



Canada Learning Code

Pan-Canadian Computer Science Education Framework Learning Forum Summary Report



Introduction

Canada Learning Code is a national charity that designs, delivers, and partners on technology education for Canadians. Canada Learning Code has embarked upon a year-long process to create a K-12 Computer Science Education Framework for Canada. The Framework is intended to be a high-level document, clarifying key terms and ideas associated with Computer Science learning, outlining skills and attributes learners can acquire at different grade levels, and ultimately providing high-level guidance that provincial and territorial governments can refer to inform their individual curriculum development.

In November 2018, Canada Learning Code convened the first conversation in the Framework development process. Representatives from provincial and territorial governments, non-profit organizations that teach Computer Science to children and teachers, curriculum writers, and academics met in Halifax, Nova Scotia, to discuss what a future Pan-Canadian Computer Science Education Framework could look like. A list of attendees can be found at the end of this report.

The meeting goals were to:

1. Initiate a discussion about the necessity and value of a pan-Canadian K-12 Computer Science Framework in the context of the Canadian learning environment, answering the question: *Why a pan-Canadian Framework?*
2. Identify the elements that would make for a successful Framework, answering the question: *What does the Framework need to contain?*
3. Inform the Framework development process, answering the question: *How should we develop the Framework?*



Over the course of a working dinner and day-long conversation, the group discussed the state of Computer Science education in their own jurisdictions, the pan-Canadian learning environment, other Computer Science establishments that would be served by a framework, and considerations to inform the framework development process. Participants also heard from Pat Yongpradit, the Chief Academic Officer at Code.org, who shared lessons learned in the framework development process that took place in the United States.

Recognizing the complexity of both Computer Science learning and the diverse Canadian education environment, the discussion was not intended to achieve consensus or resolve all the issues related to framework creation. Rather, the group was tasked with highlighting areas of alignment and disagreement, and helping to set the agenda for the framework development process.

The following is a synthesis of the discussion. It is organized into four parts: the Current State of Computer Science Education in Canada, Priorities for a Pan-Canadian Framework, Setting the Agenda, and Developing the Framework.

The current state of Computer Science education in Canada

Participants were unanimous in their observation that demand for Computer Science skills is growing throughout Canada, given the rapid expansion of Canada's tech industry. At the same time, employers outside the tech industry are also increasingly seeking skills gained through Computer Science learning, including collaboration, problem solving, and data analysis. Regardless of professional pursuits, there was consensus that comfort with Computer Science and digital literacy are essential to nurturing informed citizens and lifelong learners.

In an effort to keep up with these fast-paced changes, Canadian provinces and territories have begun to shift their approaches to Computer Science education. Several provinces have recently rewritten their curriculum to include Computer Science, coding, and computational thinking. Some schools offer Computer Science as an elective course or as a co-curricular activity, while others allow non-profit organizations that teach Computer Science skills to provide coding workshops to students both during and outside of school hours.

Participants agreed that while these solutions have improved Computer Science education, the emergent nature of the field has created an uneven learning landscape. While gaps between provinces and territories exist, there is also a growing gap between schools that have access to modern technology tools and Computer Science courses and those that do not. This divide often results in growing inequities between urban and rural communities, and affluent and impoverished communities. Participants also highlighted particular distinctions and divides between Francophone and Anglophone communities, and southern Canada and the North. Participants expressed concern that these divides could have long-term impacts on students, leaving them unprepared to meet the demands of post-secondary education or employment.



A Pan-Canadian K-12 Computer Science Education Framework was seen as one way to narrow the gap. Participants described the framework as one potential tool to level the playing field among all students, and to equip them with the requisite skills for an increasingly digital post-secondary education and workforce. Although a framework is a non-binding document, it could be used to inform curriculum development in provinces and territories across Canada.

Canada can look to several countries and regions including New Zealand, Turkey, Estonia, the United States, the United Kingdom, and the European Union, for example. Pat Yongpradit of Code.org described the framework development process undertaken in the United States, and discussed implications and lessons learned with the group. Participants agreed that while learning from other jurisdictions is valuable, Canada needs its own framework to meet the demands of Canadian society and to suit its policy landscape.



