell a story, the storyteller not only has to use the correct language but they must also understand the unique meanings and structure of that language. Attempting to replace computing logic with literal nehiyawewin terminology would be a form of cultural appropriation. Therefore, to create an Indigenously informed programming language, we must fundamentally change how we think of programming. Human languages contain a culture's meaning and knowledge and programming languages can work the same way.

Many Indigenous Peoples speak of the sacredness and importance of their languages, often stating, "our language is medicine." Therefore, it follows that, if we wish to use an Indigenous language for coding, we need to treat the coding space as sacred and the act of coding as medicinal. Promoting culture can be used as a way to add representation into coding and programming languages. However, this requires a shift in computing philosophy. Currently, programming works on a system focused on inputs and functions. In this case, cultural metaphors, knowledge, and traditions could stand in as programmatic inputs and functions. For example, in my acimow/Cree# language, I introduced smudging, the act of burning herbs to purify and protect bodies and spirits, as a computational function. Programmatically, this digital smudging clears the physical and cached memories, initializes peripherals, and clears the screen. Essentially, it prepares the system to execute a

program in an environment free of latent data that could negatively impact it.

Additionally, many languages used for computer programming use typical syntactic constructions, which can be described as a set of best practices the code must adhere to. Two such constructions are the conditional statement, sometimes called an "if ... then" function, and the loop statement, sometimes called a "do while" or a "for ... next" function. A conditional function evaluates whether a statement is true or false and the answer determines the next action—or inaction—executed by the code. Loop constructions are used to execute a sequence of instructions a specified number of times or until some specific condition is met.

The challenge with translating these programming constructions into Indigenous languages is that many First Nations languages in the Americas are polysynthetic, meaning their word constructions may create very long words by stringing together multiple short words (morphemes). Therefore, logical language statements in English, such as "if a = b then c," may not be logically or syntactically valid in a First Nations language. My remedy for this problem with language representation has been to use culturally relevant metaphors that incorporate Indigenous knowledge into the world of programming.

For many Indigenous cultures, water is life-giving and sacred. Running water sources, like rivers and streams, symbolize the continuity of life. In programming with acimow/Cree#, the word *sîpiy*, the nehiyaw word for "river," is used instead of the English "if ... then" statement. In this context, the code is presented as a river of instructions allowing the programmer to flow the story in the code along a digital waterway that can branch into sîpîsisa—smaller rivers or creeks—as needed. I use a similar analogical process for representing loops in the code.

In the harsh winter climate of Northern Alberta, where I am from, nehiyaw people count winters to determine age. For example, "niyânanomitanaw nîsosâp nititahtopiponân" translates as "I am fifty-two winters old." Age, in my culture, is a way of declaring one's resilience and strength in surviving the harsh climate and extreme cold of the season. Additionally, winter is a season that is cyclical and progressive. We do not endure the same winter every year; each winter is new and different. This cultural model is very similar to programming loops in the computer. In a program loop, each iteration typically advances the elements within the loop in some way, similar to the way each winter symbolizes aging in nehiyaw culture. For programming in acimow/Cree#, the nehiyaw word *pipon* (and some of its conjugated forms), which means "winter," is used as the looping mechanism for programming. So instead of saying "for x = 1 to 10," a programmer would type "mitâtaht pipona," or "for ten winters," and the code that follows this instruction would repeat ten times.

Ultimately, Indigenously informed computer programming is not just about giving instructions to the computer. The human-computer interaction (HCI) model must be reframed as a kinship-computer interaction (KCI) model. All programming involves a relationship between the coder and the machine but this connection should be especially present at the heart of an Indigenous computing philosophy to respect the values of that culture. There is a common understanding that programming languages—our way of communicating with computers—act as vehicles for cultural knowledge, which is encoded in the machine through coding. The result is a digital reflection of Indigenous life and knowledge. Using this perspective, we transform the computer from a binary of opposing ones and zeroes to a wholistic, unary system of animacy whose digital inner workings continuously reflect animate and inanimate worldviews of the culture with which it is communicating. In doing so, we create computing technologies infused with cultural representations of the creators behind them and the users in front of them. &

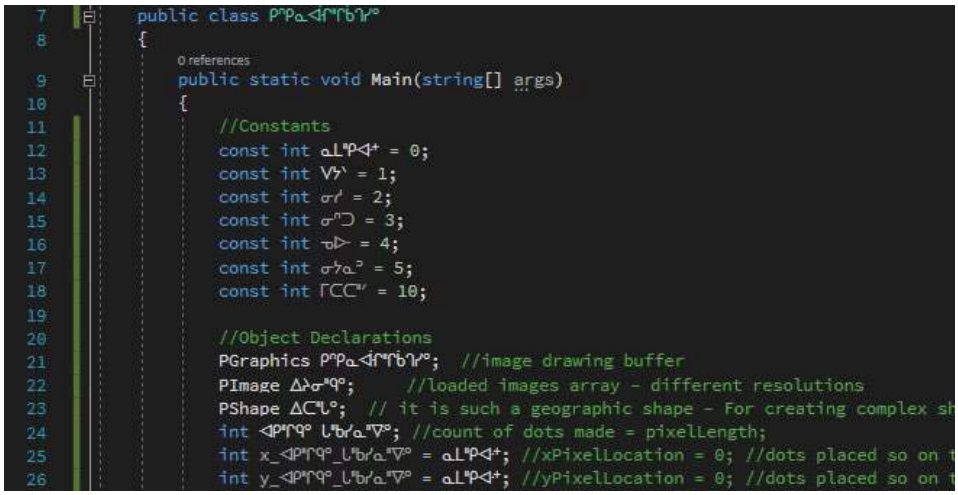
CODING AND PROGRAMMING

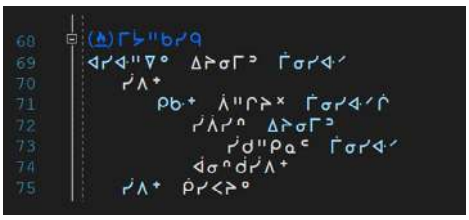
COMPUTING AND NETWORKS

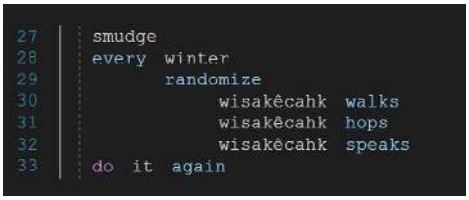
TECHNOLOGY AND SOCIETY

DESIGN

DATA







Left: An example of nehiyaw syllabics in the current version of the Visual Studio IDE.
Top Right: An example of the acimow/Cree# "river" conditional code block. The first line of code (in blue) is a call to the smudging function.
Bottom Right: The English translation of the acimow/Cree# example of code that randomizes an animation of Wisakecahk, a Cree character

Sharing Indigenous teachings using AR and the Sweetgrass Bear Treaty 6 marker carved by Stewart Steinhauer (Saddle Lake Cree Nation)

When Physical and Digital Worlds Collide

BY ALINA EYAMIE

Everywhere we look these days, augmented reality (AR) has become a part of our world. In some cases, it's so integrated into our daily lives that we don't even notice the brilliance and ingenuity behind it. Just think about it: we take pictures with Snapchat camera filters, we can track and view Pokémon on our screens through the *Pokémon GO* app, and Google Maps helps identify destinations through informational pop-ups. These are all examples of practical uses of AR.

AR has the potential to bring many things to life in new and exciting ways. It allows us to explore new universes, interact with characters, and explain learning concepts more effectively.

WHAT IS AUGMENTED REALITY?

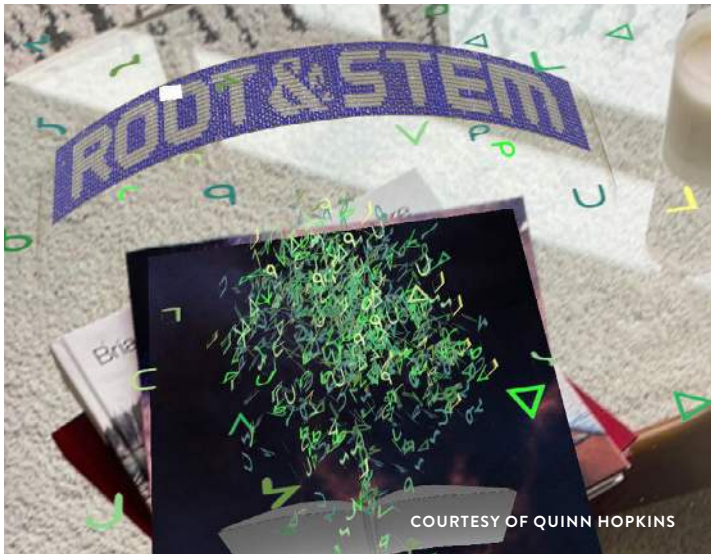
The term *augment* means "to add." Essentially, AR combines the virtual world with the physical one by overlaying or adding images, videos, or graphic displays on top of the real environment to create an interactive graphic. AR content usually includes 25 per cent digital reality and 75 per cent actual reality. Instead of depicting a completely virtual environment on-screen with a headset the way virtual reality (VR) does, AR integrates virtual objects into the real world via a screen. To see what AR can look like, scan the QR code on the contents page of this issue of *Root & STEM* with a mobile device and place the device over the cover. A new image will pop up on your screen just like the image below.

Another great example of AR use is in Google Glasses, which can display information about any place or object as a user is walking through or past it. The product combines AR with a wearable hands-free device that allows users to speak and listen to commands using voice recognition. A user could say, "Take me to the nearest park" and follow turn-by-turn directions that pop up on their glasses.

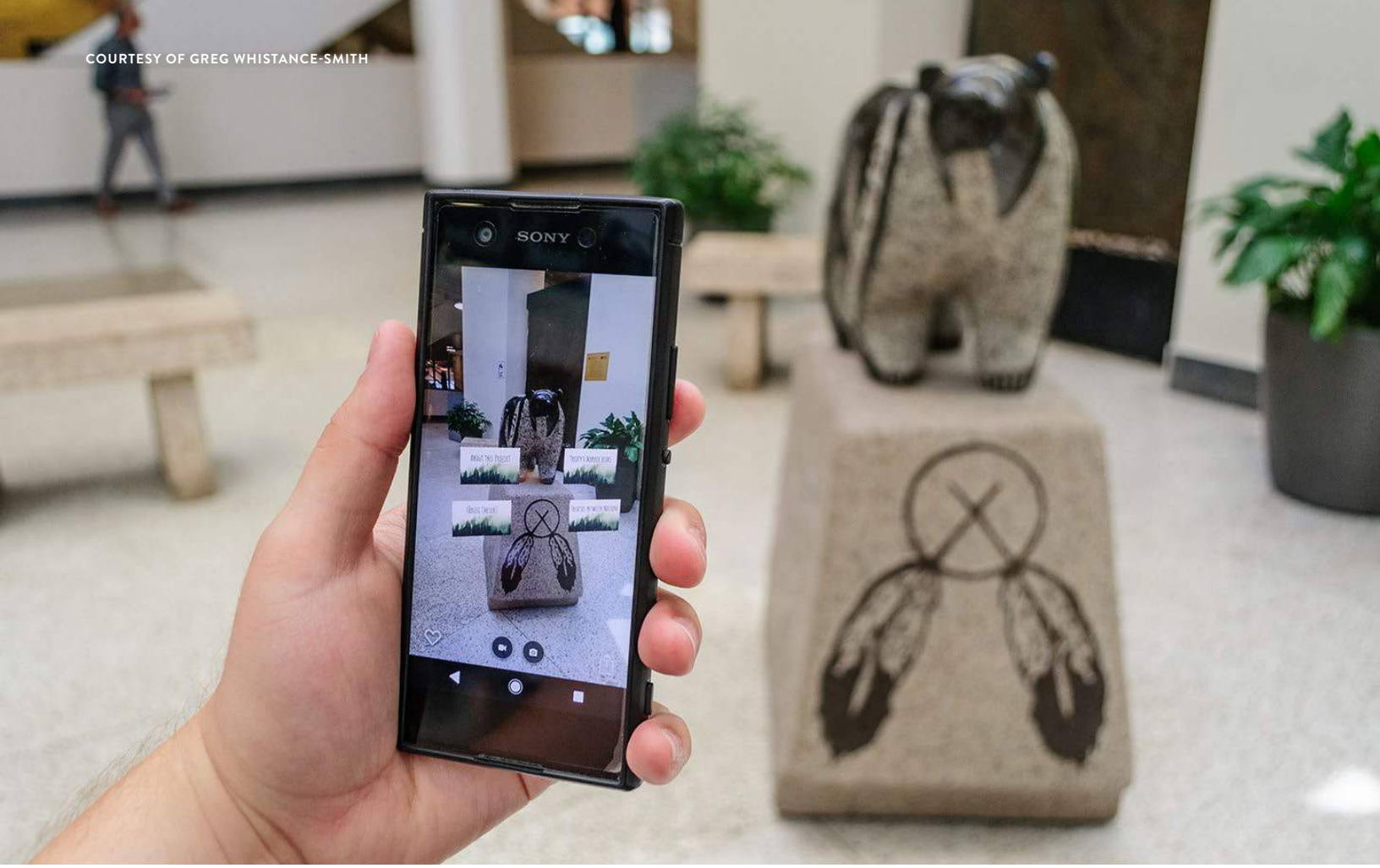
AN AR APPROACH TO EDUCATION

AR is becoming more accessible and can be integrated into classrooms of all grades and curricula—the possibilities are endless! Teachers and educators can explain classroom concepts more thoroughly by bringing their lessons to life.

AR is a great tool for kinesthetic learners and auditory learners who like to interact with their environments. These students can retain information better when presented with a virtual (and audio-visual) aspect, thus improving their memory of class material. For example, the *SkyView* app, made by software engineer Maurizio Leo, allows students to explore the universe using an AR overlay of the night sky. The user simply points their mobile device to the sky to pinpoint the constellations, stars, and planets. In 2019, a Toronto design agency partnered with the Canadian Media Fund to create an interactive AR app called *Wild Cities*. The app is centred around teaching younger generations about the



COURTESY OF QUINN HOPKINS



COURTESY OF GREG WHISTANCE-SMITH

concept of climate change through storylines that explore Canada's ecosystems and landscapes with AR technology.

AR educational applications can make the learning experience more unique and independent. Educators can't necessarily take students to India to see the Taj Mahal, or France to see the Louvre, but they can visit virtually through a series of immersive field trips with *Google Expeditions*. Each student can explore the particular landmarks and monuments that interest them, while still learning a lot about each place as a whole.

AR could help create lesson plans that have a multi-sensory approach, as opposed to using traditional textbook material. Students can take part in physical activities while virtually immersed in an interactive environment. Just think: they can view cell models of plants and animals without a microscope, or interact with deep sea whales that live at the ocean floor.

AR IN LITERACY AND LANGUAGE

Literacy is a critical part of the growth and development of children. Early childhood education typically includes the basics of written and spoken language. AR could make the learning process for this sort of literacy fun and memorable from a young age. For example, *Narrator AR*, created by Karina Youdale, is an app with an interactive twist for practising handwriting, helping to reinforce correct letter and number formations for young students. The contribution of AR to literacy learning could also help children learn languages faster and more easily. *Alphabet-AR*, by 360ed, is a resource aimed at teaching children English using AR and linguistic games, encompassing English vocabulary, alphabet, and grammar lessons.

AR AND INDIGENOUS STORYTELLING

AR can also be utilized to promote Indigenous knowledge, focusing on topics like storytelling, culture, and language revitalization. For example, students and professors from the University of Alberta worked with Cree Knowledge Keepers from Saddle Lake Cree Nation to produce the *We Are All Related* AR project, which led to the creation of the Sweetgrass Bears, four locations of AR-enhanced sculptures along a story trail on the university campus. The sculptures were carved by Stewart Steinhauer as markers of Treaty 6 that embody Cree knowledge, teachings, and treaty relationships. Users can scan different parts of the sculptures to find audio, images, and videos that bring treaty knowledge to life.

