Canada 2067 Learning Roadmap

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Preamble

During 2017, Let's Talk Science launched Canada 2067 to catalyze a national discussion about the future of science, technology, engineering and math (STEM) education to help young Canadians prepare to live, learn and contribute to their communities in the economies and societies of the future.

Internationally, Canada shows strong performance in science, ranking 3rd overall among Organisation for Economic Cooperation and Development (OECD) countries (PISA, 2015). On a pan-Canadian level, scores on the science assessment administered by the Council of Ministers of Education, Canada (CMEC) show an increase in overall performance since 2013, however, there is quite a bit of variability between provinces (PCAP, 2016). Despite this strong performance, students' interest in science decreases with age and fewer than one in two students graduate having completed a senior level STEM course (Canadian Youth Science Monitor Final Report, 2010; *Spotlight on Science Learning reports*).

Without grade 12 math and science courses, students will find that the door to an estimated half of all university and college pathways are closed to them. This comes at a time when STEM-related fields will offer significant employment growth in Canada. STEM learning is also highly relevant for students interested in non-STEM careers because it strengthens the critical-thinking and problem-solving competencies that are fundamental to navigating an increasingly complex and technologically intensive economy and society.

Canada 2067 offered a multi-pronged 'made in Canada' approach to developing a national vision and objectives that can be used by diverse stakeholders to guide their efforts that support youth development. It is designed to be a living document and is dedicated to building Canadian competitiveness by focusing on youth.

Phase 1

Development of the Canada 2067 Learning Roadmap began with a review of more than thirty international and Canadian reports on STEM education published since 2007 (Link to the policy paper). The reviewed reports focused mainly on STEM education at the primary and secondary levels in developed western countries in Europe, North America and Australia. They were selected for analysis based on their purpose, namely providing policy advice to governments about how to improve student engagement and achievement in STEM. They include reports supported by a variety of intergovernmental organizations such as the OECD, STEM-focused industry associations, parliamentary committees, scientific bodies such as the Royal Society, and government education departments.

The international reports provide global perspectives on STEM education. The Canadian reports included in the review focus on STEM education in Canada and seek to provide insight into specific challenges and opportunities that exist in this country. Taken together, the Canadian and international reports offer insight into the rapid changes currently underway in education and the growing attention to STEM among policymakers as it continues to emerge as an education priority.

The review highlighted several recurring themes that relate to key challenges facing STEM education as well as similarities in the recommendations advanced to address these challenges. Six areas of consensus emerged and are reflected in the six pillars around which the Canada 2067 Learning Roadmap is organized.

For each pillar, a vision statement, overarching questions, and key recommendations were developed. Then a year-long process involving in-person and online consultations with experts and stakeholders allowed for the refinement of recommendations. A first draft of the learning roadmap was released as a part of the Canada 2067 National Leadership Conference in December 2017. A second round of online and in person consultations then took place, and the feedback provided by students, parents, educators, millennials, researchers and other stakeholders has allowed for revisions to the recommendations to ensure they reflect relevant and realistic goals.

This document was produced to spark a conversation on how we, as a nation, can collectively support Canadian youth in preparing for their future. It is intended to be a living document to be shaped by continued input and feedback from everyone involved.

Rationale

Canadians acknowledge the aspirations and capabilities of younger generations and look to the country's strong and diverse education systems to help prepare them for the future. This learning roadmap summarizes what was learned through the Canada 2067 process about how educators and community partners believe that teaching and learning should evolve in the coming years to ensure that Canadian youth are equipped to meet the challenges of an ever more complex and technologically intensive world.

Key Recommendations

This first table summarizes the key recommendations from across all six learning pillars identified in the Canada 2067 process. The second and more detailed table includes not only all of the recommendations generated through the Canada 2067 process but also pillar-specific vision statements that translate the larger overarching Canada 2067 vision into the context of each learning pillar. In the second table, the vision statements and recommendations are again organized by learning pillar.

P/Ts = provinces/territories
STEM = science, technology, engineering, math
PL&D = Professional learning and development
ICT = Information and Communication Technologies
K-12 = Kindergarten to Grade 12
PSE = Post-secondary education

Vision Students graduate with doors open to diverse careers, with the capacity to be active and informed citizens, and with the full range of skills needed to navigate an increasingly complex and competitive world.	
Theme / Pillar	**Key Recommendations**
How we teach: *teacher pre-service education and professional learning and development*	• All teachers have the opportunity to participate in PL&D at least once per year in areas related to STEM, competency-based and inquiry-based teaching and learning. • More teachers are linked to one another and to community partners within and across schools and regions to form dynamic professional learning communities. • Interdisciplinary, experiential, competency- and inquiry-based curricula are implemented alongside initiatives specifically designed to help teachers develop their skills and abilities to teach competencies and encourage critical inquiry.