Priorities for a Pan-Canadian K-12 Computer Science Education Framework

Participants agreed that, if well executed, students would benefit from a pan-Canadian Computer Science education framework. Through several plenary discussions and facilitated conversations, participants discussed what a good Computer Science education framework would embody. The following are the key themes that emerged from those discussions:

A good framework should be student-focused

- Participants agreed that a framework should:
 - Improve student outcomes in Computer Science skills;
 - Encourage students to be digitally literate, life-long technology users;
 - Appeal to a wide variety of students, not only those interested in pursuing Computer Science. This means that rather than encouraging all students to become programmers, the framework should promote those hard and soft skills gained through Computer Science learning that can benefit a range of students considering diverse career paths.
- Participants noted that a framework should encourage approaches to education that correct the idea that Computer Science skills are only for students interested in pursuing further education and employment in that field. Skills such as collaboration, problem solving, and data analysis, which are also acquired through Computer Science education, can serve all students in virtually any post-secondary degree and professional career.



- Several participants stated that approaches to education outlined in the framework should not be dependent on the technology present in each school. Students should acquire the same level of Computer Science skills regardless of location, internet access, or tools.
- Some participants hoped that the framework would encourage students to not only use, but also create and produce technology.
- Some participants stated that through Computer Science education, students should understand the broader digital world.
 - In particular, several participants noted that a framework should outline how to address security and privacy issues in a manner relevant to students.

A good framework should be relevant for a range of policymakers and educators

- Most participants agreed that a framework should define and use common language around Computer Science skills, computational thinking, and coding. Currently, shared common language does not exist around these concepts and should be established for a framework to be useful across Canada.
- Some participants mentioned that a Computer Science education framework should not be prescriptive. It should guide curriculum development in a manner that enables both curriculum designers and teachers to interpret it to suit their own classrooms and communities.



- Some participants recognized that a Computer Science education framework will introduce new concepts into education, and should align with the existing understanding of K-12 learning. An effective framework should connect to core competencies that already exist within provincial and territorial curricula.
- Participants agreed that the framework should demystify and simplify Computer Science to the extent that teachers without formal training in the field should be able to read, understand, and incorporate the framework into their classrooms.
- Several participants noted that a framework does not have to be lengthy to be effective, and that it may be practical to craft sections of the framework for specific user groups, such as teachers and policymakers.

A good framework should be flexible

- Participants agreed that a Computer Science education framework should be flexible and broad enough to use in all provinces and territories, in both French and English, and in urban and rural communities.
- A few participants mentioned that a framework should help educators share teaching resources, both locally within their own boards and across Canada, as teachers and policymakers do not often have the opportunity to interact with and learn from one another.



A good framework should have long-term value

- Participants agreed that a Computer Science education framework should future-proof Computer Science education as much as possible, since coding languages and technology advance more rapidly than curriculum is updated. To that end, many participants stated that the framework should be language agnostic, and only reference specific coding languages when absolutely necessary.
 - However, some participants stated that specific coding languages may be necessary to impart concepts to students.

Setting the Agenda

During the afternoon, participants broke into four small groups to discuss the vision and outcomes that should guide the framework development process, as well as the key groups and topics the framework will need to engage with to be of value to Canadians. By breaking participants into smaller groups with space for each participant to share their thoughts, this activity helped identify considerations for the framework development process. Each group of participants brainstormed over definitions, issues, and scope, while some common themes emerged across all four groups:

- Participants agreed that a Computer Science education framework will have valuable applications for education and industry, yet also have the potential to go beyond this to build inclusion, equity, and empowerment. Participants emphasized the importance of ensuring the framework development process is designed to empower Canadians as active learners, creators, and citizens, and to boost their confidence and high-level thinking skills.



- Participants also identified flexibility and adaptability to different groups and contexts as a crucial component to build into the development process and the framework itself. Participants agreed that to achieve this outcome, the conversation to develop the framework must include all groups that the framework is intended to create value for. Participants also emphasized the importance of establishing common ground and language early on for inclusion and clarity.
- At the same time, participants recognized that how different groups and stakeholders are engaged in the framework development process may differ. Specifically, finding the right way to engage members of the tech industry will require nuance and strategy. Other areas that groups believed will require special consideration included designing the framework for different age and educational levels, and ensuring its long-term value and sustainability amidst rapid changes in technology and society.

These shared insights emerged as small groups worked through prepared templates to brainstorm considerations in four areas: vision, impact, agenda-setting, and issues. The following are the key ideas that emerged from these discussions:

Vision: Our framework will empower students to...

- Develop confidence and see themselves as active contributors to the digital world they live in.
- Access the same skills, regardless of geography, language, access to Internet, and social and economic positions.
- Develop high-level thinking skills including creativity, problem solving, adaptability, tolerance of ambiguity, and learning through failure.



- Gain transferable skills and knowledge to pursue a wider range of career paths.

Impact: How can the framework be most helpful for students, educators, and policymakers?