AR technology is proving to be an innovation that is transforming education in literacy, language, Indigenous knowledge, and the way we interact. Fusing the physical and digital worlds, it opens up opportunities for learning in an interactive and immersive way. **&**

CODING AND PROGRAMMING
DESIGN
COMPUTING AND NETWORKS
DATA
TECHNOLOGY AND SOCIETY

PHOTOS COURTESY OF CHRISTOPHER MARTIN

Learning Hodinohsó:ní Language through Gaming

BY CHRISTOPHER MARTIN

For years, there's been a push to prepare high school students better for the STEAM-focused job market with more hands-on classes, access to technology, and the removal of financial barriers. Over in Brantford, Ontario, **Six Nations Polytechnic (SNP)** has pushed past the finish line. The SNP STEAM Academy is a unique program that offers students the chance to earn both high school and college diplomas in a STEAM field, all entirely tuition-free, while promoting Indigenous culture and language education.

SNP's vision is to achieve international distinction for excellence in Indigenous education, Indigenous language revitalization, and the continuance of Indigenous knowledge. It is the mission of the SNP STEAM Academy to redesign education by braiding Indigenous knowledge with the Ontario Secondary School curriculum.

On December 1, 2022, the Grade 9 students attending SNP STEAM Academy's Ẹhsáhdo:k, "You Will Grow" program were given an incredible opportunity by the Pinnguaq Association, which offered them the opportunity to collaborate on the educational video game ***StarScribe***, created by game designer Brandon Bunnie. Together, students created a version of the game that focuses on Hodinohsó:ní Star Knowledge, languages, and worldview.

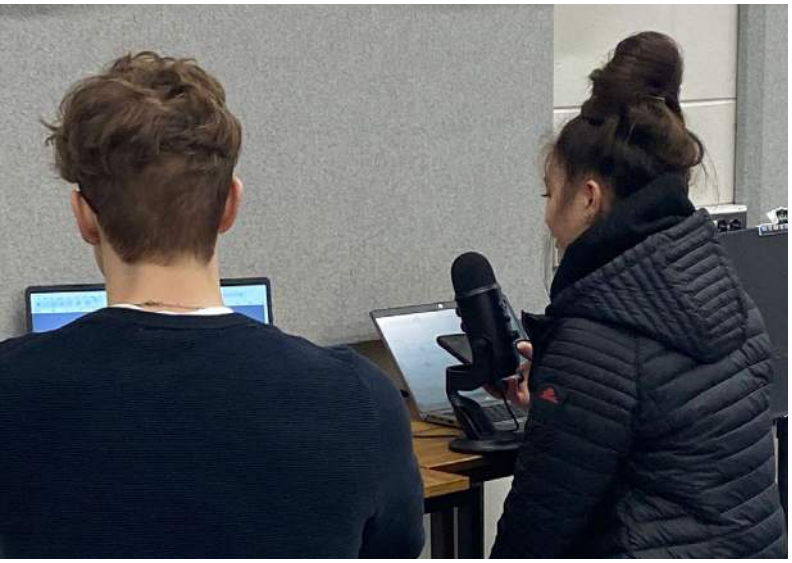
The project engaged students in video game design, and aligned perfectly with the academy's vision and mission to promote Hodinohsó:ní languages and literacy. This iteration of *StarScribe* features SNP STEAM Academy students sharing the Gayogohono (Cayuga) and Kanienkeha (Mohawk) languages, reciting ancient stories, and using their creativity to develop digital art pieces.

Students were trained on the graphics editing software Inkscape and Photopea to create digital works of art to accompany cultural knowledge of the Sun, the Moon, and the stars. Students also created images for Hodinohsó:ní stories such as the Creation story and the Great Bear (the Big Dipper constellation). Taylor Staats, a Grade 9 student, said: "I really enjoyed the art piece of the project. I love art and it allowed me to explore that."

Another component of the project was to have students create voice recordings for the pronunciation of Gayogohono and Kanienkeha words that correspond with the prominent components of the Sky World. Students volunteered to make audio recordings of stories to accompany the digital art pieces inserted into the game.

A screenshot of how the Hodinohsó:ní Creation Story and cultural knowledge is featured in the gameplay of *StarScribe*

"Through the Hodinohsó:ní/Rotinonhshonni worldview of our universe, we will assist in the survival of life on this planet through research, study of alternative views, and dissemination of information."



The Hodinohsó:ní languages were spoken and recorded by SNP STEAM Academy students Olivia Thomas, Dredon Bomberry, and Kayden George.

The preservation of Hodinohsó:ní knowledge is vital to the legacy of the Hodinohsó:ní Nations—the Seneca, Cayuga, Onondaga, Oneida, Mohawk, and Tuscarora—across Turtle Island. Written and oral communication helps pave the way to cultural preservation for our youth through education and technology. Harvey Longboat Sr., a Six Nations educator, captured the importance of braiding Indigenous knowledge with Western education, saying: "Through the Hodinohsó:ní/Rotinonhshonni worldview of our universe, we will assist in the survival of life on this planet through research, study of alternative views, and dissemination of information. Six Nations Polytechnic will endeavour to keep up with the beat of the 21st century and, at the same time, offer the understanding inherent in our language and culture."

This collaboration with Pinnguaq gave SNP STEAM Academy students the opportunity to shine through an authentic, hands-on, cross-curricular experience woven together with Hodinohsó:ní knowledge at the forefront of their learning.

Nya:weh to Pinnguaq.

Nya:weh to the Six Nations Polytechnic STEAM Academy staff.

Nya:weh to Deyohahá:ge: The Indigenous Knowledge Centre. &

CODING AND PROGRAMMING

DESIGN

COMPUTING AND NETWORKS

DATA

TECHNOLOGY AND SOCIETY

Top: Grade 9 students and Kanyen'kéha (Mohawk) teacher Stonehorse Moore recording the Kanyen'kéha language for *StarScribe*. Bottom: Grade 9 students recording the Gayogo̱ho:nǫ' (Cayuga) language for *StarScribe*

ILLUSTRATION BY LINDSAY HILL

Scratching More than the Surface

with Sherisse Richards

BY CHELSEA KOWALSKI

Scratch, a programming language, has become an increasingly popular classroom tool that helps students learn to code, think creatively, and reason logically. Created by the Scratch Foundation, the software uses basic coding principles to allow users to create animated stories, games, and more. Pinnguaq's own Sherisse Richards, a senior digital skills educator, spoke with *Root & STEM* about community efforts to bring Scratch to classrooms all over the world.

What is Scratch and how can it be useful for educators?
In the words of Scratch's co-founder, Mitch Resnick, "Scratch is a programming language and an online community." It's wonderful because it allows for the creation of animations, interactive stories, and games, and uses a block coding structure. And it really affords users of all ages the opportunity not only to think systematically but also to collaborate creatively, to really stretch their imaginations and do so many wonderful things. It's 100 per cent free and open-source. It's used in about 200 countries in more than 70 languages. Primarily, they say it's targeted toward the ages of 8 to 16 but there's also ScratchJr for those who are even younger.

I'm super, super enthusiastic about Scratch. It's one of my favourite platforms because it allows for that interactive storytelling element but also gives educators the opportunity to play with their students. It's very useful for educators who are looking to teach their students fun ways of learning programming literacy while supporting the use of imagination.

For Scratch users who need support, what resources are available?
Beyond the resources provided by the Scratch Foundation, Pinnguaq has an amazing resource called "Literacy through Scratch Story Games—Teacher's Guide" that we made in partnership with Ilitaqsiniq. There are so many different online resources that you can reference for help, but the teacher's guide puts everything right there for you. It discusses Scratch as a learning tool and goes over the basics. For example, it covers the project stage where your character—called a sprite—is formed, as well as how you can access various backgrounds and the different block commands to get your sprite to look a certain way. Then you'll learn about the coding area, where you can put all those puzzle pieces together to tell a story.

Why is Scratch in particular useful for educators focused on bringing inclusive and accessible tools to their classroom?
For starters, the Scratch Foundation is awesome. They partner with various organizations, such as Pinnguaq, to find out what some of those barriers are that we see firsthand. They really take into account the voice of the community. Inclusivity is oftentimes a barrier because people may not want to participate if they don't feel well represented. But in Scratch, you can overcome that by creating your own sprite that is reflective of who you are in your story. It's equitable. Oftentimes in underrepresented communities, especially Indigenous communities, there are so many rich stories or oral traditions. Scratch affords us a medium to tell those stories while being part of the learning experience. For people

with absolutely zero knowledge base, that's OK. You don't need any prior experience. I would even go as far as to say it's a confidence booster. It's just like LEGO®. You snap the puzzle pieces together and your story comes to life.

How does a programming language for coding help support literacy and language development?

This is also where our teacher's guide can come in handy. It does a great job of explaining how Scratch is a language tool in regard to digital literacy. It was actually created with a purpose to help teachers use Scratch for language literacy and conservation. There are different types of languages and programming languages, and Scratch really allows students to write their story games in any language, and with any writing system, including syllabics.

Additionally, video games created by users in their language can then be used to teach others. These games are created by the community for the community. There are so many times I see learners who get so enthusiastic because not only do they feel represented, but they're also able to use a platform that really is inclusive of their culture or their story. It's a powerful thing to see someone's face light up when they feel that their story matters—because it does.

There is also the Inuktitut Digital Literacy Game Engine. It's a host of three games, for which we partnered with Ilitaqsiniq, that focuses on teaching Inuktitut using fun images, syllabics, and Inuit culture. These are examples of how learners can actually use these platforms in creative ways, where they can make meaningful connections to things that are relevant to their world.

Any advice for people who want to try Scratch after reading this?

My advice for anyone who wants to utilize Scratch for the first time is: Just do it! Just jump in the Scratch pool. And don't worry about making mistakes. As I said, the wonderful thing about Scratch is, there's no wrong way of doing something. Just try it. Don't be afraid of anything. There's nothing wasted when you're Scratching. Scratch is a puzzle with pieces coming together in order to create a beautiful story and people have that same connectivity. Connectivity in terms of our goals and purposes. We all want to be able to feel included, to learn, and to matter. So the thing that I can say is just go ahead and start. There's nothing to lose and so much to gain. &

• • •

The STEAM Makers section of *Root & STEM* showcases the different ways educators engage with students and promote STEAM concepts in and out of the classroom. If you know of an educator who goes the extra mile, tell us about them at **STEAM@pinnguaq.com**.

CODING AND PROGRAMMING | DESIGN | COMPUTING AND NETWORKS | DATA | TECHNOLOGY AND SOCIETY

More Scratch resources for further learning can be found at **pinnguaq.com/stories/scratching-more-than-the-surface**.

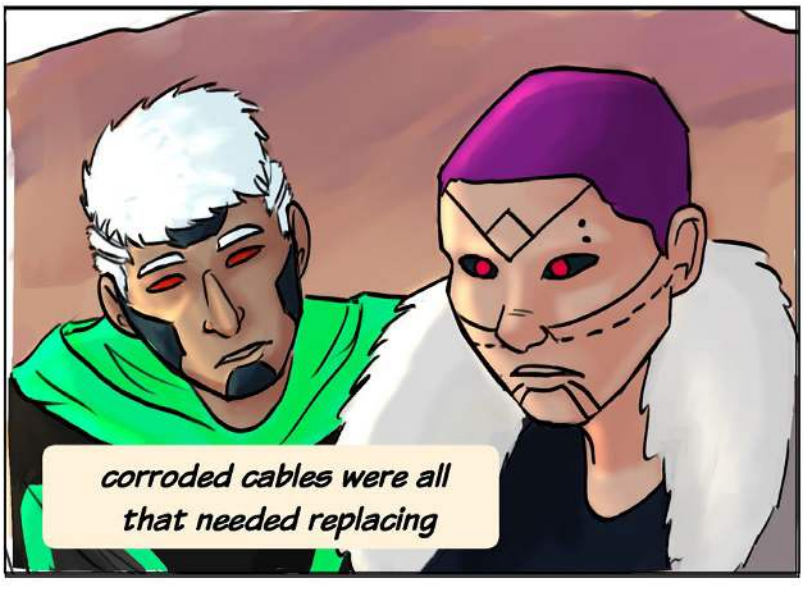
Left: Sherisse and the workshop students giving Scratch a thumbs up. Right: Sherisse going over some of Scratch's guiding principles for learners new to Scratch