Key Recommendations con't

How we learn: *pedagogy, curriculum and assessment*	• In addition to promoting fundamental skills like literacy and numeracy, school curricula – as well as learning activities offered by community partners – increasingly include:
	  ○ competency- and inquiry-based approaches to learning;
	  ○ interdisciplinary and experiential (hands-on) approaches to learning;
	  ○ new technologies to enable more creative, interactive and student-centred approaches to learning and to promote digital literacy.
	• Teachers have the training, support and resources to ensure that an increasingly interdisciplinary, experiential, competency- and inquiry-based curriculum can be implemented effectively.
	• Teachers and students take advantage of the opportunities afforded by new ICTs to transform teaching and learning by making them more accessible, interactive, individualized, dynamic and experiential.
	• PSE entry requirements evolve so that they recognize and value students who have engaged in innovative, experiential, inquiry-based, competency-based and interdisciplinary approaches to learning at the K-12 level.

What we learn: *skills and competencies*	• All students graduate with at least one senior level interdisciplinary STEM course. • PSE enrolments (in terms of total number of students) in the STEM-related fields increase each year.
Who's involved: *stakeholders, partnerships, leadership and coordination*	• Community partners align the focus of their own STEM education programs with the Canada 2067 recommendations. • Schools and STEM learning community partners work together so that all students engage in experiential learning opportunities with community partners at least once every year. • Businesses align 20% of their community investment goals related to education to support achievement of Canada 2067 recommendations. • Governments commit at least 1% of STEM research budgets to support achievement of Canada 2067 targets.
Where education leads: *career information and education guidance*	• Students access information about STEM education and future careers on an everyday basis in the classroom in the context of the regular school curriculum, and not just in separate careers classes or through career counseling. • The provision to students of information about STEM education and future careers is strengthened by improving links between STEM learning in the classroom and experiential learning involving community and workplace partnerships. • All parents have access to information and support about STEM education and future careers.
Equity and Inclusivity: *Learning opportunities for all students*	• Student participation in STEM courses is made more equitable and inclusive in terms of gender, culture, socio-economic background, and region. • STEM education evolves to address the specific needs of Indigenous students and to incorporate other world views.

HOW WE TEACH		
Theme / Pillar	**Vision**	**Diagnostic Questions**
How we teach: *teacher education and professional learning and development* **Key Questions:** How can teachers get the support they need to enhance the delivery of STEM education to make it more relevant, engaging and exciting for youth?	Education faculties recruit and train a sufficient number of student teachers with STEM experience.	• The number of STEM teacher vacancies is matched by appropriate enrolment and graduation rates of teacher candidates with a specialization in STEM. • More STEM-based teaching is incorporated into teacher education programs. • The teaching profession is showcased to STEM students to attract more teachers with a STEM background.
	STEM education is delivered by teachers with specialized training and confidence in STEM disciplines and STEM pedagogy in elementary and secondary schools.	• Pre-service teachers are trained to facilitate interdisciplinary, experiential, inquiry- and competency-based learning and mentored during their practicum experiences by teachers versed in these approaches – the way in which pre-service teachers are trained models this shift to these approaches. • Raise the % of primary and secondary school science, mathematics and computer science teachers who have specialized subject-specific pedagogical training related to these disciplines to international averages.
	There are sufficient opportunities for ongoing STEM-based PL&D and for the development of collaborative learning communities (in school and online) for teachers.	• All teachers have the opportunity to participate in PL&D at least once per year in areas related to STEM, competency-based and inquiry-based teaching and learning. • All P/Ts establish online platforms to support collaborative learning communities for teachers that enable ongoing learning by teachers. • All P/Ts establish formal mentoring programs that match new teachers with teachers who have demonstrated experience with inquiry and competency-based STEM teaching. • All P/Ts collect data to establish a baseline measure of the % of teachers who have access to ongoing STEM PL&D opportunities and work to increase this % each year. • More teachers are linked to one another and to community partners within and across schools and regions to form dynamic professional learning communities. • Interdisciplinary, experiential, competency- and inquiry-based curricula are implemented alongside initiatives specifically designed to help teachers develop their skills and abilities to teach competencies and encourage critical inquiry.

HOW WE LEARN		
Theme / Pillar	**Vision**	**Recommended Goals and Targets (by 2023)**
How we learn: *pedagogy, curriculum and assessment* **Key Questions:** How can we create programming that is rooted in inquiry-based learning? How can experiential and cooperative learning transform STEM education? How can technology transform the way we teach STEM?	Interdisciplinary, experiential, competency- and inquiry-based learning are comprehensively integrated into STEM education. Teachers have the training, support and resources to ensure that an increasingly interdisciplinary, competency- and inquiry-based curriculum can be implemented effectively.	• All P/Ts collect data to establish a baseline measure of the number of students who have access to experiential STEM learning opportunities and work to increase participation in the future. • All students taking a STEM class participate in at least one inquiry-based project each year that students design/co-create. • All teachers are given sufficient preparation time to design effective inquiry-based lessons. • All teachers have access to sufficient PL&D and other resources on how to design and deliver interdisciplinary, experiential, competency- and inquiry-based STEM learning. • Assessment activities, including standardized testing, evolve to accommodate competency-based learning. • Teachers have the training, support and resources to ensure that an increasingly interdisciplinary, experiential, competency- and inquiry-based curriculum can be implemented effectively.
	STEM education takes advantage of the possibilities of transforming teaching and learning offered by new ICTs.	• Teachers and students take advantage of the opportunities afforded by new ICTs to transform teaching and learning by making them more accessible, interactive, individualized, dynamic and experiential. • All teachers have pre-service training and access to ongoing PL&D opportunities focused on effective use of ICTs for teaching and assessment to leverage their potential to change pedagogy, impact learner experience and improve outcomes. • Teachers have the opportunity each year to participate in PL&D that builds capacity to use ICTs for learning.

