Teaching for the Digital Future:

Developing a Pan-Canadian K-12 Computer Science Framework

Working Document 1: Initial Findings and Directions

For Consultation

DIGITAL SKILLS FIT FOR OUR TIME

Public education exists to provide all students with the opportunity to learn the competencies and skills that can meet the needs of their times.

Today, our times are shaped by pervasive digital technologies that are changing how people live, work, interact, and learn.

And though the best digital technologies are almost effortless to use, few of us understand how they work, or the logic that underpins them.

We want to empower students to be both users and makers of digital technologies and enable them, with their abilities, to enjoy and harness the power of these new tools.

UNEVEN ACCESS TO COMPUTER SCIENCE EDUCATION

Over the past decade, education leaders across Canada have been making strides towards including Computer Science education in curricula. Yet, the Computer Science education landscape remains uneven.

Some provinces and territories require all students to learn Computer Science, whereas others offer these classes as electives. For some students, Computer Science education is integrated across a variety of subjects, while for others it is an extracurricular activity. And in a few cases, there is little or no opportunity for students to learn the subject.

The result is inequitable access to high-quality Computer Science education across Canada.

CREATING GREATER ALIGNMENT

One way to address this unevenness is to create alignment in Computer Science education outcomes for provinces and territories across Canada.

We intend for a Pan-Canadian K-12 Computer Science Education Framework to do just this. In particular, it would present a vision for Computer Science education in Canada and provide a set of guidelines for what every Canadian student must know in order to navigate an increasingly digital world.

In addition to addressing the unevenness in access to Computer Science education, greater alignment will also:

- Extend the benefits of a high-quality Computer Science education to all Canadian students
- Integrate Computer Science learning opportunities across various courses
- Broaden access to the field of Computer Science, notably for groups that have been traditionally underrepresented in the industry
- Close the growing gap between those who use digital technologies and those who make them
- Ensure that Canadian students remain globally competitive

CRITERIA FOR SUCCESS

To succeed, we will:

1. Build a framework by engaging with a broad range of stakeholders from across Canada including policy-makers, curriculum developers, teachers' unions, school boards, educators, parents, as well as NGOs and industry leaders.

2. Be allies to teachers who have valuable insights into the needs of their students and ultimately know what works in classrooms.

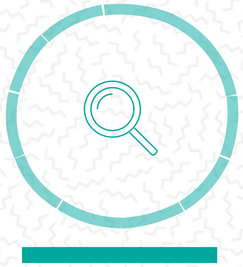
DEVELOPING THE FRAMEWORK

Working with an Advisory Group of leading thinkers from across the country, Canada Learning Code is spearheading the development of this Framework by engaging with policy-makers, teachers, industry leaders, and NGOs.

2018 Forum

In November, we convened experts in Computer Science, as well as in policy and curriculum development, to discuss the need for a CS Framework, what it could include, and how it should be built.

Fall 2018



1

Research and Informant Interviews

We completed a scan of provincial and territorial curricula, researched similar frameworks from other jurisdictions, convened an advisory group, and spoke to some 30 key informants from Canada and around the world to gather recommendations on how to develop the Framework.

Winter/Spring 2019

Working Document 1: Initial Findings and Directions

2

Survey and Stakeholder Engagement

We want to make sure the perspectives of policy-makers, curriculum developers, teachers' unions, teachers, industry, and NGOs are captured. That's why we're gathering feedback on this working document through an online survey and workshops.

Summer/Fall 2019

Working Document 2: Competence Guide

3

Survey and Public Engagement

We will continue gathering feedback as we develop the Framework. After we release our second working document, we will continue collecting feedback through another online survey and workshops.

Winter/Spring 2020

Framework

HOW TO READ THIS DOCUMENT

Putting ideas to paper is a critical first step for engaging with stakeholders and collecting feedback on what we have learned and how we should move the project forward.

This working document is just that — a first step.

It will be used to collect feedback through our online survey and jump-start conversations about the future of Computer Science education in Canada with:

- Policy-makers
- Curriculum developers
- Teachers' Unions
- School boards
- Educators
- Industry stakeholders
- NGOs

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What to expect in *Teaching for the Digital Future: Developing A Pan-Canadian K-12 Computer Science Framework*

A vision for Computer Science education by 2040

If we work to create guidelines for enhancing how Computer Science is taught across Canada, the first cohort of fully-integrated students could graduate by 2040.

By 2040, students should…

Become creators of digital artifacts
More than being users of technology, students should understand how technology works, and be capable of creating their own digital tools.

Convey how technology works
In addition to being able to build their own digital tools, students should be able to explain to others how digital tools and technology work.

Implement technology in everyday life
Students should be able to use technology to develop creative solutions that can address challenges they personally face, or issues affecting their community and the world around them.

