

# STEM OUTREACH FOR YOUTH AND EDUCATORS IN THE BEAUFORT DELTA REGION OF THE NORTHWEST TERRITORIES

**A. Trimble<sup>1\*</sup> and H. Turko<sup>2</sup>**

<sup>1</sup> Aurora Research Institute, Aurora College, Inuvik, Northwest Territories, Canada

<sup>2</sup> Aurora Research Institute, Aurora College, Fort Smith, Northwest Territories, Canada

\* [atrimble@auroracollege.nt.ca](mailto:atrimble@auroracollege.nt.ca)

## Abstract

With support from Polar Knowledge Canada, Aurora Research Institute's (ARI) Western Arctic Research Centre offers students, teachers, and communities engaging, interactive science, technology, engineering, and math (STEM) programming to improve science literacy and build on the relationship between traditional and scientific knowledge.

Opportunities for youth to engage in hands-on scientific learning is limited in the Northwest Territories (NWT). As a result, interest in STEM subjects and careers may be lower than among youth in southern Canada. ARI delivers hands-on learning experiences for youth, professional development sessions and support for teachers, and community events to foster interest and confidence in the sciences. ARI's STEM outreach programming is dynamic, relevant to northern issues and curricula, and based on the needs of educators and community youth programs. Special care is taken to integrate regional, Indigenous

knowledge and languages into STEM programming and land-based activities, which makes for rich learning experiences. ARI also connects local STEM professionals and visiting researchers with youth and community members through interactive learning experiences and plain-language research talks. Based in the North, the ARI outreach team has strong relationships with the community groups and schools it serves and offers sustained programming—connecting with northern youth and educators many times during the school year. The ARI outreach program is critical to building capacity among northern educators and youth in STEM fields. Demand for the programming is increasing and the community-oriented, responsive ARI STEM outreach program has been expanded to include South Slave Research Centre. Further plans include expanding to the ARI Yellowknife branch, to reach youth and educators in the North Slave, Sahtu, and Deh Cho regions.

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## Introduction

It is estimated that in the next 15 years, more than 25,000 jobs will need to be filled in the Northwest Territories, most requiring post-secondary education and many in STEM related fields (Government of the Northwest Territories, 2016a). However, graduation rates in the NWT are consistently lower than the rest of Canada: the most recent comparable data indicate the NWT graduation rate of 52% was significantly lower than the Canadian average of 78% (Government of Northwest Territories, 2016b). Student performance in STEM subjects is also low—in 2013, the percentage of students achieving acceptable standards for grade 9 math was 37% for the NWT overall (Government of Northwest Territories, n.d.). When these results are broken down further, scores in larger centres are higher than in more remote communities (Government of Northwest Territories, n.d.; The Conference Board of Canada, 2016). Students need repeated exposure to role models and engaging STEM activities to motivate better performance, graduate, and pursue post-secondary education. However, opportunities for youth to engage in hands-on scientific learning are limited in the NWT, particularly in the more remote communities. As a result, interest in STEM subjects and careers in the North may be lower than among youth in other parts of Canada. Fostering student interest and engagement in the sciences and improving their awareness of local STEM careers will encourage more northern youth to pursue postsecondary education and return to the territory to fill these roles in Canada's North.

Schools play a critical role in student engagement and success, and the development of Canada's North. Unfortunately, many educators in the NWT are underserved and have limited access to professional development opportunities in STEM programming. In a 2016 survey conducted by Let's Talk Science, Inuvik teachers were asked what their biggest challenges were in teaching STEM subjects. The top two reasons were "time constraints for planning hands-on activities and/or labs" (chosen by over 90% of respondents) and "finding appropriate STEM resources" (chosen by over 40%

of respondents) (Anonymous Inuvik teachers, Let's Talk Science, 2016).

In order to address these needs in real, practical ways the ARI has revamped its outreach initiatives to include northern youth and educators by:

- delivering hands-on activities to the students;
- bringing in STEM professionals and discussing STEM based career options with classes;
- meeting with teachers and providing them with resources; and
- offering professional development workshops which focus on STEM delivery.

Being based in the regions served by the ARI, these outreach initiatives help staff develop relationships with local students and educators while delivering resources and hands-on programming on a regular basis.

## Program development and structure

ARI's mandate is to improve the quality of life for NWT residents by applying scientific, technological, and Indigenous knowledge to solve northern problems and advance social and economic goals. Its mission is to advance the territory's research capacity through discovery, outreach, and education. ARI operates out of three research offices: the Western Arctic Research Centre in Inuvik, the South Slave Research Centre in Fort Smith, and the North Slave Research Centre in Yellowknife (Figure 1).

As the research division of Aurora College, ARI is a northern organization with strong ties to education and capacity building. It has a long history of improving science literacy and communicating research to northern residents. This legacy is maintained through:

- connections to colleges and universities;
- engagement with the public through speaker series and family events;
- outreach to schools, camps, and daycares; and
- contributions to northern research and community-based monitoring programs.

ARI is a clear and active stakeholder in both research and education in the NWT.