For **students**, the framework should:

- Be applicable even where access to computers or the Internet is limited.
- Promote inclusion and equity, including increasing girls' participation in information and communications technology fields.
- Develop competencies at an age-appropriate level.
- Support students' internal growth and career exploration.
- Expose students to a large variety of concepts and help them develop a deep understanding of our digital world (including the Internet of Things, Artificial Intelligence, and Virtual Reality).

For **educators**, the framework should:

- Create a common, accessible language for teaching that minimizes and/or demystifies jargon.
- Support teachers to facilitate learning in areas where they lack confidence or expertise.
- Emphasize the value and purpose of learning concepts over rigid instructions.
- Identify different technology-based tools that can be used in different settings.

For **policymakers**, the framework should:

- Be flexible and adaptable for individual provinces, territories, and organizations.
- Have long-term value in the face of changing tech realities.
- Be designed to create value for diverse groups, especially Indigenous groups.
- Demonstrate the importance of investing in Computer Science education.
- Provide valuable assistance in setting direction for curriculum.

Agenda-Setting: What needs to be on the agenda in order to get this right? What groups need to be part of the conversation for each item?

- The conversation should prioritize equity and inclusion and meaningfully involve everyone who the framework is intended to create value for, including post-secondary institutions, educators, students, Indigenous groups, rural communities, industry representatives, unions, provinces and territories, and policymakers.
- The development process should make use of existing research and seek to glean best practices from groups in the US and UK who have successfully created a Computer Science education framework.
- The framework development process should explore how to communicate the value of Computer Science curriculum, and the understanding needed to teach it, to pre-service teachers and those who may be reluctant to embrace the concept.

- A common language needs to be established early on in the framework development process.

Issues: What components of the framework could be controversial?

- How to best engage industry and create practical career connections.
- Age- and educational-level expectations and how the framework can create value for students from kindergarten to post-secondary.
- Security, privacy, and data storage.
- Establishing definitions clarity on what the framework is centred around: computational thinking, coding, computer science, digital literacy, or technological fluency.
- Specific learning outcomes.
- How it will be funded, including how much funding comes from industry.

Issues: What components of the framework would be generally agreed upon?

- The importance of Indigenous leadership and input.
- The need for collaboration.
- Focusing on core competencies that can be developed in different jurisdictional curricula.
- Accessibility and value to Canadians regardless of geography, language, and access to the Internet and other infrastructure.

Developing the framework

Participants agreed that developing a framework will require engagement with a number of organizations and groups. Participants mentioned that the following groups should be involved in the framework development process:

- Provincial and territorial education ministries as they craft the curriculum for students;
- Elementary and secondary school teachers as they will implement the framework in their classrooms;
- Non-profit organizations focused on teaching coding skills to teachers and children outside of school time;
- Post-secondary institutions to ensure the linkages from Computer Science skills learned in K-12 align with post-secondary programs;
- Indigenous people as a group historically excluded from conversations about curriculum development;
- Francophone people as a group that will face unique questions regarding the delivery of educational concepts usually developed in English;
- Academics;
- Tech industry members both as future employers of Canadian students and as early adopters of new technology;
- Elementary and secondary-age students;
- Parents of students.



Participants suggested these next steps to begin the framework development process:

- Research and consider other Computer Science education frameworks and their development processes that have been undertaken elsewhere in the world.
- Convene an advisory committee to guide the framework development process.
- Create an engagement plan that provides meaningful opportunities for stakeholders to participate in the development of a framework.
- Develop a way to promote the framework after it has been created and encourage adoption of the framework by provinces and territories.



Response from Canada Learning Code

The Canada Learning Code team is thrilled by the recommendations put forward in this report. We want to thank the Forum participants for the sharing their ideas and suggestions with us.

In reading this report, we are most excited to learn that the participants recommended the development of a Pan-Canadian Computer Science Education Framework and we agree that establishing common practices will improve equity and access to Computer Science skills across Canada.

We are also eager to take up the Forum participants' recommendation to include more people in discussions about creating the Framework. We understand the importance of involving provincial and territorial education ministries, teachers, marginalized groups, and academics, and students in the framework development process.

As we move forward and work to draft Canada's first Computer Science Education Framework, we will look to this summary to guide our thinking about developing a national engagement process and structuring a framework. We appreciate the feedback not only on how to structure the framework engagement process, but who to have in the room throughout this process.

We're so excited to continue working with you along the way in creating a pan-Canadian Computer Science Education Framework together.



Forum Attendees

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Sharon Brown, Canada Learning Code

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