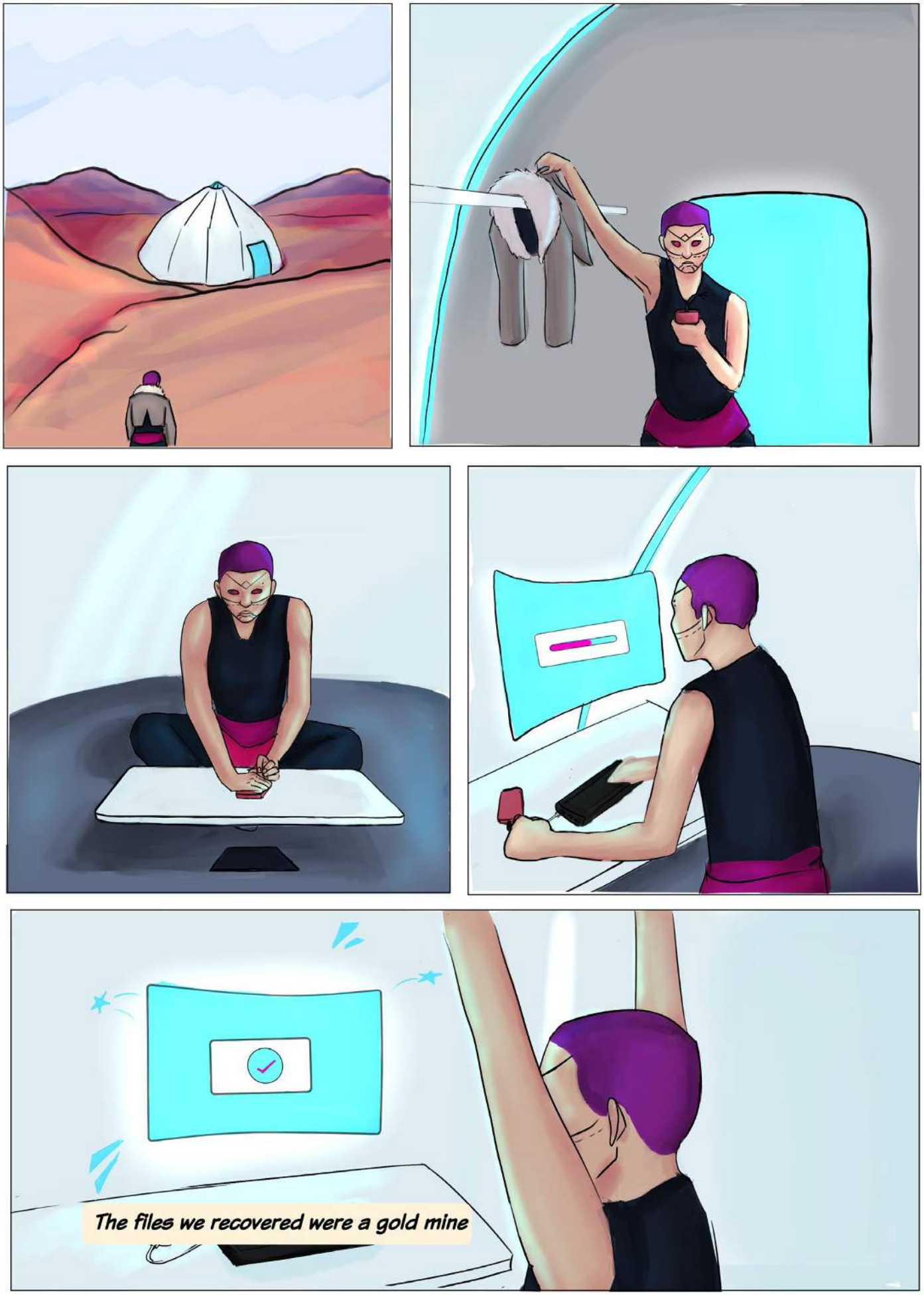

SIVUNIVUT
The Future
Olivia Akeeshoo Chislett

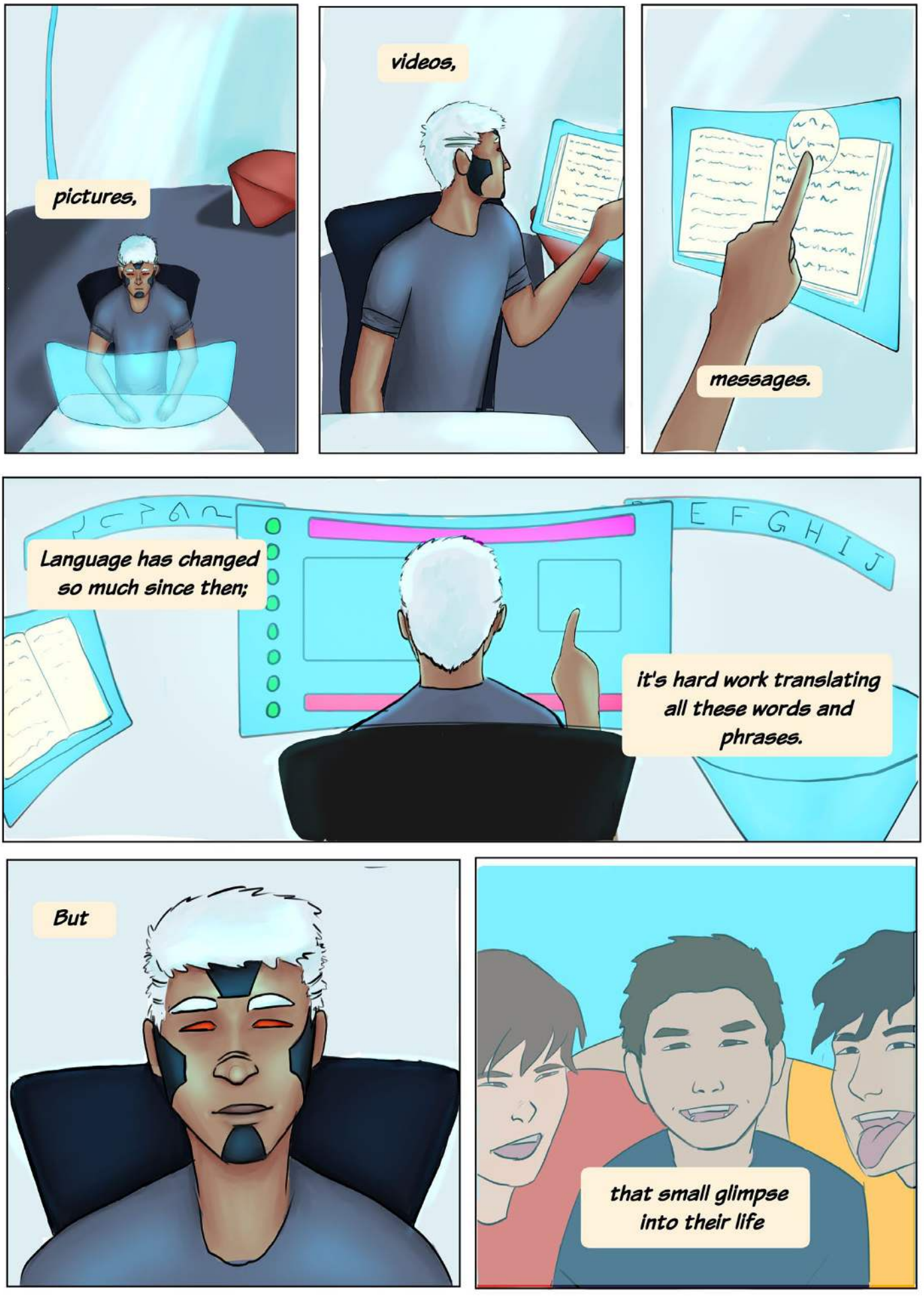

we found something today


a hard drive in the ruins


the condition was remarkable


corroded cables were all that needed replacing


The files we recovered were a gold mine


pictures,
videos,
messages.
Language has changed so much since then;
it's hard work translating all these words and phrases.
But
that small glimpse into their life


That feeling that
We aren't so different
Despite being decades apart
despite the world changing,
moving forward
These things stay the same
We are the same

ADVENTURE RESEARCH

Hello adventurer! Your job is to collect research on Canadian animals in their natural habitats and record a noun, verb, and adjective for each animal you see in your notebook. Go to the start location on your map and travel along the dotted lines until you reach your destination! If you get confused or need help, look at the sticky note labelled hints!

NOTES

HINTS:

Noun: A word that identifies a person, place, or thing.
Verb: A word that describes an action or state.
Adjective: A word that describes a noun or pronoun.

START

Hi there! I am a pine marten. Did you know that in the summer, 30 per cent of my diet consists of berries and fruit? I store food during summer to prepare for winter. Pine martens are commonly found on pine trees, hence our names. I am small and I like to climb trees and hunt for food.

Hey adventurer! I am a badger. Did you know I am a great digger? My powerful forelegs help me burrow through the soil. Many badgers are social and can be found in groups, which are called cetes or clans. We are nocturnal, which means we sleep during the day, and are up at night! I am strong, I dig, and I have fur.

Baaaaa! I am a bighorn sheep. Did you know our horn size is a symbol of rank? Male horns can weigh up to 14 kilograms! We are herbivores, which means we do not eat meat. We are commonly found in the desert. I am big, and I can run up to 65 kilometres per hour.

Oh, hello there! I'm a narwhal but my kind are commonly referred to as "unicorns of the sea." Our horns can grow to as long as nine metres, and we can grow two of them. We also change colour with age. Narwhals are blue when we are young but we turn mostly white when we are super-duper old. I have long horns, smooth skin, and love to swim.

Language Is the Root of STEM

BY ANDREW MCCONNELL

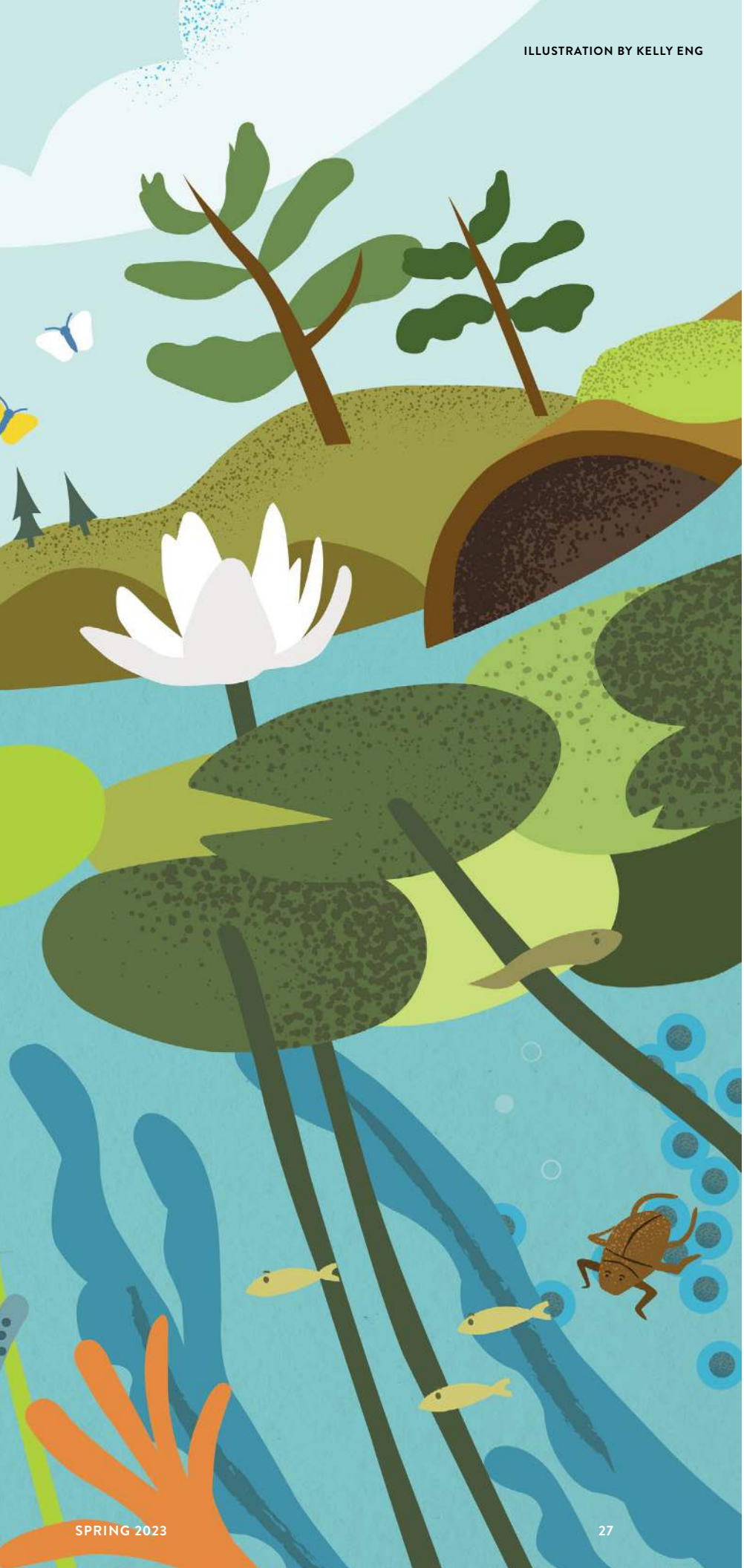


ILLUSTRATION BY KELLY ENG

As an Indigenous educator—a technology teacher in Ontario—I have watched how literacy affects which concepts students are able to comprehend and discuss. Words hold power. They can excite and educate, but they can also demote, demoralize, and defame. The very word *science* can be used to validate knowledge, while withholding it can prescribe information and ideas as "mere" folk knowledge—or, worse, defame them as myths and legends. Indigenous STEM knowledge is often a target of this exclusion and devaluation, and the reason has more to do with language than you might think.

At first blush, it might seem outside the realm of STEM, but language is at the heart of thought, and so the rules of language lay out the rules for thought. Language and literacy (a form of access to language) set up the limitations—or lack thereof—of what we can think or even describe when we try to comprehend a phenomenon or a problem. Try it for yourself at this moment. Think about something, anything. I'll wait. Was that thought wrapped only in vision, sound, smell, sensations of touch, or did you have an internal dialogue?

Language orders the world for us. Our education system maintains that order, placing a cultural lens on how we see ourselves in tandem with the rest of creation. The English language, my first language, has distinct categories for societies beyond the obvious connotations of "First World"

***"The way this community has chosen to conduct science lessons comes out of their culture, where nothing is disposable or extraneous. This behaviour is a physical manifestation of the words* nindinawemaganidog *and* minobimaadziwin."**

and "Third World." The word *tribe* has been used to separate colonial nations from Indigenous ones wherever the former have ventured. Subsequently, this simple use of one word has methodically kept Indigenous ways of thinking trapped in the past and stripped of value in the present. Ironically, it is Indigenous perspectives that may hold solutions that can address the problems the modern world has created, especially those regarding preservation and stewardship of the land for future generations.

For Indigenous people, our tribe is simultaneously our nation, our family, our community, our past, present, and future. Our languages contain our ways of thinking and, by extension, our ways of being, and they are very different from the languages (and, therefore, ways of thinking and being) used in Eurocentric science. This is one of the precious gifts we offer the world. Eurocentric science has been responsible for both amazing peaks in innovation, and disastrous lows, while at the same time shunning what Indigenous science knows intrinsically. Indigenous Peoples are dependent on the rest of the world for the acknowledgement of our existence.

As an Anishinaabe person, I see how our concepts of ways of living in relation to others are key missing elements in current STEM education. Some would refer to this as ethics; in reality, these concepts are much deeper. The current crises Indigenous Peoples are dealing with are not ethical; they are existential. STEM is currently focused on the innovative things we can do, which includes teaching students concepts that have been developed in labs and classrooms, building upon what is currently in use. With an emphasis on progress, rarely is there an opportunity for students (or educators) to question whether we should pursue STEM work and methods that are harmful to the world and to ourselves. Furthermore, students aren't even given a framework—or the linguistic tools—to begin to evaluate what is good and bad beyond immediate and personal goals.

Anishinaabemowin—the language of Anishinaabe people—does, however, carry key concepts for evaluating our effects on the world and inherently questioning whether we should do something. The word *nindinawemaganidog* translates as "all my relations"—but the meaning runs deeper than one's family. It is about our connection to all other living things and our relationship with them.

We see multiple communities living in the same space. We recognize plant communities, bird communities, insect communities, animal communities, and we acknowledge our reliance on them for life itself. We have known, for instance, about our reliance on insects since long before Western science became alarmed at the decrease in bee populations. We have no traditional insecticides, no word for a chemical that would kill insects and affect the population of our relatives, the eagles. We live in a deep relationship with the world and care for it rather than seek to control it. We know that we live because all other things live. This is of course a perceptual model for viewing the world—our literacy sets it up for us.

Western science, with its language of objective position, almost god-like, is a different perceptual model. It has its own stories of study, dissection, theorizing, and a belief that one can take up an objective position outside an event—observe it, and remain apart from it. This is a key part of experimentation and academic study. It is the literacy of school science and is held tightly by curricula and classroom practice. However, for people who fundamentally recognize that we are inextricably linked to the world, and that experimentation has an effect on other living things, the model of objectivity seems forced. For instance, the animals we dissect came from somewhere and the chemicals we use to preserve specimens will have an effect on the lands they go to once we are done with them.

A friend of mine teaches in a northern Anishinaabe community, one that still has access to traditional land and practices. For their science class about dissection and anatomy, a local trapper will bring in an animal that has recently been caught. He will dissect the animal for the students in

class and carefully explain to them what all the organs are, and how each part is used by the animal before its death and how he will use them afterwards. The students can see everything and ask questions in the moment, and learn why they trap—to live—and why they wouldn't—to preserve the animal community.

This practice of minimizing the impact on the environment lives in the concept of minobimaadziwin, another great example of how language creates a base of understanding for our science. The word translates to "good living" or "living a good life." Again, the meaning is much deeper. It isn't based on what you have or how easy your life is. It's about how you live in relation to others, meaning all of our relations; the plants, animals, birds, fish, all other living things. The school's practice of working with the trapper is an example of this. The animal has been killed so that someone else can live. It makes sense to work with that same animal to teach students about the science of life—biology—rather than kill another animal. The way this community has chosen to conduct science lessons comes out of their culture, where nothing is disposable or extraneous. This behaviour is a physical manifestation of the words *nindinawemaganidog* and *minobimaadziwin*.

What Anishinaabe call minobimaadziwin, environmentalists (now) call "sustainability." While sustainability has only recently entered our curriculum, and made it into everyday conversation, it has existed in our language as a fundamental concept of how to be a human being. Anishinaabe people know that we live because everything else does—not the other way around. The scientific concept is so fundamental to being Anishinaabe that we teach it to our children from the very beginning. These ideas are in our literary traditions, the stories we tell our children, not because they are simple ideas but because they are so important for the future. These concepts of conscious reliance on the rest of the world set up how we grow into responsible adults ready to work in relationship with our communities and those with whom we come into contact.