Thanks to a formative collaboration between ARI, Let's Talk Science, and the Beaufort Delta Education Council, and with support from Polar Knowledge Canada, ARI established an outreach coordinator position in 2016. The intent of this role is to serve educators and students, while continuing ARI's standard outreach activities. Based in Inuvik, the outreach coordinator serves the Beaufort Delta region, which includes eight communities and nine schools, with approximately 6 500 residents and 1 500 students. The outreach coordinator ensures ARI's STEM outreach programming is relevant to local students, the courses they are taking, and the places they call home. This outreach initiative is culturally sensitive, responsive to community needs, and built upon strong northern relationships and partnerships.

The schools in the Beaufort Delta region have land-based cultural programming built into their school year, and these learning environments are often the richest. They provide a natural platform for students to explore the principles of the natural world, think about stewardship of land and wildlife, and to gain hands-on experience with environmental monitoring tools and techniques that can serve them later in life. ARI understands the importance of making connections between traditional knowledge, local knowledge, and scientific knowledge.

Through the STEM outreach program, ARI is able to address both the breadth and depth of engagement for students and educators. Being based in the region the outreach program serves, ARI outreach staff are able to develop relationships with local youth and educators. ARI also delivers resources and dynamic programming on a year-round basis, in schools that only hosted STEM outreach teams once every year or every few years. This model of delivery creates multiple interactions with students over the course of their education.



Figure 1: Aurora Research Institute is located in the Northwest Territories, with headquarters in Inuvik, and branches in Fort Smith and Yellowknife.

## Connecting northern youth with northern role models and careers

The Western Arctic Research Centre hosts over 200 visiting researchers each year, many of whom are studying natural sciences. This community of research professionals is a rich resource. ARI staff draw on this community to create STEM outreach materials and conduct classroom and community visits. ARI staff also draw on their northern partners in science and education. There are many STEM professionals based in northern communities, from wildlife and parks officers to water quality specialists and permafrost engineers. ARI connects local STEM professionals and visiting researchers with youth and community members, through interactive learning experiences and plain-language research talks. Facilitating interaction between

youth and STEM professionals and showcasing local career options in northern communities helps increase awareness of the exciting jobs available close to home. ARI works with the host educator and the guest STEM professional to ensure the visit includes hands-on activities and strong curriculum ties. When these visits take place on the land, the learning experience is especially rewarding for the students and guests alike.

## Program focus

ARI's STEM outreach program focuses on three target audiences.

### 1. Student outreach

School outreach includes hands-on, interactive lessons aimed at increasing interest and improving knowledge in STEM subjects. Students can participate in engaging STEM lessons and use some of the latest technologies in education, such as coding and 3D design and printing. ARI staff work with schools and their on-the-land programs to offer insight into how Indigenous knowledge and scientific knowledge can work together. Youth learn about the past, present, and future of our regions. ARI connects students with local STEM professionals and researchers to offer them practical experience and to increase their awareness of STEM-related careers (Figure 2). Students from across the region also have the opportunity to participate in the Inuvik Robotics and Engineering Club, either in person or by videoconference, and to participate in a variety of challenges from developing videogames to contributing to ARI's cube satellite project.

### 2. Teacher outreach

ARI's Outreach Coordinator works with teachers individually and in small groups to provide professional development and to support STEM-related lessons, activities, and resources. For example, an elementary school teacher may request resources and ideas for teaching students about structure and stability. In response, ARI might brainstorm engineering challenges for the students



Figure 2: Hydrology researchers offer students a series of challenges using scientific instruments and concepts that connect snowpack to stream health, wildlife, and forest fire frequency.

or plan a field trip to see how melting permafrost is affecting northern infrastructure. The resources ARI offers are aligned with the curriculum, locally relevant, and appropriate to the needs of the teachers ARI works with in the North (Figure 3). Special care is taken to include Indigenous knowledge and the languages of northern regions. As teachers gain more confidence in offering STEM programming, ARI will continue to provide support in order to build capacity for interactive lessons offered in schools.

### 3. Public outreach

ARI provides a platform where northern communities can inquire, comment, and request information about science and research happening in the North. ARI's Scientific Speaker Series,



Figure 3: Daycare students learn about the sun, the moon, and the surprising shadows a solar eclipse can make.

where community residents can hear plain-language research talks, is one of our most popular outreach events. These talks feature the scientists and researchers working and travelling in our region—studying various topics from permafrost to archaeology. ARI also hosts and supports family friendly STEM events, such as the community Science Rendezvous in Inuvik (Figure 4), and the Dark Sky Festival held in Fort Smith, the world’s largest dark sky preserve. These family events foster confidence and connection with northern youth as they explore and learn alongside their parents and peers.

## Participant feedback

After a classroom visit, we asked, “What did you learn today? What surprised you?”

A grade six boy answered, “That science is fun. And that I’m good at it.”