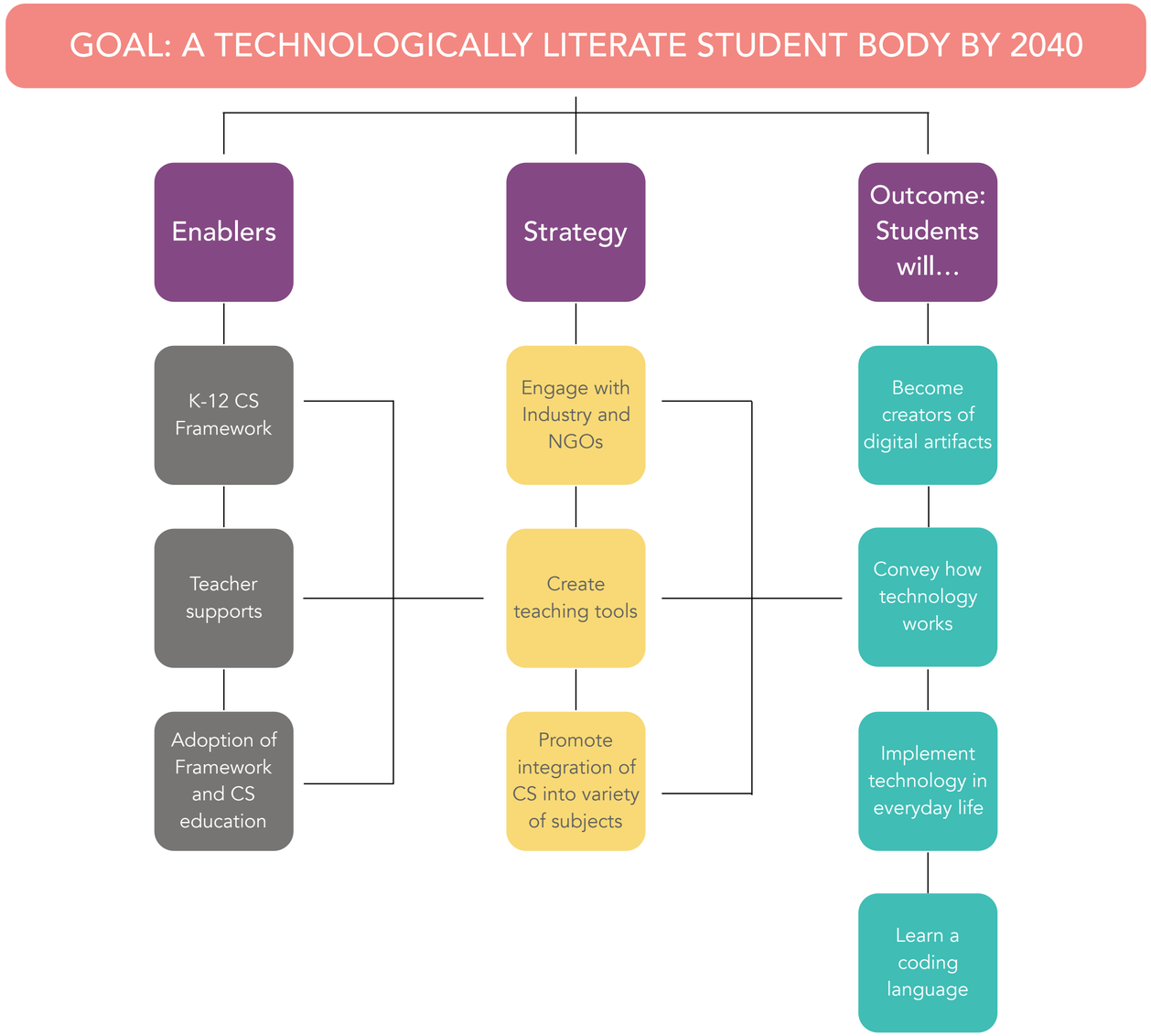
To do this by 2040, students will need to…

Learn a Computer Science language

Beginning at an early age, all students should learn at least one Computer Science language, be it CSS, Java, HTML, Python, or any other. Learning a coding language helps students understand the inner workings of digital technologies. Crucially, it also allows them to feel capable of fixing that technology, or accurately diagnosing the problem when something goes awry.