Indigenous ways of being and thinking are not viewed by popular culture as valuable for the future. Science fiction, which can be seen as the literature of STEM, is the literacy of what could be; the possibilities of the future. And it never includes Indigenous people, our languages, or ways of being. This has been the historical practice of non-Indigenous politicians and writers for a long time. Think of the more recent, popular, dystopian sci-fi stories of a world worn out and people leaving this world behind to go to find a new one to colonize. *Interstellar* is just one example. Whose story is this?

The language of exploration and colonization is so ingrained in Western culture that it is projected forward into the future through fantasy. Colleagues of mine were building an assignment around STEM, hoping to engage students in a project that would make concepts approachable and real. The project asked students to be space explorers on a mission to colonize a new planet. Nobody saw the irony or immediately understood why Indigenous teachers raised eyebrows at the concept of leaving this world behind, abandoning it after using it up, and moving on to do the same with a new world.

Recent science fiction by Indigenous authors replays different stories from our past. Cherie Dimaline's characters in *The Marrow Thieves* survive pursuit by those who would steal their dreams, and in *Moon of the Crusted Snow,* by Waubgeshig Rice, an Indigenous community comes together to survive while the rest of the world appears to have stopped. There is a key scene in this book where an Elder and a young man discuss the idea of apocalypse. It comes out that we have already survived our apocalypse and come out the other side with the support of our families, our languages, and our technology. This is our science fiction, which continues our literary legacy, maintaining our fundamental STEM concepts of learning from the land, using what is available, and being wary of the damage that we might cause today and tomorrow.

This is one reason why replacing the standard Grade 11 English credit with the Understanding Contemporary First Nations, Métis, and Inuit Voices course is a good idea. It brings in concepts that are prevalent in many Indigenous cultures and supports students to think differently and critically about how and why we do things. Every class

"Anishinaabe science and technology has a history of working with the environment and seeking balance. There is no desire to conquer the world."

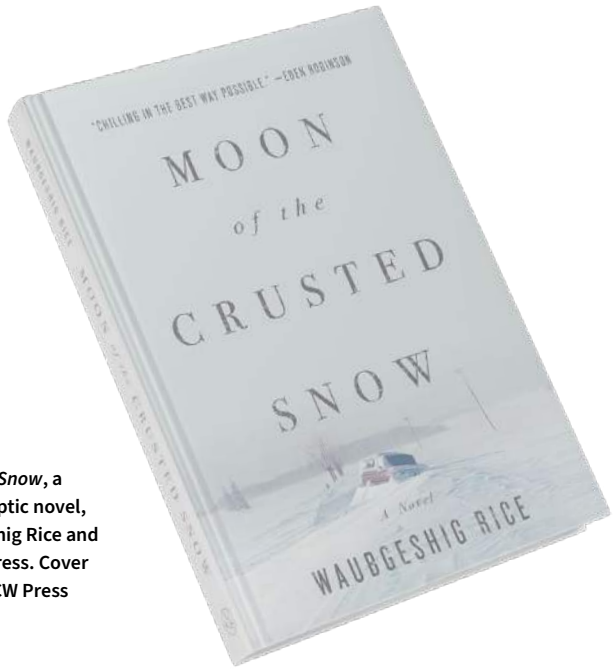
a student takes is related, and every class will influence the others. STEM courses teach how things work, while language courses reveal what is possible.

Rice's own experiences as a writer could have been very different if the Ontario curriculum had shown Indigenous representation in literature. "When I attended high school in Ontario in the 1990s," says Rice, "Indigenous authors and their books were completely absent from the curriculum. I wouldn't have known that Indigenous writers even existed if it weren't for my family members who were already aware of them and shared their work with me. The education system back then failed me and all of my peers by not teaching us about the brilliant Indigenous storytellers who were blazing a trail in literature."

But even changing courses on literature won't be enough as past mindsets live on in educators. Just this year, a colleague insisted that Indigenous knowledge is superstition compared to the knowledge of Western science, even after attending professional learning about the new Indigenous literature course. He dismissed our knowledge—which has survived millennia—as folksy ideas, not useful in the present, let alone the future, despite it having helped us to survive and adapt in the face of incredible change and outside pressure. He was ignorant of how much Indigenous cultures have contributed to the collective scientific knowledge of the world, from the development of crops like corn, potatoes, tomatoes, and medicinal plants, to health tools, like syringes and petroleum jelly.

The primary question of STEM has been, How can we do this? It should also include the question, *Should* we do this? The things we do are very often the issues behind the crises. Minobimaadziwin, in this case, asks us to take a moment to look around and note that our situation is the result of how we use our science, technology, engineering, and math.

Anishinaabe science and technology has a history of working with the environment and seeking balance. There is no desire to conquer the world. The concept of nindinawemaganidog makes us aware of our dependence on the land and its inhabi-



***Moon of the Crusted Snow*, a daring post-apocalyptic novel, written by Waubgeshig Rice and published by ECW Press. Cover photo courtesy of ECW Press**

tants. Minobimaadziwin explains why our communities fight against the building of pipelines under rivers and lakes.

Language and literacy are therefore part of the cure for what currently ails us, because both allow us to describe what we might dream, desire, and value. Our languages are our collective literacy, and they allow us to dream of things and share them with each other. Not only do we share the language, but we share the meaning behind it. This is why literacy is important in STEM.

For example, when the idea of sustainability is already ingrained in the language of a culture, the people of that culture are ahead in protecting their environment and themselves from harm. In cultures where the right words don't exist, time is spent developing the language to explain what is happening and then time is spent arguing on whether it is actually happening. This is the situation for STEM fields right now in non-Indigenous nations that have wrestled with and historically opposed the ideas of sustainability and collaboration to solve the collective issues we face.

Language is the only means for describing and planning for the future. If there is to be a future for humans at all, it needs to include Indigenous literacies and ways of thinking. This is why systems of education need to remove their restrictions on including Indigenous authors, thinkers, and cultures.

We saw a glimmer of it in Ontario this past summer. The new science curriculum contained references to both STEM and the importance of Indigenous ways of thinking. But time passed, and Indigenous ideas were removed from the final release while STEM thinking remained. For all of the discussion about being innovative and preparing students for the challenges ahead, the curriculum—the literature of education—is being held back.

It's the curriculum that is not changing, and the curriculum is the language that sets up what teachers can teach and evaluate in the classroom.

For a writer like Rice, it's clear that Indigenous voices not only add important representation but can also effectively strengthen science and literacy learning for all students. "I'm thrilled to know that students today [can] have more access to Indigenous books built right into the provincial curriculum. The truths shared in these works can empower Indigenous students and enlighten non-Indigenous ones. The future is much brighter as a result."

The current system of education in Ontario is the same as it was in the past, so it delivers the same results. Its promise of success is not universally delivered. Government reports, like the Royal Commission on Aboriginal Peoples, have made it clear why Indigenous people have remained marginalized. I ask again, should we continue to do this, or is it time for Western education to adapt? If we want a different result, we need to start by thinking differently. Thinking differently requires us to change the language that we use. The first step on this journey is to let others in. **&**

TECHNOLOGY AND SOCIETY

DESIGN

From Oral Traditions to the Digital Age

How unique digital initiatives are bringing Inuktut to every screen

BY MERAL JAMAL

PHOTOS COURTESY OF MERAL JAMAL

Jeela Palluq-Cloutier had been teaching and sharing Inuktitut for years when the Pirurvik Centre, a learning facility based in Iqaluit, asked for her help with a unique project.

An educator at heart, she'd spent over two decades teaching in classrooms, interpreting and translating at events, and producing resources such as books in the language.

"Through different ways, I've been contributing to making our language visible out there."

Having worked with a host of organizations—Pirurvik, Inhabit Media, and Inuit Uqausinginnik Taiguusiliuqtiit, which is the Inuit Language Authority in Nunavut—Palluq-Cloutier had a wealth of experience, as well as versatility and adaptability in how and for whom she built Inuktut resources.

It was her knowledge of the language and her experience with translation that she tapped into when Pirurvik asked her to bring Inuktut into the digital world. The first time, in 2005, involved translating the Microsoft interface into Inuktitut. This included translating words that were completely new to Inuktitut, like *flash drive, internet,* and *e-mail*. For Palluq-Cloutier, this meant a lot of interpretation. For example, the word "internet" became "ikiaqqivik," an old word associated with shamans and their ability to travel around to others without leaving their bodies. Considering how much news the internet makes available at one's fingertips, the word was deemed appropriate.

Now, more than 15 years later, her work has moved to translating Facebook's desktop interface into Inuktitut as well. In collaboration with Pirurvik, Palluq-Cloutier was able to pull from her earlier work with Microsoft, but there were still challenges, particularly around differences in word length and language structure.

INUKTUT AS CULTURE AND HERITAGE

Inuktut encompasses five main Inuit languages spoken across the country, according to Statistics Canada, including Inuvialuktun, Inuinnaqtun, and three dialects of Inuktitut. For a language that is older than Canada—and of course, the internet—attempts to bring Inuktut to the digital world are not a new endeavour.

Before companies like Microsoft and Meta (the parent company of Facebook) took an interest in the language, Inuit on the ground were already adapting Inuktut to bring it online.

A successful example is the Inuinnaqtun revitalization that the Kitikmeot Heritage Society (KHS) has been spearheading from Cambridge Bay. An Inuit-led charitable organization that has been around for over 25 years, KHS focuses on the priorities of Inuinnait—a distinct regional group of Inuit living in the Central Canadian Arctic, according to the society's website.

KHS aims to revitalize Inuinnait culture and maintain the passing of knowledge across generations by reawakening the Inuinnaqtun language, reclaiming identity, and recording knowledge of and resources in Inuinnaqtun, "so that generations to come will inherit the connection to our ancestors and their knowledge, values, and worldview."

Over the years, KHS has spearheaded the learning and use of Inuinnaqtun in a myriad of ways. Successful examples include hosting language courses, creating digital atlases that share knowledge of the land and Inuit who live on it, publishing learning resources such as books and dictionaries, and conducting oral interviews with Elders in Cambridge Bay who grew up on the land speaking fluent Inuinnaqtun and have first-hand experience with living the traditional Inuinnait life.

Emily Angulalik, President of KHS, says one of the primary goals for revitalizing Inuinnaqtun is to reclaim culture and tradition.

"We know that colonization has impacted many of our people. But we can regain our language and our culture through [language] programs and projects—and it's at our own time and at our own pace," Angulalik says, adding that "revitalization has to be at the personal level."

While other societies and regional Inuit associations invest in cultural and traditional

Top: Legislative Assembly of Nunavut in a March 2023 session. Bottom: Jeela Pallaq-Cloutier, the translator behind digital language work with Microsoft and Facebook

"It's important to accommodate our youth, our younger generation who are so used to technology."

activities in their own ways, Angulalik notes the revitalization of Inuktut will help more Inuit heal from the trauma of their past.

"We're in this era of healing. We're in the era of moving forward and [Inuinnaqtun revitalization is] just enriching."

INUKTUT FOR ALL GENERATIONS

According to Angulalik, a big reason the heritage society has digitized many of its Inuinnaqtun language resources is to help bridge the gap between older and younger Inuit.

Through its online Inuinnaqtun Language Atlas, for example, speakers of all levels can look up words for actions like walking slowly, wearing certain clothing, or describing something as beautiful. They can also listen to audio pronunciation to know how the word is said.

"There have been changes happening over the years, as well as impacts from them today," Angulalik says. "One of them is that our youth are not speaking [our language] as much as they could be."

Angulalik points out that digitizing Inuktut will help reach young learners where they are most engaged: online. It will also help make technology more accessible for older Inuit who want to use digital devices and the internet in their own language. Ultimately, Angulalik says digital language resources, such as those created by KHS, help Inuit of all ages learn at their own time and pace.

"Our younger generation, as the Elders would say, should really learn the language," she says. "But again, it's about time and pace."

For Angulalik, forcing Inuit across generations and lived experiences to learn their languages may hurt the learning process more than help it. According to her, it's important to adapt to how, where, and when younger Inuit speak with Inuktut today.

"It's important to accommodate our youth, our younger generation who are so used to technology."

INUKTUT EDUCATION

Palluq-Cloutier's husband helped her translate 11,000 English words into Inuktitut to bring the language onto Facebook. He helped her break down the large files sent along by Meta into smaller pieces of information to translate.

It took Palluq-Cloutier over two months to translate the entire desktop interface for Facebook. What made the process easier was reusing some of the terms she had already translated for Microsoft.

Using Facebook in Inuktitut today, Palluq-Cloutier finds her translations to be both a source of a lot of pride and a little embarrassment.

The translation is a source of pride for her because growing up in Nunavut in the 1970s, much of her education took place in English.

"My English is very good because I was forced to speak and read and write in English," Palluq-Cloutier recalls. "I'm good with my English but I wish I had had the chance [to learn Inuktitut]."

It's also a little embarrassing because using Facebook in Inuktitut today, she sees "some mistakes" in some of the words she translated from English to Inuktitut.

"I know they are easily fixable ... but I was a little embarrassed by the mistakes and also proud that our language can be out there in this way."

Conversations about Inuktut use, especially in Nunavut's education system, are ongoing within political circles and across communities.

The territorial education system currently provides instruction in Inuktitut only

Education Minister Pamela Gross (left) and Culture and Heritage Minister Joanna Quassa at the Nunavut Arctic College in Iqaluit

through Grade 4. While Inuktut classes are offered by the Nunavut Arctic College, the main language of instruction throughout educational institutions is in English.

With Nunavut celebrating Inuktut language month in April, the use and spread of the language, especially by younger Inuit, was most recently brought up in the winter sitting of the legislative assembly, which began on February 22, 2023.

Minister of Culture and Heritage Joanna Quassa presented the 2019–20 and 2020–21 reports at the assembly on February 28.

According to the 2020–21 report, the Culture and Heritage Department helped develop more than 200 new resources that were intended for Inuktut language learning: 117 in Inuktitut and 84 in Inuinnaqtun.

The report also highlights the role that platforms such as Microsoft Translator are playing in making Inuktut more accessible.

"The addition of Inuktitut to Microsoft Translator will allow access to Inuktitut for anyone with internet access via computer, phone, or tablet at home, at work, or in the classroom," the report notes.

"This also creates opportunities for individuals and businesses requiring or providing Inuktitut language services."

According to Palluq-Cloutier, the most important aspect of translated digital platforms such as Facebook and Microsoft Translator is the way they become learning and teaching tools themselves.

Even though she grew up without a formal education in Inuktitut, she says having Inuktitut as an option online is an opportunity "to use our own language."

At the end of the day, however, it's not only about creating such tools but ensuring their widespread use—across classrooms and communities.

"People will now have the availability and the choice to use these platforms," Palluq-Cloutier says.

"That's important—to be able to have the choice [of Inuktut] and to use it."

Along with helping younger and older Inuit practise using the language online, she hopes these platforms are a learning tool for people from all professions and walks of life, but especially for others like her.

"I am hoping that with my work ... information that [needs] to be conveyed is properly done so in both languages."

Often, Inuktut translators face challenges when translating English words that do not have an Inuktitut equivalent, or that may be jargon.