“I just wanted to send a quick note of thanks for our hands-on PD [professional development] session. It was such fun, and a great source of ideas and activities to do with our class! All so do-able, with easy access to materials, and a good wow-factor for the kids -- thank you!! I hope we get to have more PD sessions together in the future.” –Elementary school teacher

“Again, thank you so much for all your help! It really has been a great afternoon and the kids had LOTS to talk about when we got back. I can only imagine how much more they will want to share with their parents when they get home.” –Elementary school teacher, after an outdoor exploration of local plants and their traditional uses

“I watched from above as several of the children interacted with the enormous map; they were soaking up the learning while having bunches of fun. Thank you to your team for all of the mindful preparations that have gone into making each of the activities full of learning and fun!” –Elementary school principal, after a GeoWeek session

“I wanted to thank you for our time together, and all the time and enthusiasm you put into outreach on an ongoing basis! You’re an amazing person! I really enjoyed spending some time together and I am very grateful that you are the on-the-ground person we get to work with!” –Let’s Talk Science outreach team

“We should thank you for coming over and bringing out hidden interest of some of the kids which we never saw while working with them here at the library. It was great to see kids participate and enjoy. We are eagerly waiting for the next session with you.” –Public Librarian and Afterschool Program Coordinator

## Increasing demand

The first year of ARI’s STEM outreach program was about connecting with educators and raising awareness of the support available for STEM delivery. It was also about developing outreach activities that provided northern context to everyday STEM principles. As the program got underway, word spread, and so did demand. Table 1 shows the number of youth interactions, professional development sessions, and community events has grown each year.



Figure 4: Science Rendezvous offers the public a chance to explore the science behind northern communities, with each local organization offering hands-on activities to participants.

## Expansion

In 2018, ARI's STEM outreach program was expanded to include the South Slave region, with a part-time Outreach Coordinator position located at the South Slave Research Centre in Fort Smith. The South Slave region consists of seven communities and eight schools, with approximately 8 000 residents. In less than a year, ARI staff have provided several engaging STEM learning opportunities for youth, teachers, and families including:

- a week-long Actua summer camp held in Fort Smith for over 30 youth;
- the first family Science Day with over 40 attendees;
- a visit by Nagin Cox, a spacecraft operations engineer at NASA's Jet Propulsion Laboratory; and
- professional development training for teachers in design thinking and computational thinking.

A new science, technology, engineering, arts, and math (STEAM) course was implemented in Fort Smith's junior high classes. ARI has offered teachers support in the form of co-planning and modelling hands-on lessons. Over the past 10 months, relationships in the communities and schools have been built and people are eager for more outreach.

Table 1: ARI Outreach metrics. Participant metrics reflect the total number of participants reached at multiple events, not the number of unique individuals reached. The outreach coordinator position was established in 2016 to serve students and educators in the Beaufort Delta region, while continuing ARI's standard outreach activities. The intent of the program is to connect with northern residents many times in a given year, as such programming is offered year-round.

	2015	2016	2017	2018
Youth Outreach (Preschool through Grade 12)	7 events 1 110 youth 1 community	18 events 466 youth 1 community	41 events 1 204 youth 2 communities	147 events 2 819 youth 6 communities
Educator Outreach	None	2 events 5 teachers from 1 community	8 events 58 teacher from 8 communities	14 events 127 teachers from 8 communities
Community Outreach	8 events 237 participants	13 events 457 participants	20 events 944 participants	26 events 1 070 participants
Scientific Speaker Series	8 speakers 9 events 145 participants	27 speakers 14 events 277 participants	28 speakers 13 events 311 participants	40 speakers 15 events 325 participants

ARI has been able to connect and offer support to at least one teacher in each school in the South Slave Divisional Education Council.

The response to a workshop with Let's Talk Science has been extremely positive:

*"I haven't had a more applicable PD in a long time! The activities provided were beneficial and useful. I have already used most of the activities in my class."*

*"I very much enjoyed the workshop, as I'm sure you noticed by my interest and enthusiasm! The [coding kits] are great and I have already used them...and have sparked their interest into delving deeper into the use of these items."*

Through hands-on activities, ARI's STEM outreach program has supported youth as they discover new concepts through critical thinking and discovery-based learning opportunities. STEAM clubs are starting in the region, coding and robots are being used in classrooms, and STEAM design challenges are helping make connections between curricular outcomes and real-world problems.

As ARI continues its outreach programming in the South Slave region, local youth, families, and organizations will continue to benefit from opportunities to make connections between scientific knowledge and traditional knowledge on the land. ARI offers support to new teachers through hands-on-science workshops for the Bachelor of Education students at Aurora College. Through its outreach program, ARI also plans to continue providing opportunities for youth to develop their critical thinking skills, to ask important and innovative questions, investigate problems, and be engaged in their learning.

## Next Steps

ARI recognizes the value of this outreach program and will work to ensure it continues. It hopes to secure long-term funding to sustain and expand the successful outreach programs established in the Beaufort Delta and South Slave regions, to mentor additional staff in outreach skills and to provide programming to remote communities more often. In time, ARI intends to expand the STEM outreach program to the North Slave region, as it has a branch in Yellowknife. With this forward momentum, ARI looks to reach youth and educators in the Sahtu and Deh Cho regions.

Even now, the community-based, responsive programming is a model for science promotion in remote, underserved regions. ARI staff look forward to seeing more relationships built, students inspired, and educators equipped as this outreach program continues.

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