



Project Insights Report

# Inclusive STEM Pedagogies in K-12 Education



**PARTNERS**

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## Executive Summary

Digital and technological advancements in the last two decades have drastically changed the way Canadians live, work and access information. This phenomenon has significantly changed the needs and skills required within the Canadian workforce. As a result, provinces and territories have begun developing coding and digital literacy curricula to meet new demands and standards reflected in the job market.

Despite efforts by Canadian provinces and territories, researchers have shown that the field of computer science and programming at the university level is mostly populated by white men. Not only do women remain under-represented, but girls also continue to show low interest in fields related to science, technology, engineering and mathematics (STEM) and computer science. Some statistics and studies, however, neglect to consider diverse experiences, systemic barriers and structures, and intersecting identities within STEM and computer science. The risk, therefore, is that despite government financing to increase diversity in computer science, and the increase of coding and programming curricula, underrepresented students might continue to slip through the cracks, thus bringing little to no change to the currently white, male-dominated digital economy.

The purpose of this project is to review research and literature that recognizes current strengths but also identifies gaps in existing resources. This will help properly inform future curricular and educational decisions that nurture strong foundations for diversity, equity, accessibility and inclusion in the digital workforce.

### KEY INSIGHTS

- 1** A more uniform approach to equity and diversity training needs to be incorporated into K-12 teachers' professional development requirements.
- 2** Stereotypes and biases about learners in K-12 must be challenged to create inclusive learning environments in STEM classrooms.

**3**

More culturally relevant support systems should be made available in K–12 systems (e.g., Elders, other community-based resources).

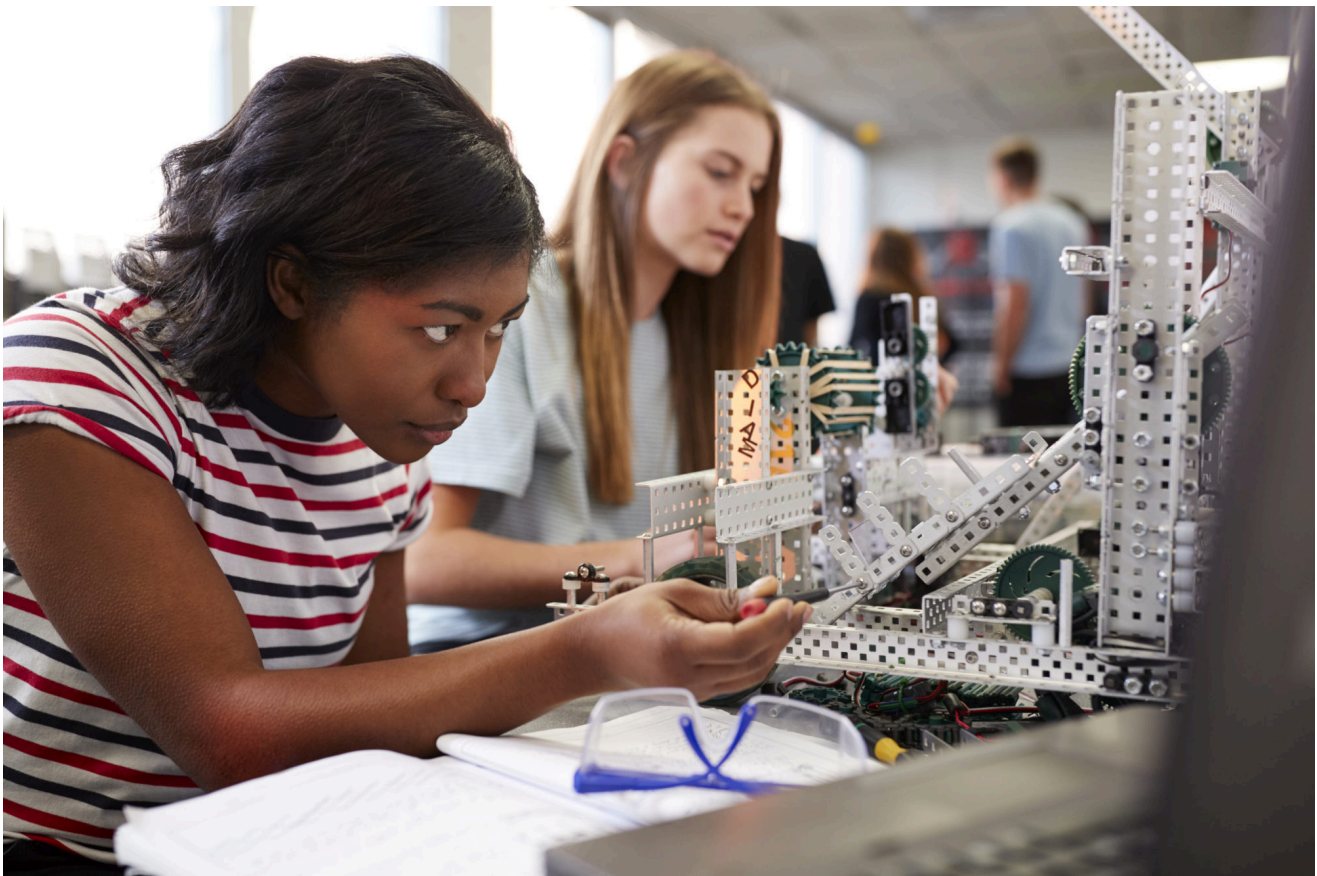
## ▶ The Issue

It is the responsibility of Canadian government bodies, industries and communities to prioritize diversity, equity, accessibility and inclusion (DEAI) education systems, which address systemic barriers faced by diverse youth in a variety of fields, such as digital literacy and, more significantly, STEM.