With Inuktitut now available on Facebook and Microsoft Translator, Palluq-Cloutier says she hopes other Inuit in her field of work have an easier time—that when they come across a complex or highly technical English word, they simply open their laptops, click on a website, enter the word in the search bar, and find exactly what they're looking for in Inuktut. &

COMPUTING AND NETWORKS

TECHNOLOGY AND SOCIETY

DESIGN

DATA

ROOT & STEM

APPsolutely Mobile

IMMERSIVE PODCASTS

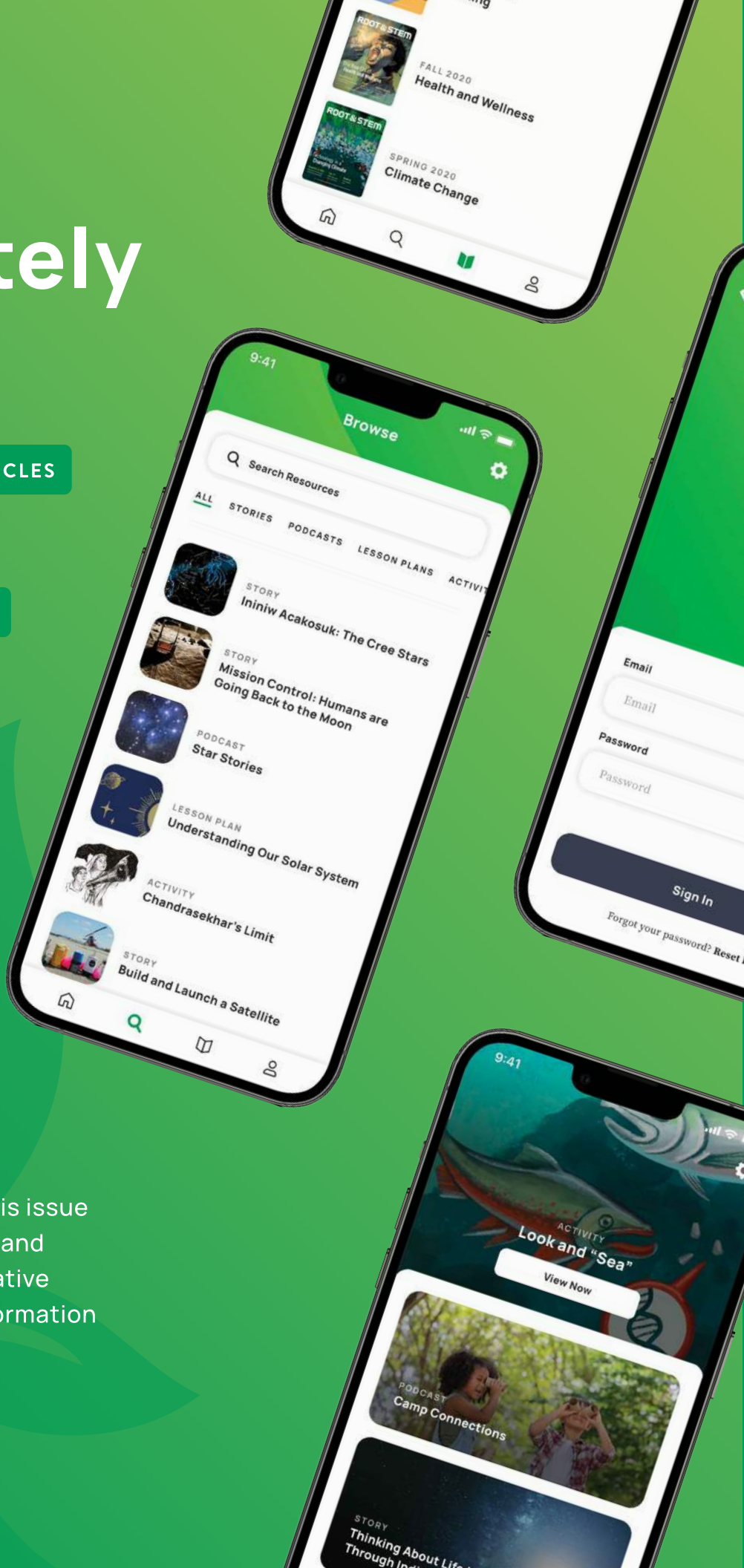
ARTICLES

STORIES

LESSON PLANS

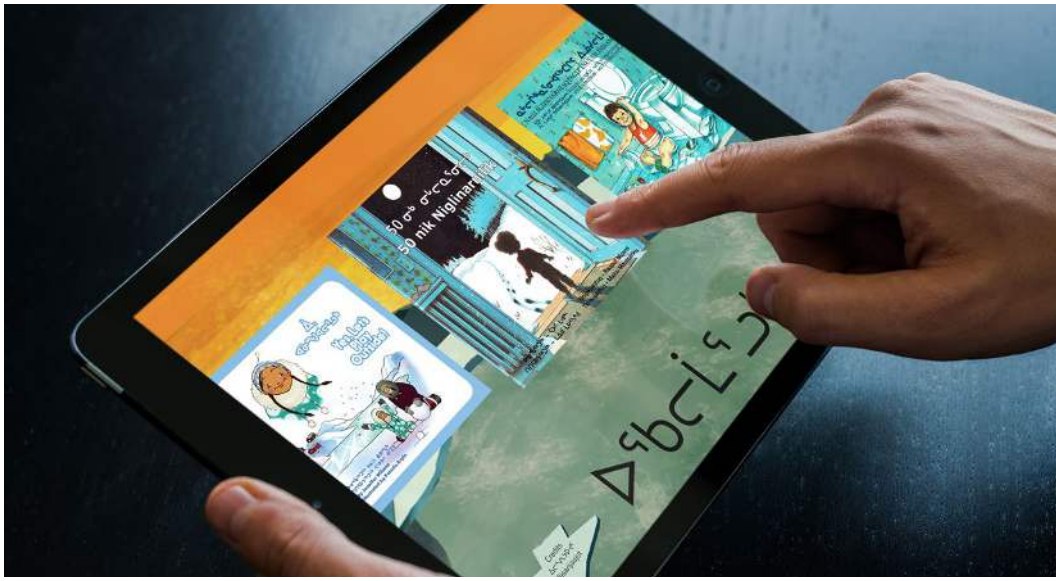
CLASSROOM STEAM ACTIVITIES

EXCLUSIVE CONTENT



Download a digital version of this issue on the *Root & STEM* app for iOS and Android, designed to put innovative STEAM education tools and information in the palm of your hand!

@pinnguaq



Uqalimaarluk is a storytelling app that allows users to read and hear children's stories in Inuktitut

Digital Kit

PAST ISSUES

If you missed past issues of *Root & STEM*, you can find them online at
pinnguaq.com/root-stem

RESOURCES

We have developed additional digital resources for educators to use in the classroom that connect to the theme of Literacy and Language—including lesson plans, video tutorials, and handouts. They can be accessed online via the links that follow.

Root & STEM Podcast

This podcast expands on the *Root & STEM* content and invites experts and professionals in STEAM education to share knowledge. The current series explores the theme of Literacy and Language in relation to STEAM education. The episodes are approximately 15 minutes long and are available on the Pinnguaq website or your streaming platform of choice.
pinnguaq.com/learn/the-root-stem-podcast

Root & STEM App

Filled with the same informative articles, podcasts, and lesson plans as its printed counterpart, the *Root & STEM* educational app is a free digital resource for K–12 educators and learners at all ages. The app puts the STEAM content and curriculum of the magazine in the palm of your hand, with interactive elements being added regularly. Available for download on the App Store and the Google Play Store.

Uqalimaarluk App

Uqalimaarluk brings your favourite children's books to life with sounds, illustrations, and full narration in Inuktitut. The app features *Yes, Let's Play Outside!* by Jennifer Wilman, Inuktitut translations of *Fifty Below Zero* and *Love You Forever* by Robert Munsch, and much more! *Uqalimaarluk* was developed in partnership with Ilitaqsiniq. Available for download on the App Store.
pinnguaq.com/partner-with-us/game-app-development/uqalimaarluk

Explaining the Digital World: Augmented Reality

This video dives into the wonderful interactive world of augmented reality, demonstrates how it differs from virtual reality, and shows how it is being utilized for language and literacy education.
pinnguaq.com/learn/explaining-augmented-reality-series

Isumakkaq (ᐃᓱᒪᖅᑲᖅ)

Isumakkaq is a game about guessing a secret word. Players have several chances to guess the word by typing out the letters. Every time they guess, the letters used can reveal hints as to which letters are part of the secret word. Choose between playing from a randomized list or taking on the daily challenge with a new word everyday. The best part? Players get to use Inuktitut syllabics and learn Inuktitut. At the end of each play, the word is spelled out in Latin script and its English definition is revealed.
pinnguaq.com/learn/isumakkaq-game

Message to Educators

As we continue to advance in the fields of science, technology, engineering, art, and mathematics, literacy remains a pivotal component of education. The lessons that follow explore the literacy skills that are essential in enabling students to read, interpret, and communicate effectively, which is a crucial part of STEAM education. Moreover, literacy is vital in facilitating critical thinking and problem-solving, which are key elements needed for success in modern learning environments.

The lessons in this issue lie at the intersection of literacy, coding, and STEAM education, highlighting the ways in which these skills complement and reinforce one another. They have Inuit literature and poetry as focal points along a pathway which then diverges into various areas of STEAM education.

We hope these lessons will provide avenues to explore the ways in which literacy and coding can complement each other to create powerful learning opportunities.

— **AYESHA AKHLAQ**
Pinnguaq Curriculum Lead

LESSON 1

Coding a LEGO® Maze

Author: Ayesha Akhlaq

Level: Kindergarten to Grade 3

Curriculum Links

Ontario

- **1.4** – Demonstrating Understanding
- **1.6** – Extending Understanding
- **2.2** – Interactive Strategies
- **3.1** – Metacognition

Learning Objectives

- Learn how to apply reasoning and inquiry to building computational thinking skills
- Foster creative thinking and problem-solving skills
- Introduce coding blocks and terms

Materials

- Code and maze templates (download files at **pinnguaq.com/learn/coding-lego-maze**)
- Scissors
- Pencils or markers to map out path
- LEGO® blocks and figurines (or other figurines of similar size)
- Thermal laminator and laminating pouches (optional)
- Paper cutter (optional)
- Dice (optional)

In this lesson, students learn coding basics by building a rudimentary understanding of command codes, sequences, and loops. This lesson is a great opportunity for young learners to apply computational thinking in real-life contexts. By the end of the lesson, students will be able to solve problems using trial and error. This lesson is also a great starting point for an introduction to coding at a young age.

Vocabulary

- **uujuq** (UU-juq) – caribou stew
- **palaugaaq** (pa-la-oo-GAAQ) – bannock, a biscuit bread
- **kamik** (ka-MIK) – a skin boot
- **Amautalik** (a-MAU-ta-lik) – an ogress from Inuit mythology who wanders the tundra in search of children. She has a basket made of driftwood on her back to carry away the children she finds wandering the land. She has long, unkempt hair and large, powerful hands. The basket on her back is very smelly, infested with bugs, and covered in slime to trap children inside

*(Source: Putuguq and Kublu and the Attack of the Amautalik! by Roselynn Akulukjuk, Danny Christopher, Illustrated by Astrid Arijanto, **inhabitmedia.com/2022/04/26/putuguq-and-kublu-and-the-attack-of-the-amautalik**)*

Build a Story within a Game

For a great creative exercise, encourage students to write their own stories. Alternatively, read the following story to the students as a build-up to the activity.

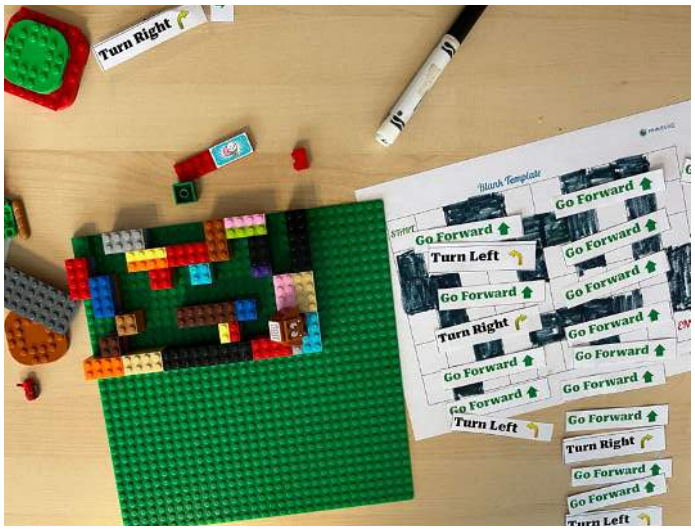
> *Putugup and Kublu are brother and sister. One day, they were going to their grandparents' house to enjoy some delicious uujuq with some yummy palaugaaq. Putugup lost his kamik in the snow and went looking for it. He wandered a little too far from the path and ran into an ogress who was wandering the tundra looking for the lost children. The ogress kidnapped Putugup and trapped him in a cave. The ogress blocked the entrance of the cave with an intricate maze so he couldn't run away. The only way out of the maze was to find the exit using coding skills.*
>
> *When Putugup didn't return after some time, Kublu went looking for her brother. She soon found the tracks of the ogress that led to the cave. She realized that her brother had been taken by the Amautalik. Kublu was very smart; she discovered that she had to solve the maze using code to rescue her brother. But since the cave is dark and gloomy, she will need your [the learner's] help. Your mission is to use coding principles to help Kublu break Putugup out of the maze.*

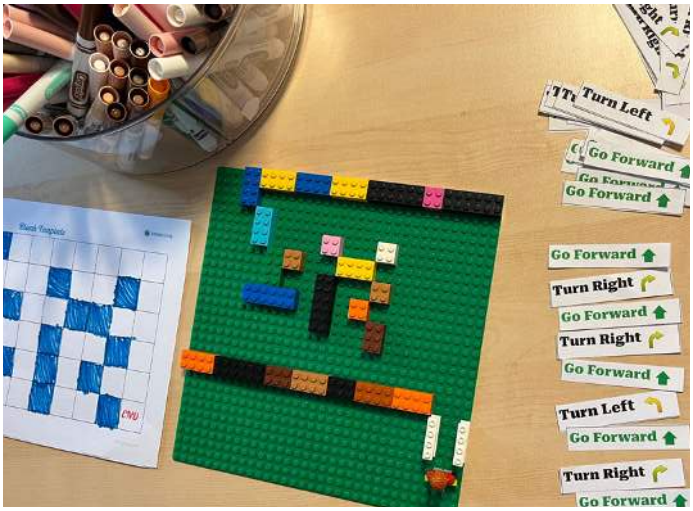
*(Source: Putuguq and Kublu and the Attack of the Amautalik! by Roselynn Akulukjuk, Danny Christopher, Illustrated by Astrid Arijanto, **inhabitmedia.com/2022/04/26/putuguq-and-kublu-and-the-attack-of-the-amautalik**)*

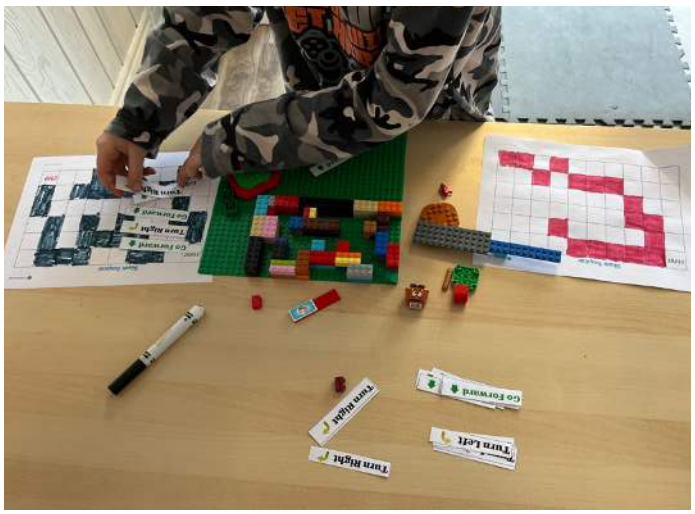
Instructions

- Cut out the coding blocks from the handouts provided
- Set up the maze using the maze templates. It is recommended that students design their own mazes. Remind them to think backwards and keep a clear path to the exit. The maze shouldn't be unsolvable

A finished maze might look like this:







Once the maze is set up, it is time to start the lesson.