To accomplish this, we should…

- **Create a Computer Science Education Framework that:**
  - Defines the barriers and challenges facing Computer Science education in Canada
  - Establishes a shared understanding of what values, skills, and competencies should be included in a Computer Science education
  - Clarifies and promotes the acquisition of both ‘beginner’ and ‘advanced’ Computer Science skills
- **Engage with NGOs and industry to understand what new role they might play in supporting and enhancing access to a Computer Science education**
- **Promote the integration of Computer Science education into a variety of different subjects**
- **Present a pathway for supporting teachers with curricular suggestions for integrating Computer Science into the classroom**
- **Inspire adoption of the Framework and Computer Science education across the country**



How these elements connect

Challenges facing Computer Science education

CHALLENGES FACING COMPUTER SCIENCE EDUCATION

1 **Unreliable internet causes northern, rural, and Indigenous exclusion**

If internet connectivity is unreliable in many parts of Canada, a fact that disproportionately excludes northern, rural, and Indigenous students from opportunities to learn Computer Science, **then** this Framework should include ways of teaching Computer Science that do not rely exclusively on the internet.

2 **Systemic barriers impact student learning**

If poverty, discrimination, or geographic isolation hinder students' ability to participate fully in opportunities to learn Computer Science, to see a future for themselves in the field, or to imagine attending college or university, **then** this Framework needs to strive for accessibility and inclusion to begin overcoming all socio-economic barriers to learning Computer Science.

3 **Language barriers**

If coding languages and many digital tools are typically only available in English, **then** this Framework should be written in both of Canada's official languages, English and French.

4 **Lack of access to digital tools and gadgets**

If the cost of tablets, computers, and digital teaching gadgets are prohibitively expensive for governments, school boards, and individual students to purchase, **then** this Framework should include ways of teaching Computer Science that are not entirely dependent on technology.

5 **Accessibility barriers to working with technology**

If working with computers and technology can pose accessibility challenges for students with physical, cognitive, or learning disabilities, **then** this Framework should incorporate principles of Universal Design in supporting equal, flexible, and intuitive access to Computer Science learning opportunities.

6 **Heavy workload for teachers**

If teachers across Canada are already facing heavy workloads, **then** this Framework should be short, easy to understand, and outline pathways for teachers to acquire or enhance their professional development of Computer Science teaching skills, regardless of the subject areas they teach.

Guiding Values

GUIDING VALUES

In developing this Framework, we propose that Computer Science education should be:

Integrated
Computer Science education is its own distinct field, but it also shares many concepts and ways of thinking with a broad array of subject areas, including languages, civics, math, and science. Computer Science therefore should be taught within this broader context.

'Two-Eyed'
Computer Science education should be 'Two-Eyed', asking us to see issues from Indigenous and Western perspectives. By combining these two views, we encourage cultural and multi-disciplinary collaboration and integrated thinking. Also known as *Etuaptmu'k*, 'Two-Eyed' seeing is a principle advanced by Elders Albert and Murdena Marshall of the Mi'kmaw Nation.

Inclusionary
Computer Science thrives on a diversity of skills, experiences, and views, and is most effective at meeting technical and social challenges head-on when it is inclusive of everyone. It should be taught or learned by anyone, anywhere, at any time, regardless of age, gender, race, religion, ethnicity, or access to expensive gadgets or internet connectivity.

Solutions-seeking
Computer Science education should promote solution-seeking and encourage students to be creative, adaptable, and flexible when designing and building digital tools. This notion is also a common Inuit education principle known as *Qanuqtuurunnarniq*.

Adaptable
Computer Science education should be able to adapt both to local contexts and emerging technological changes. This will be necessary to ensure it is effectively taught and learned in classrooms across the country.

Collaborative
Computer Science education should focus on creating opportunities for students to practise skills and competencies by working effectively with others to discuss, build, test, and revise digital artifacts.

Human-centred
Computer Science is about humans using computing to solve a range of challenges, and is best taught, learned, designed, and understood with a variety of human experiences in mind.

What should be included in Computer Science education?

While ‘coding’ has become a stand-in for what many imagine when they think about Computer Science, the discipline extends well beyond creating websites and software.

For the purpose of developing this Framework, we propose that Computer Science education should be built around the following five components:

Expanding this section and drafting a Competence Guide is the focus of the next working document.

HOW YOUR INPUT WILL HELP US

By completing our online survey and attending in-person workshops hosted across Canada, you can help us answer the following questions:

- Is the Framework heading in the right direction?
- Is our vision realistic and feasible?
- Does it identify all necessary barriers to accessing a high-quality Computer Science education?
- Have we identified the right components of Computer Science education? What is missing?
- Is the information gathered to date accurate?

Feedback submitted on this version of the document will be used to help us build our second working document that will be released in Fall 2019. After another round of public and stakeholder engagement, including an online survey and workshops, **the Pan-Canadian K-12 Computer Science Education Framework will be made available to the public in Spring 2020.**

Questions? Send an email to: csframework@canadalearningcode.ca

THANKS FOR YOUR INTEREST IN STRENGTHENING COMPUTER SCIENCE EDUCATION IN CANADA