In response, provincial and territorial governments have invested considerable resources into promoting STEM and computer science to those under-represented in those professions, which includes people of colour and women. In response, numerous provinces and territories have made coding curricula mandatory, and the federal government has provided financial support to community- and classroom-based coding programs that ensure access for learners in marginalized communities. To date, however, only some progress has been made in increasing the representation of women and marginalized groups in STEM and computer science programs.

Against this backdrop, one of the focuses of this research project is adolescents' engagement with digital literacy and, by extension, STEM practices, as it relates to provincial curricula in Canada. While digital literacies are not the targeted focus of this review, the considerations offered impact the future of the digital economy.

This knowledge synthesis review examines inclusive practices in K–12 STEM education, focusing on improving the participation of diverse youth in future professions in the digital economy.



## What We Investigated

The objectives of this review were to:

- identify studies in STEM and STEM-related education fields that address gender and race as part of their focus;
- identify gaps and strengths in STEM and STEM-related studies to help researchers, administrators and educators create more diverse, equitable, accessible and inclusive education systems that prepare students for and promote future digital professions;
- identify areas of future research.

## What We're Learning

### **Curriculum reform must be culturally responsive, learner-led**

Curriculum reform is required to provide access to and within STEM and STEM-related education. Curricula must be culturally responsive and learner-led, integrating real-world and hands-on learning informed by a diversity of cultures, languages, values and knowledge.

### **Improved DEAI training should be offered to future teachers**

Studies show that DEAI training for teachers is insufficient. Student-centred teaching practices should incorporate technology in the classroom and require anti-racist cultural competency to support and communicate effectively in meeting the diverse needs of students.

### **STEM aspirations in K-12 students should be cultivated**

Students who are marginalized by society often have a difficult time identifying with and feeling like they belong in STEM due to bias and assumptions. Stereotypes and biases in STEM must be challenged to create inclusive learning environments.

### **Educational policy reform must address systemic barriers to success**

Structural racism and discrimination in education policies continue to negatively impact diversity of participation in STEM. Future policy reform needs to address barriers and prioritize academic well-being of underrepresented students. Adequate funding and resources, as well as unambiguous policies and training, should be provided to increase student success and opportunities.

### **Community supports foster a sense of belonging for STEM students**

Support systems and community connections are critical in increasing the advancement of underrepresented students in STEM and STEM-related education. Family, Elders, teachers, administrators, educators, guidance counsellors, support staff, peers and community liaisons all have the potential to provide positive support to help students feel like they belong in STEM communities.

## Why It Matters

The under-representation of women and people of colour in STEM and computer science is problematic for several reasons.

If the Canadian government wishes to increase and diversify its digital workforce, it must include ways to address systemic barriers in education and encourage access and success for all students.

Furthermore, multiple studies have proven that a diverse workforce is significantly more successful than homogenous ones, since the inclusion of varied experiences and points of view reduces or eliminates gaps in thinking, encourages innovation, improves corporate strategy and reduces conflict and poor social practices.

For the Canadian economy to speak to the diversity that it praises, and to ensure that changes in the economy benefit all Canadians, it is imperative to look at ways to foster a diverse, equitable, accessible and inclusive digital workforce. One way to work toward more equitable futures for Canada's digital workforce is to increase the quality and quantity of mandatory digital literacy and coding curricula across the country.

In order to make sure that this workforce is diverse and inclusive, it is important to develop resources, curricula and educational policies that increase interest in STEM and digital literacy, value diversity and inclusion, and nurture success for all students.

## ► What's Next

To generate more diverse opportunities and universally accessible opportunities in the digital economy, it is crucial that policies address structural racism and discrimination in education, with a focus on:

- curriculum reform that adopts culturally responsive and learner-centred pedagogies informed by cultures, languages and values, with a DEAI focus;
- culturally inclusive teaching practices that are consistently integrated into classrooms and supported by professional development, with a DEAI focus;
- support systems that provide access to Elders, teachers, staff and mentors who are reflective of students' diverse lived experiences, as well as access to programs and services that provide academic, financial, cultural, and mental health and wellness resources;
- community collaboration and input into decision-making processes related to curricula and service to support underrepresented students;
- future research into how the complexities of intersectionality impact student retention and persistence in both STEM and STEM-related education and careers.



### **State of Skills: Unleashing AI into the Skills Development Ecosystem**

FSC-supported AI tools have bolstered outcomes in skills matching, career development guidance, and recruitment. The overall effectiveness of these tools was underpinned by recognizing and mitigating the inherent bias and discrimination embedded into these technologies.

[Read Thematic Report](#)

Have questions about our work? Do you need access to a report in English or French? Please contact [communications@fsc-ccf.ca](mailto:communications@fsc-ccf.ca).

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The Future Skills Centre acknowledges that the Anishinaabe, Mississaugas and Haudenosaunee share a special relationship to the 'Dish With One Spoon Territory,' where our office is located, bound to share and protect the land. As a pan-Canadian initiative, FSC operates on the traditional territory of many Indigenous nations across Turtle Island, the name given to the North American continent by some Indigenous peoples. We are grateful for the opportunity to work in this territory and commit ourselves to learning about our shared history and doing our part towards reconciliation.

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