Please note: It is for the teacher to decide what level of difficulty they want to introduce into the lesson based on the student's age and their understanding of the **For** and **If** statements.

PRE-K to JK: Basic Coding Statements

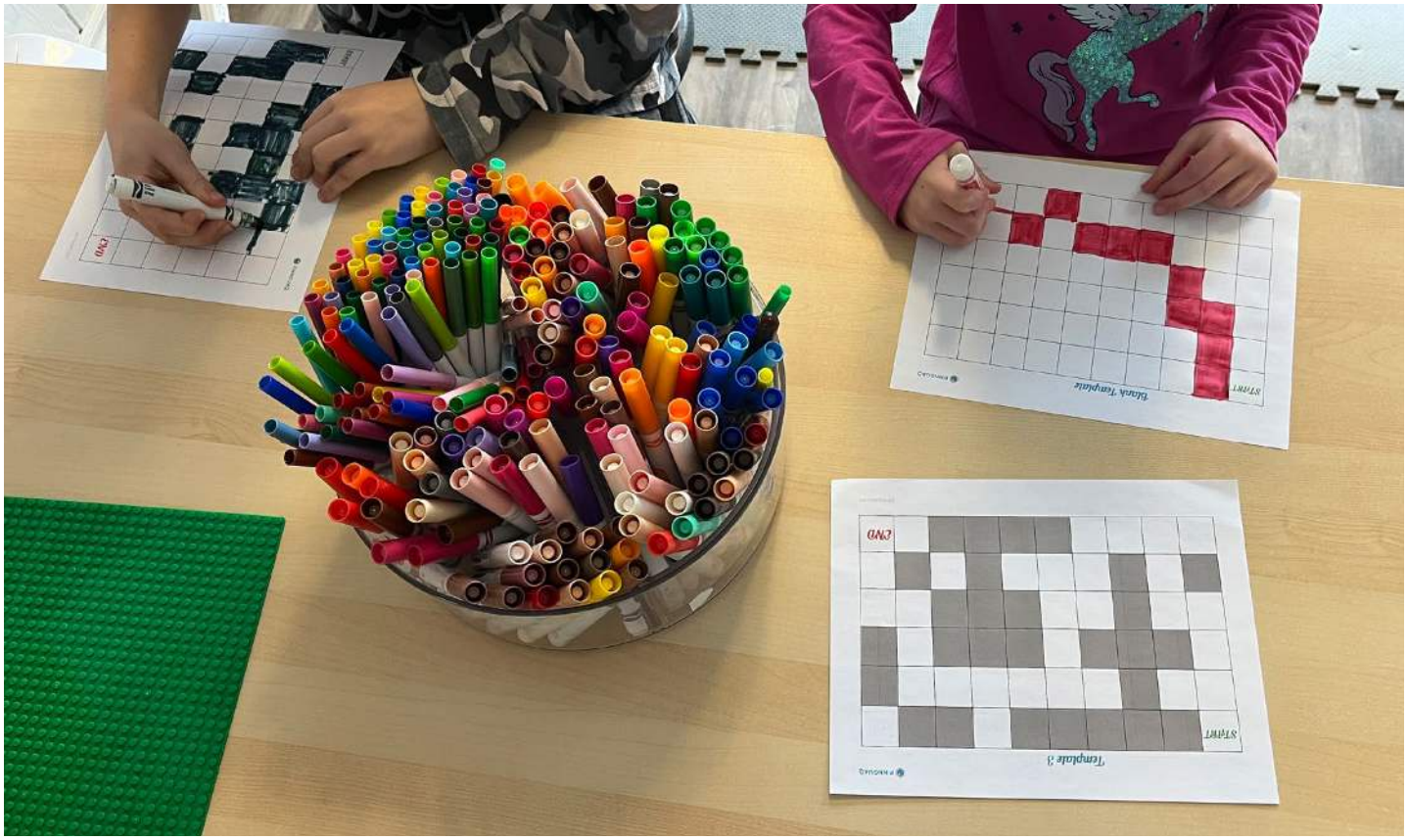
Using the story as a background, students apply coding principles to code their way out of the maze. Place the LEGO® figurines at the **Start** block. See how many moves in all directions can be made before running into obstructions. Count the steps until the figurines reach a blockage. Decide whether to turn right or left. Use one **Go Forward** block for each step. For example, if the figurine has to take four steps, use four **Go Forward** blocks. Use the **Turn Left** and **Turn Right** blocks to navigate the maze. Keep going until the figurines escape the maze.

JK to SK: Introduce the For Loop and End Statement

At this point, students should be able to understand simple coding. If not, students with some knowledge of coding can start the activity from this point. Explain that loops are used when we want a process to repeat for a specified number of times, and to simplify the code. For example, instead of repeating the **Go Forward** block, we can use the **For _____ steps** block. In the blank space, fill in the number of steps to be taken, for example, four or five etc. Always place an **End** code to tell the LEGO® figurines to stop moving. **End** statements are an essential part of loops—without them, the program doesn't know when to stop.

Grades 1 to 3: Introduce If, Then, and Else If Statements

This level requires a lot of trial-and-error learning. It is helpful to give students real-life examples: ***If*** *I eat all my veggies,* ***Then*** *I can have ice cream for dessert*, or, ***If*** *I don't brush my teeth,* ***Then*** *I will get cavities;* ***Else If*** *I brush my teeth twice a day,* ***Then*** *I won't have as many visits to the dentist.*



Young learners at Pinnguaq's Kawartha Lakes Makerspace use a LEGO® maze activity to learn the basics of coding

If, **Then**, and **Else If** statements are used for computational purposes to find the best possible solutions. At this stage, students should try to formulate the best way out of the maze by thinking in terms of **If** and **Then**.

After setting the maze, ask the students to pick a number and roll the dice. For example, if students pick the number three, and the dice roll is greater than three, the figurines can move forward. If the dice roll is less than three, the figurines move back a space. Keep repeating until the figurines reach the exit. Make sure the figurines don't run into a dead end. If that happens, end the code and start over.

Conclusion

The Government of Ontario's Science and Technology curriculum has introduced Coding and Emerging Technologies expectations in the STEM Skills and Connections strand, starting from Grade 1. This lesson is one avenue for educators to introduce coding in a real-life context. After the activity, engage in a discussion about

- The importance of coding literacy
- Practical applications of coding literacy
- Technologies based on coding
- Impact of coding and emerging technologies on everyday life

Resources

Use the following resources to explore block coding in a Scratch environment:

- Scratch Basics Series (**pinnguaq.com/learn/scratch-basics-series**)
- Creating a Short Story Animation in Scratch (**pinnguaq.com/learn/creating-a-short-story-animation-in-scratch**)
- Introduction to Animation and Movement in Scratch (**pinnguaq.com/learn/introduction-to-animation-and-movement-in-scratch**)
- Interactive Storytelling with Scratch (**pinnguaq.com/learn/interactive-storytelling-with-scratch**)

CODING AND PROGRAMMING

COMPUTING AND NETWORKS

DATA

LESSON 2

Storytelling from an Animal's Perspective

Author: Ayesha Akhlaq

Estimated Time: Three 35–40 minute sessions. This lesson can also be done as a stand-alone activity or broken down into smaller blocks with one activity per day

Level: Grades 4 to 6

Curriculum Links

Ontario: Writing

- **1.2** – Developing Ideas
- **1.3** – Research
- **4.1** – Metacognition

Ontario: Reading

- **1.4** – Demonstrating Understanding
- **1.5** – Making Inferences
- **1.6** – Extending Understanding
- **1.7** – Analyzing Text

Ontario: Coding and Emerging Technologies

- **A2.1** – Write and Execute Code

Learning Objectives

- Write a story from a critically endangered animal's perspective and translate it into a digital format using Scratch
- Develop an understanding of land and sea stewardship while learning to think from a different perspective
- Learn how important pristine habitat is for sustaining flora and fauna

In this lesson, students respond to writing prompts that require them to think about other/diverse perspectives via **RAFT**-style storytelling:

- **R**ole of the Writer: Who are you as the writer? A movie star? The Prime Minister? A plant?
- **A**udience: To whom are you writing? A senator? Yourself? A future generation?
- **F**ormat: In what format are you writing? A diary entry? A newspaper article? A memoir?
- **T**opic: What are you writing about? Animals? Plants? The ocean?

Vocabulary

- **Habitat** – the natural home or environment of an animal, plant, or other organism
- **Perspective** – a particular attitude towards or way of regarding something; a point of view
- **Endangered Species** – a species of animal or plant that is at serious risk of extinction
- **Flora** – the plants of a particular region, habitat, or geological period
- **Fauna** – the animals of a particular region, habitat, or geological period
- **Pristine** – in its original condition; unspoiled
- **Pollutant** – a substance that pollutes something, especially water or the atmosphere
- **Deplete** – diminish or decrease in number or quantity

Reading Activity

Start by reading the Animals Illustrated series book *Ringed Seal* (**inhabitmedia.com/2022/04/20/animals-illustrated-ringed-seal**), written by William Flaherty and illustrated by Sara Otterstätter (or any story related to the topic). Go over the following material about ringed seals:

- Habitat
- Food sources
- Geographic locations

After reading the story, ask students to imagine they are ringed seals living in the pristine water in the north and create a rich backstory. Here is a sample:

> *"Hi! My name is Ringo and I live way up in Nunavut Tunngavik in Northern Canada. I grew up in pristine conditions with clear and cool waters, plenty of food, and lots of resources for my siblings and me to rely on. We used to play and spend our days in the water, enjoying the clean environment of the Canadian Arctic. Until recently, we lived a peaceful and quiet life.*
>
> *"With the increase in the human population, I have new competition in my habitat. Humans have plundered the resources of my ecosystem via overfishing and polluted many of the pristine resources that my siblings and I rely on. Animals are not as adaptable as humans, so it is difficult for us to find alternate food resources. Now, with less food for my family and me, I have decided to leave the Arctic tundra and move somewhere else. I decided to move down south in hopes of finding better food resources and a cleaner habitat. But, it was a*

huge mistake. The waters down south were more polluted than I ever imagined. Food is not only scarce but also unhygienic. I have to navigate through lots of ocean debris, oil spills, fishing nets, and tons of plastic waste that humans dump in the ocean.

"Sometimes, I mistakenly eat a piece of plastic because it looks like food. My friend, Tim the Turtle, told me he has lost many friends this way.

"I just wish humans would use the resources more responsibly and think not of just themselves but of other creations on Earth who also rely on the natural resources of Mother Earth to survive."

Discussion Prompts

Lead the discussion by asking students to imagine they are the ringed seal from the story. Use the following prompts:

- How would you define your own habitat and the things you need to survive?
- What would you do or how would you survive if these resources become depleted?
- If you could not find food, what would you do?
- If you have to look for alternate sources of food or resources, where would you go?

Ask the students to pick

- An original, natural, and pristine habitat
- A place the animal might move to, which could be a city or a swamp
- Three different animals that are local to the habitats the students have just picked

Computer Activity

After reading *Ringed Seal*, students watch a video to learn about this endangered species. Endangered Species | FuseSchool (**youtube.com/watch?v=2XdeLpm42i8**).

Students will need the following materials:

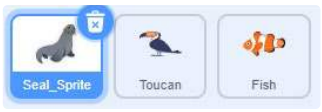
- Scratch account (download if necessary)
- Media library
- Access to the internet and computers

Begin the activity: Here's an introduction (**pinnguaq.com/learn/scratch-basics-episode-1**) to the Scratch interface. For the teacher's reference, here is a story made in Scratch (**scratch.mit.edu/projects/10128197**).

Once all the students are set up with Scratch profiles (view instructions at **pinnguaq.com/learn/storytelling-from-animals-perspective**), introduce the Scratch interface (**pinnguaq.com/learn/scratch-basics-episode-1**). Students should follow these steps:

1. Delete the existing **sprite—a cat**, and choose the animal(s) picked in the brainstorming session. To continue with the story we have just read, let's pick a ringed seal sprite. Once it has been selected, the sprite will appear at the bottom right corner under the workspace. Feel free to choose multiple animals for the story.

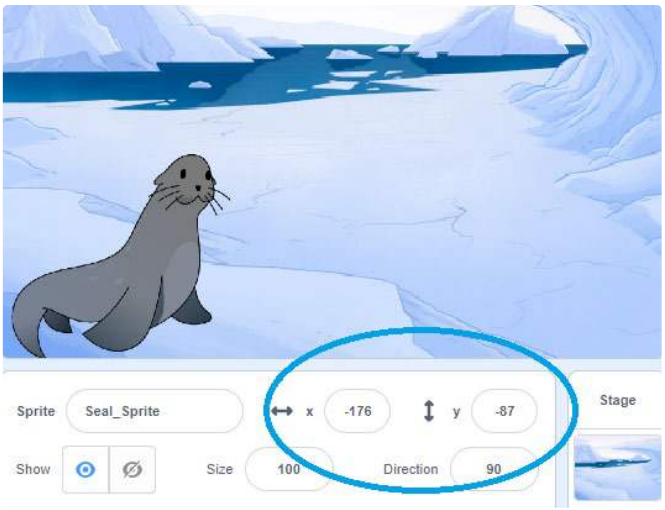
2. Add multiple backdrops and sprites, one for the original habitat and the other for the new one. From the built-in library, choose the Arctic/tundra backdrop and other potential habitats the sprite might want to move to, e.g. forest, wetlands, or underwater.

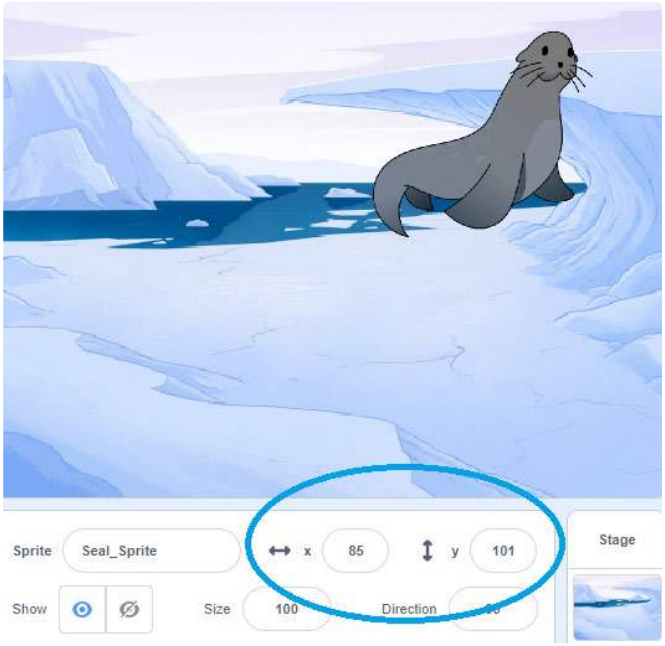


3. Click on the yellow **Events** button from the panel on the left, select the **when flag clicked** block, and drag it to the code area. This will be the start of your code.

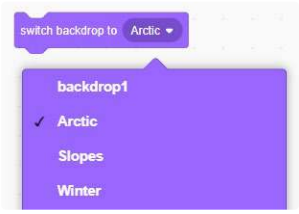
4. From the left-hand panel, click on the purple **Looks** button and choose the **say Hello! for 2 seconds** block. Drag that block under the **when flag clicked** block (it will "click" into place). Add dialogue to introduce the sprite.

5. Click on the sprite and make it move around the space. Notice that as the sprite is moved around, the X and Y coordinates on the screen change. From the blue **Motion** button on the left panel, drag and drop the **go to x:___ y:___** block to the code area. Move the sprite to the bottom left of the stage. Check the values of the X and Y coordinates and add them to the block.

