

## Using First Nation Pedagogies to Improve Computer Science Education

Software engineering and computer programming have existed as careers in Canada for decades. Hundreds of thousands of Canadians have worked designing and building software for companies. However, First Nations in Canada are severely underrepresented. While one in 343 Canadians are computer programmers, only one in 1207 First Nations work in the same career (Statistics Canada). With the goal of attracting more First Nations to engineering fields, this report will explore how different Indigenous pedagogies can make learning computer science more engaging, collaborative and memorable. It will describe an example programming lesson with the goal of teaching virtual salmon to swim upstream past obstacles that applies these pedagogies in meaningful ways.

Computer programming education stands to benefit from a change in how education is shared. In western computer science classes, learning is a one-way process in which the teacher tells the students what they need to know and then expects each student to apply that knowledge to solve a closed problem on their own. This is a straightforward process for the teacher, but is often frustrating for learners. It doesn't allow for students to build off each other's ideas.. They aren't incentivized to think outside the box and be creative. This can be rectified using the First Nation pedagogy of learning in a circle (Indigenous Education). By treating the teacher and students as equal and having everyone in the group work towards a common goal, everyone gets the chance to learn more, together. The most significant way this lesson format sets itself apart from typical western teaching is by having the entire class collaborate on a problem. Not only does this make the lesson more engaging, it also prepares students for a career in computer

programming, where understanding how to work together on code is crucial to finding success.

This change is very likely to improve the experience of First Nation learners who are accustomed to this pedagogy, but its demand for creativity and collaboration will also make the lesson more helpful for non-Indigenous learners.

Collaborating on a common solution is helpful in making the class more engaging, but it is limited by the nature of traditional western coding problems. Usually, the problems students are required to solve aren't open-ended, there is only one correct solution. In order to overcome this, the lesson can be designed to instead ask students to solve an open-ended problem that is multi-staged and becomes progressively more challenging throughout the lesson. With success in solving an initial straightforward problem with a clear solution, students are challenged to solve increasing complex variations of the problem that have multiple possible solutions. In this demo lesson, the students will be programming salmon to make their way upstream. The problem will begin with a simple, closed solution with one salmon and a simple path to the finish. As students progress, the class will discover obstacles such as multiple salmon starting in different positions, rocks, etc. This refinement incorporates the First Nation supported learner-centered approach, where the teacher acts as “a facilitator of learning” as opposed to a “classroom manager” (British Columbia 48). By choosing an open ended problem and accepting that the teacher doesn't know everything about the topic and is also learning and thus is open to novel and creative approaches to the solution, the lesson becomes even more engaging.

Another Indigenous pedagogy that can enhance computer programming education is land based learning. While western-style education traditionally occurs in the classroom, historically First Nations have typically learned outside. When education takes place outdoors, there are

“measurable socio-emotional, academic and wellbeing benefits” (Mann et al.). Computer programming education would benefit from taking advantage of opportunities to have students learn outside the classroom in natural environments. This example lesson is intended to be performed in nature overlooking a stream with migrating salmon. Students will be able to look up from their salmon simulation and see real salmon, stimulating creativity through learning from real salmon. Not every lesson easily translates itself to a natural environment. However, by looking for ways to move lessons and learning opportunities outdoors, instructors can stimulate learning and creative and innovative problem-solving by their students.

By incorporating Indigenous pedagogies and communication practices into computer science education, it can become a more engaging, collaborative, and effective learning environment for First Nations and all students. The example lesson outlined in this essay demonstrates how collaborative, learner-centered, and land-based approaches can be applied to computer programming instruction. Through working together in a circle to solve an open-ended problem in the outdoors, students are encouraged to think creatively, build upon each other's ideas, and develop the teamwork skills essential for success in the software engineering field. By embracing these pedagogies, we can not only increase representation in the technology sector but also cultivate a more diverse and innovative generation of computer programmers and software engineers.

### Works Cited

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