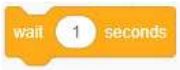




6. Next, code in the backdrop change. From the bottom right **backdrop** tab, add as many backdrops to the story as wanted. Choose the **switch backdrop to** block to choose the next backdrop.

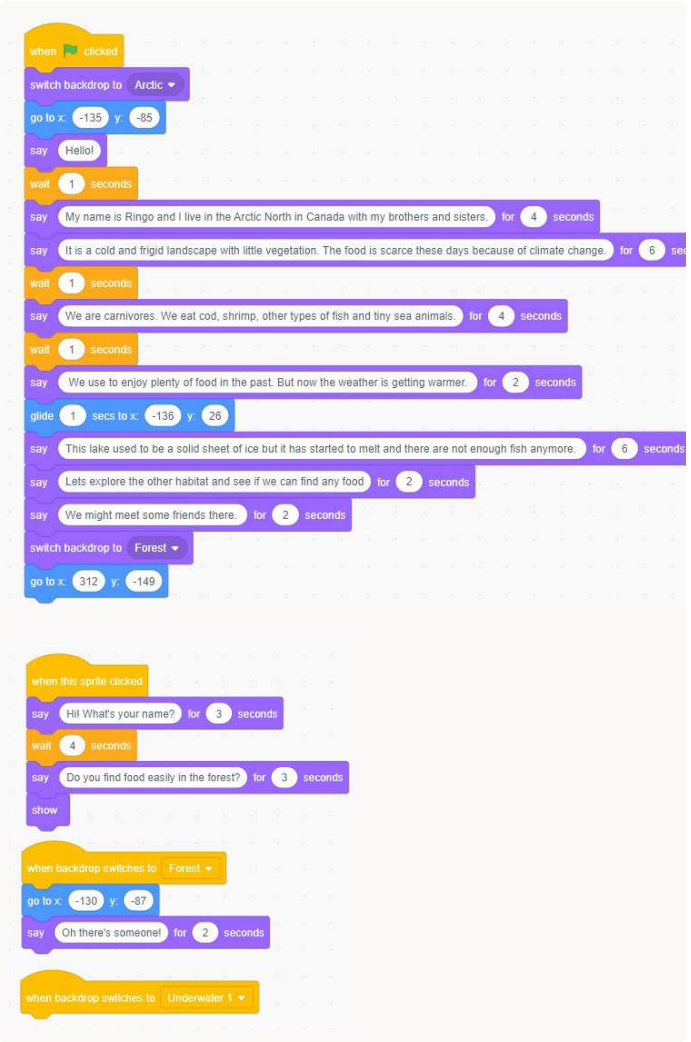


7. To add dialogue, use the **say Hello! for 2 seconds** block and write the dialogue. Click the orange **Control** button from the left panel and drag a **wait 1 seconds** block to the code area. This block will add a pause between each dialogue.

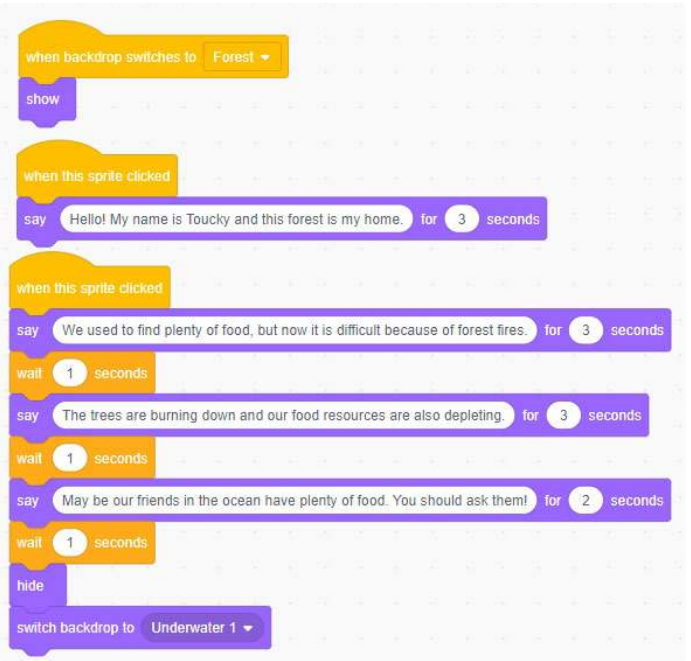


8. Be sure to write code for each sprite in the code area. Click each sprite and follow the above steps to add dialogue.
9. Make sure to add the **hide** block at the end so the sprite doesn't show at the start of the code. Click on the sprite to trigger the dialogue. The resulting code will look like this:

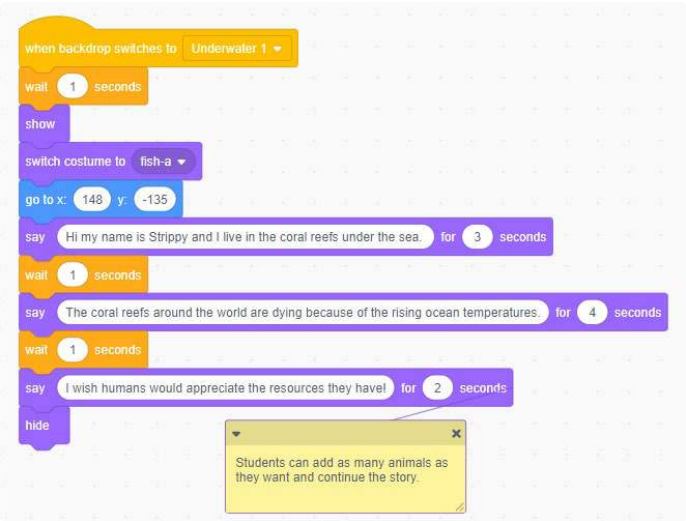
Code for **Ringed Seal** sprite:



Code for **Toucan** sprite:



Code for **Fish** sprite:



Students can use the following link to continue the story by adding more animals and backdrops. Once students have created their stories in Scratch, it's time for them to present their work to their peers.

Scratch project link: **scratch.mit.edu/projects/783332377**

Conclusion

Students are able to showcase their rendition of the story in a digital format and as an illustration. They understand the importance of preserving the environment and of land and sea stewardship from an animal's point of view.

Extended Discussion

Students can explore literature and different animal habitats to broaden their understanding.

Resources

- Endangered Species | FuseSchool (**youtube.com/watch?v=2XdeLpm42i8**)
- Scratch Basics Series (**pinnguaq.com/learn/scratch-basics-series**)
- Creating a Short Story Animation in Scratch (**pinnguaq.com/learn/creating-a-short-story-animation-in-scratch**)
- Introduction to Animation and Movement in Scratch (**pinnguaq.com/learn/introduction-to-animation-and-movement-in-scratch**)
- Interactive Storytelling with Scratch (**pinnguaq.com/learn/interactive-storytelling-with-scratch**)
- Being My Best ME: Coding My Well-Being Story in Scratch (**pinnguaq.com/learn/being-my-best-me**)

CODING AND PROGRAMMING

TECHNOLOGY AND SOCIETY

DESIGN

LESSON 3

Exploring the Gender Gap in STEM Careers

Author: Ayesha Akhlaq
Estimated Time: 40 minutes

Level: Grades 7 to 8

Curriculum Links

Ontario: Writing
- **1.2** – Developing Ideas
- **1.3** – Research
- **2.1** – Forms
- **4.1** – Metacognition
- **4.3** – Portfolio

Ontario: Reading
- **1.4** – Demonstrating Understanding
- **1.5** – Making Inferences
- **1.6** – Extending Understanding
- **1.7** – Analyzing Text
- **4.1** – Metacognition

Ontario: Media Literacy
- **1.2** – Making Inferences
- **1.3** – Responding to and Evaluating Text
- **3.4** – Producing Media Texts

Nunavut: Uqausiliriniq
- Communication
- Language
- Creative & Artistic Expression
- Reflective & Critical Thinking

Learning Objectives

- Read the scientific text and demographic charts from the published paper
- Write a report based on understanding of the journal
- Discuss the findings and explore solutions to mitigate the impeding factors

In this lesson, students read a scientific journal paper, examine charts and graphs, and try to decipher data from them. Students extract useful information from the texts and put meaning to the graphs and numbers.

Reading Activity

Have students read **Historical Comparison of Gender Inequality in Scientific Careers across Countries and Disciplines**

> *Gender differences in academia, captured by disparities in the number of female and male authors, their productivity, citations, recognition, and salary, are well documented across all disciplines and countries. The epitome of gender differences is the "productivity puzzle"—the persistent evidence that men publish more than women over the course of their careers—which has inspired a plethora of possible explanations, from differences in family responsibilities to career absences, resource allocation, the role of peer review, collaboration, role stereotypes, academic rank, specialization, and work climate.*
>
> *The persistence of these gender differences could perpetuate the naive interpretation that the research programs of female and male scientists are not equivalent. The following charts provide a background and comparison between the gender gaps in STEM careers across many disciplines and countries.*

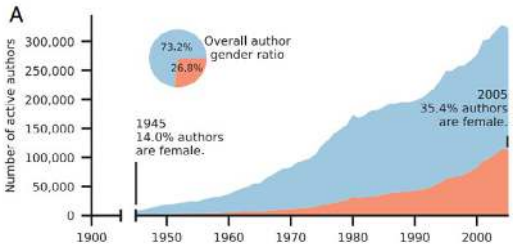


Figure A: Gender imbalance since 1955. (A) The number of active female (orange) and male (blue) authors over time and the total proportions of authors

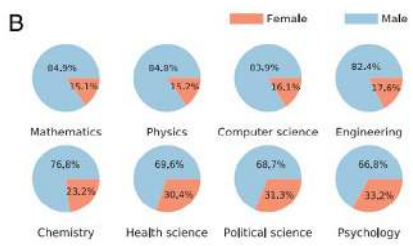


Figure B: The proportion of female authors in several disciplines

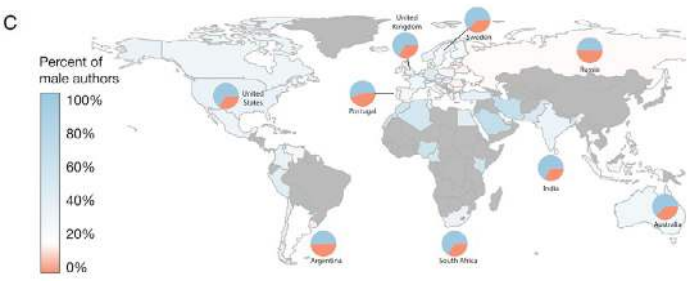


Figure C: Number of male and female authors across countries

*(Source: Huang, J., Gates, A. J., Sinatra, R., & Barabási, A. L. (2020). **Historical comparison of gender inequality in scientific careers across countries and disciplines**. Proceedings of the National Academy of Sciences, 117(9), 4609–4616.)*

Discussion Prompts

- After reading the text and looking at the graphs, what factors do you think might play a role in gender bias in the scientific community?
- **Figure A** shows that between the years 1945 and 1960, there were no published female authors. Why do you think that is?
- After 1960, female authors started to publish in scientific journals. What factors were likely involved that encouraged women to pursue careers in science?
- **Figure B** shows that women's contribution to published work is still very low across many disciplines. Do you think females are discouraged from pursuing careers in science? Do you think STEM resources are targeted to the male population?
- **Figure C** shows the comparison between male and female published authors across different countries. It is interesting to note that in the United States and Australia, a little more than a quarter of the published authors are female while in Russia and Argentina, it is almost half. What do you think are the factors that discourage or hinder women's contributions to science, particularly by country?

Next, encourage students to explore various factors that contribute to less female representation in STEM careers. Ask:

- How many of the female students aspire to careers in science? Why? Why not?
- What do they picture when they think of a scientist? Do they picture a male or a female?

Computer/Tech Activity

After the class discussion, ask students to write a report on their findings and conclusions using APA format.

APA Paper Formatting Basics

- All text is double-spaced
- Use one-inch margins on all sides
- All paragraphs in the body are indented
- Centre the title on the page with the student's name and school/institution underneath
- Use 12-point font throughout
- Number all pages in the upper right-hand corner

Provide the students with a list of female scientists and ask them to create a career profile highlighting the women's work and contributions in their field. Students can also choose from the following list:

- Hayat Al Sindi
- Marie Curie
- Ismahane Elouafi
- Rosalind Franklin
- Maria Goeppert-Mayer
- Dorothy Hodgkin
- Katherine Johnson
- Irène Joliot-Curie
- Hedy Lamarr
- Romani Makkik
- Barbara McClintock
- Shannon O'Hara
- Betsy Palliser
- Carla Pamak

Students can also choose a female scientist from their country or region and create a profile.

Here is an inspiring profile of Shannon O'Hara (Inuvialuit Settlement Region), Romani Makkik (Nunavut), Betsy Palliser (Nunavik), and Carla Pamak (Nunatsiavut), who are the Inuit Research Advisors for their respective regions. Students can learn more about their research and fields of study here:

science.gc.ca/site/science/en/northern-contaminants-program/meet-ncp-partners-and-researchers/romani-makkik-shannon-ohara-betsy-palliser-and-carla-pamak

Conclusion

This exercise allows students to extract and decipher information from scientific texts and draw conclusions. More often than not, information in published journals is highly technical and difficult to unpack. Through this lesson, students gain insight into how journals are written and what kind of information can be extracted from charts and graphs. It also allows the students to explore various factors that might encourage women to pursue careers in STEM fields.

Resources

- Women in Science (**science.gc.ca/site/science/en/women-science**)
- Arctic Advocacy podcast (**pinnguaq.com/learn/the-root-stem-podcast/arctic-advocacy**)
- Beyond Ones and Zeros podcast (**pinnguaq.com/learn/the-root-stem-podcast/beyond-ones-and-zeros-the-ethics-of-indigenous-data-management**)
- Space Careers: Abby Lacson Profile (**pinnguaq.com/stories/steam-around-us-abby-lacson-profile**)
- Beyond Blathers: Science in Modern Media podcast (Part 1) (**pinnguaq.com/learn/the-root-stem-podcast/podcast-play**)
- Beyond Blathers: Science in Modern Media podcast (Part 2) (**pinnguaq.com/learn/the-root-stem-podcast/podcast-play-part-2**)

TECHNOLOGY AND SOCIETY

DATA

LESSON 4

Translating Literature to Code

Author: Ayesha Akhlaq
Estimated Time: Two 40-minute sessions

Level: Grades 9 to 12

Curriculum Links

Ontario: Reading and Literature Studies
- **1** – Reading for Meaning
- **2** – Understanding Forms and Styles
- **3** – Reading with Fluency
- **4** – Reflecting on Skills and Strategies

Ontario: Oral Communication
- **1** – Listening to Understand
- **2** – Speaking to Communicate

Nunavut: Uqausiliriniq
- Communication
- Language
- Creative & Artistic Expression
- Reflective & Critical Thinking

Learning Objectives

Through this cross-curricular lesson, students read the poem ***Holding Grief*** by **Ashley Qilavaq-Savard** and illustrate the poem using DALL-E.2. This allows students to make innovative and meaningful connections between artificial intelligence and literature, thus exploring a new medium of expression.

This lesson merges the worlds of artificial intelligence (AI) and poetry. Students read a poem and decipher it to analyze tone, emotions, and symbolism. Students use DALL-E-2 to create an AI-generated rendition of the poem based on their critical analysis.

Vocabulary

- **uummati** – heart
- **nuna** – land
- **aqsarniit** – northern lights
- **sila** – weather
- **siku** – ice
- **imiq** – water
- **Talking Circles** – Talking Circles, also called peacemaking circles, come from the traditions of Indigenous Peoples of North America, particularly tribes in the Midwest. Circle processes are based upon equality between participants and the principle of sharing power with each other instead of having power over one another. Talking Circles can be used for discussion, problem-solving, and/or decision-making. The basic purpose of a Talking Circle is to create a safe, non-judgemental place where each participant has the opportunity to contribute to the discussion of difficult and/or important issues

Reading and Critical Analysis

To begin the lesson, read the poem ***Holding Grief***.

If I give my heart to the land, will it hold grief like I do? Too tightly and too long
it rolls in like thick ice fog in the dead middle of winter
drowning in debilitating delicacy
frost full of fragility
reassure that resilience is resting nearby
waiting for this all too familiar
Nothing feeling to disappear
Nothing feels empty, quiet, seemingly safe
Nothing likes to take time and lose it
more than grief
I don't notice this feeling seeping into my roots
like lifeless dry leaves slowly spreading
decay to Indigenous lineage
I'd never imagined a drought could happen in the Arctic tundra that is my home
until I felt it reached to my veins, right to my core
I stand staying still as seasons change around me
letting this Nothing become me as I wait for vitality

I learned with wasted time that one does not wait for resilience to be awoken
revival of resilience begins with a cry
a release
of sadness
regret
grief
feelings flooding in, not to be drowned in but to replenish and clearance the inner self
I gave my uummati to the nuna
not to let this all too familiar Nothing consume me

*(Source: "Where the Sea Kuniks the Land" by Ashley Qilavaq-Savard, **inhabitmedia.com/2022/12/13/where-the-sea-kuniks-the-land**)*

After reading the poem, lead the discussion with the following prompts:

- In your opinion, what is the format and structure of the poem?
- Do you find any symbolism in the poem?
- Do you identify any rhyming scheme in the poem? Or is the poem in free verse?
- Determine the voice and tone of the poem. What words or images convey the tone?
- Are you able to decipher the poet's feelings through her words? What do they convey?
- Does the ending offer closure to the story?

Poetic Tools and Structures

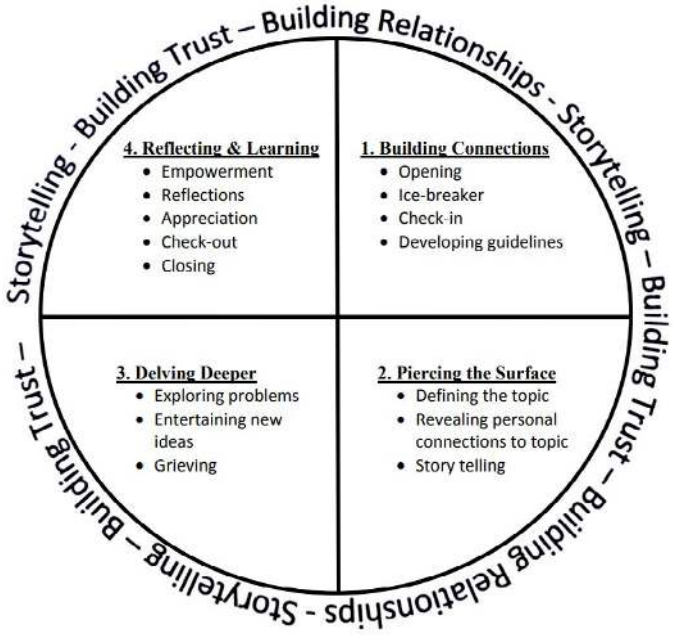
Poets use a variety of tools and structures to enhance the meaning and emotional effects of their work. Some of these are:

- **Simile** – A comparison stating one thing is like another: "leaves me like a needle"
- **Metaphor** – A comparison stating that something IS something else; using one thing to designate another: "in the haystack of light"
- **Hyperbole** – An exaggeration to create a strong impression or emphasize a point: "more or less kills me"
- **Rhyme** – Correspondence of sound between words or the endings of words, especially when these are used at the ends of lines of poetry: "delight/light"
- **Alliteration** – Repetition of consonant sounds, usually at the beginning of words: "to look, to listen, to lose myself"
- **Assonance** – Repetition of a vowel sound: "that leaves me like a needle"
- **Point of View** – (in fictional writing) The narrator's position in relation to the story being told, e.g. first person, second person, or third person

After reading the poem, ask the students to identify all the poetic devices and elements that have been used to express the meaning and emotions of the poem. The students should be able to identify all the above mentioned elements in the poem.

Talking Circle Activity

The teacher can also host a Talking Circle (**heartland.edu/documents/idc/talkingcircleclassroom.pdf**). Talking Circles are characterized by the use of a talking piece, which regulates communication. Both talking and listening are important in the circle because mutual understanding lays the groundwork for deeper, more meaningful discussion. Only the participant holding the talking piece may speak. Participants who do not have the talking piece listen and reflect on what the person with the talking piece says. The talking piece is a meaningful and symbolic object that the facilitator, also called the circle keeper, brings to the circle. The circle keeper often incorporates an explanation of the meaning of the talking piece into the circle activities.



*("Using Talking Circles in the Classroom" by Alaina Winters and Heartland Community College, **heartland.edu/documents/idc/talkingcircleclassroom.pdf**)*

Receiving the talking piece is an invitation to share with the group and helps ensure that everyone gets an opportunity to share at their own pace and in their own way without interruption. Participants share what they want, can remain silent during their turn, or pass by giving the talking piece to the next person. The talking piece is passed clockwise around the circle with each participant having a turn to share their authentic personal stories and have them respectfully heard and acknowledged without judgement, condemnation, or advice (unless advice is solicited).

Follow the steps for the Talking Circle discussion:

1. Establish a talking piece and respect it so the person who has it can convey their full message without interruption. Those who do not have the talking piece, listen respectfully and reflect upon, consider, and honour the meaning of what others say in order to build on the conversation.
2. You can pass if you wish. Non-verbal communication and silence sometimes say more than words.
3. Mute cellphones and computer devices to avoid interrupting others.
4. Speak for yourself and from your own experiences and perspectives. Use "I" language instead of generic language, like, "people think...," or sweeping generalizations, like "students want..."

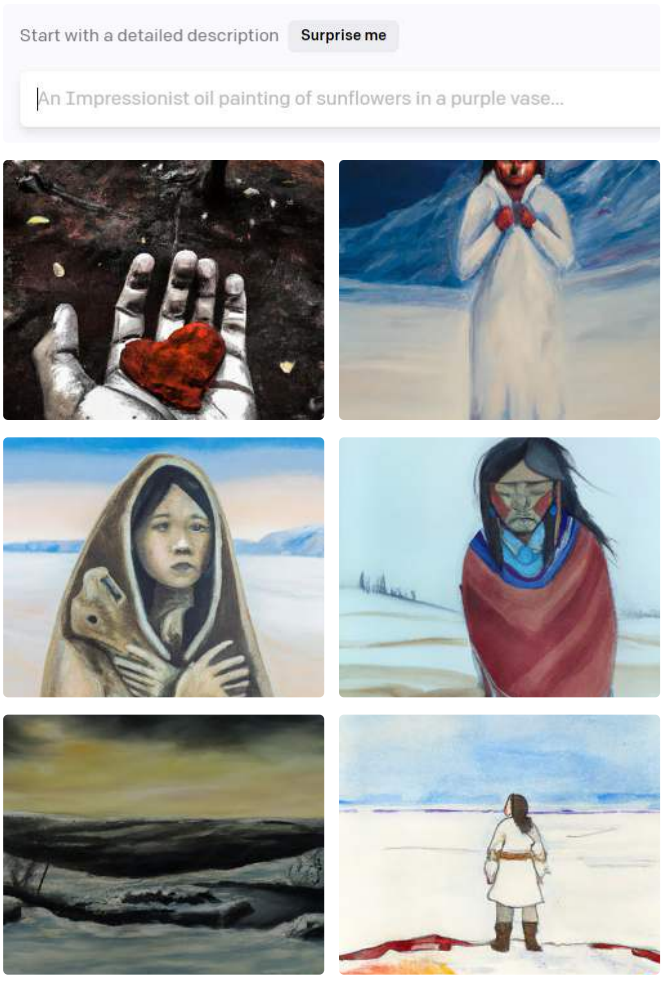
5. Be courageous, honest, and open with your own stories. Speak your truth from your heart and be open to hearing others' truths.
6. Listen with the heart, allowing what others say to move you. Bear witness but do not provide advice or argue.
7. Honour what others say with confidentiality and integrity, sharing only with context and in relevance to your own life and learning, not as gossip.
8. Take notes of the discussion to be used as a reference point for the next activity. These will be your "critique notes."

Using the poem and its metaphorical meaning as a topic of discussion, ask students to share their similar experiences or thoughts, and what new perspectives they have gained. Once the students have deciphered the meaning of the poem, ask them to note their ideas as a reference point for the computer activity.

Computer/Tech Activity: DALL-E 2 OpenAI

Ask the students to review their notes from the previous activity. Use the first five minutes of the lesson to go over the poem and its structure, tone, and symbolism.

1. Go to DALL-E-2 (**openai.com/dall-e-2**), an openAI tool, and sign up. Refer to the notes and find the most accurate description of the poem. Type the sentence in the search bar and hit **Generate**. Here are some examples of AI-generated images based on the poem:



2. Take other excerpts from the critique notes and create a story of an Inuit woman depicting resilience in the face of adversity. Use the openAI tool to illustrate the story and create an illustrative piece of art.
3. Students can also explore different styles of painting, for example: Van Gogh, Picasso, mosaic, or abstract. The following images were generated by the prompt, **"Create a Van Gogh-style painting of an Inuit woman standing in the frozen tundra."**

4. Present the illustrative story to peers to gather feedback and find ways to continue the discussion.

Resources

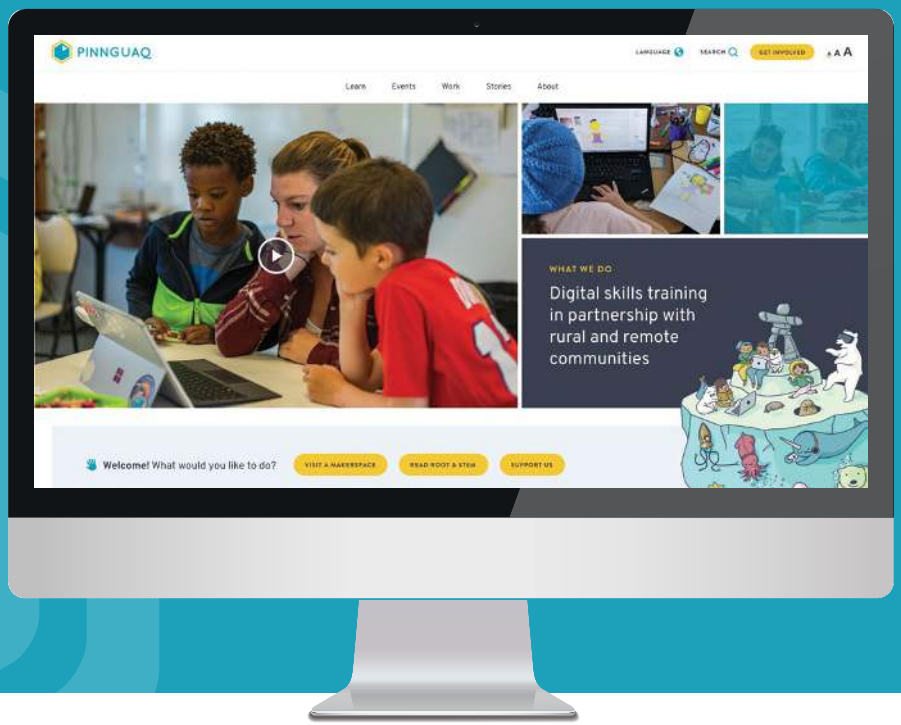
- To learn more about Talking Circles, read the paper "Using Talking Circles in the Classroom" by Alaina Winters and Heartland Community College (**heartland.edu/documents/idc/talkingcircleclassroom.pdf**)
- To explore more poems and literature from the Indigenous artists, check out books and reading material from Inhabit Media (**inhabitmedia.com**)
- To learn more about Nunavut-based educational resources, check out books and reading material from Inhabit Education Books (**inhabiteducationbooks.com/collections/all**)

CODING AND PROGRAMMING

TECHNOLOGY AND SOCIETY

DESIGN

LEARNING RESOURCES



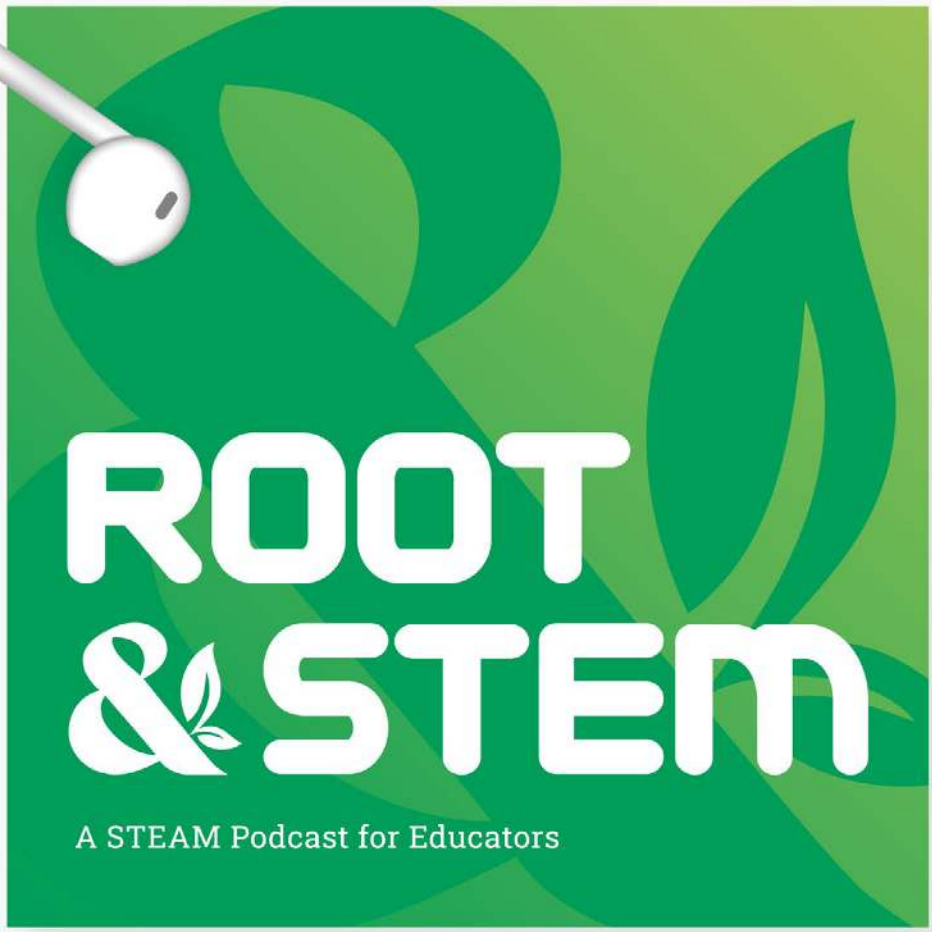
LOOKING FOR MORE CONTENT?

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

If you would like to receive **free** print copies of *Root & STEM*, please sign up at **pinnguaq.com/root-stem-subscription**

Discover Diverse Voices in STEAM Learning



Expanding on the print edition, the *Root & STEM* podcast introduces listeners to communities, projects, and activities exploring STEAM education in a digital world.

LISTEN ON Spotify

Listen on Google Podcasts

Listen on Apple Podcasts

pinnguaq.com/learn/the-root-stem-podcast

Interested in following the journey of *Root & STEM*? Follow Pinnguaq on Facebook, Instagram, and Twitter to share thoughts about the podcast using the hashtag **#RootandSTEMPod.**