	Interdisciplinary and co-operative approaches are welcomed and used by STEM educators, and STEM learning is woven into other disciplines.	• At least 50% of secondary school STEM courses are issues-based and interdisciplinary.
		• All P/Ts increasingly combine subject-specific curricula with competency-based, interdisciplinary curricula.
		• All students participate in at least one co-operative project that integrates STEM methods across multiple subjects and disciplines each year.
		• In addition to promoting fundamental skills like literacy and numeracy, school curricula – as well as learning activities offered by community partners – increasingly include:
		  ○ competency- and inquiry-based approaches to learning;
		  ○ interdisciplinary and experiential (hands-on) approaches to learning;
		  ○ new technologies to enable more creative, interactive and student-centred approaches to learning and to promote digital literacy.

HOW WE LEARN		
Theme / Pillar	**Vision**	**Recommended Goals and Targets (by 2023)**
	All students, regardless of whether they are concentrating in STEM subjects, should receive an appropriate amount of STEM education.	• All P/Ts should require students to have both a grade 12 mathematics credit and a grade 12 interdisciplinary science credit to graduate.
	Assessment tools are designed to measure the learning outcomes we value most.	• All teachers have access to pre-service training and ongoing PL&D opportunities focused on the assessment of competencies. • All teachers have access to pre-service training and ongoing PL&D opportunities focused on using digital tools to enable differentiated and individualized assessment of competency acquisition. • New pedagogies and assessment strategies, including standardized testing, should evolve together to ensure they are aligned. • PSE entry requirements evolve so that they recognize and value students who have engaged in innovative, experiential, inquiry-based, competency-based and interdisciplinary approaches to learning at the K-12 level.

WHAT WE LEARN		
Theme / Pillar	**Vision**	**Recommended Goals and Targets (by 2023)**
What we learn: *skills and competencies* **Key Questions:** How can we enable youth to learn cross-cutting competencies required for the future? How can we promote digital literacy among youth?	The focus of teaching and learning is on cross-cutting competencies as well as bodies of disciplinary knowledge.	• Increase the number of P/Ts that have moved to competency-based curricula. • All students graduate with at least one senior level interdisciplinary STEM course. • PSE enrolments (in terms of total number of students) in the STEM-related fields increase each year. • All P/Ts identify and prioritize cross-cutting competencies in descriptions of learning outcomes across all subjects and grade levels.
	Definition of literacy is expanded to include digital literacy and skills.	• Adoption by all P/Ts of a curricular definition of digital literacy and strategies for teaching it across K-12, including a plan for how to hire and train teachers with the skills required to teach it. • Participation of Canada (all P/Ts) in the International Computer and Information Literacy Study with a placement by Canada in the top group of countries. • Non-technical ICT skills to ensure good digital citizenship and ethical behaviour are explicitly incorporated .

WHO'S INVOLVED		
Theme / Pillar	**Vision**	**Recommended Goals and Targets (by 2023)**
Who's Involved: *stakeholders, partnerships, leadership and coordination* **Key Questions:** How can we establish and nurture strong relationships with partners outside the education system? How can the community and local business be effectively engaged in education? How can learners be more engaged in changing the education system?	Consideration is given to the responsibilities of learners and the role of students in bringing about change in education.	• All P/Ts integrate student involvement in the design of learning activities as an explicit learning objective or expected outcome in their curricula.
	Parents are active partners who are well integrated into their children's STEM learning.	• Increase the proportion of parents who often talk to their children about taking optional STEM courses in secondary school. • All parents correctly understand the course requirements for their children's high school graduation. • More opportunities are created for educators, parents and students to share and align their perspectives and expectations regarding approaches to STEM education.
	PSE institutions are active partners that are well integrated into K-12 STEM learning.	• Are post-secondary institution entry requirements appropriate for modern society and the modern economy? • Are post-secondary institutions sufficiently active in partnering with schools in support of STEM learning?
	Students deepen their engagement with STEM learning and become more career aware by accessing experiential and co-operative learning opportunities.	• Schools and STEM learning community partners work together so that all students engage in experiential learning opportunities with community partners at least once every year. • Every student graduates secondary school with at least one work-integrated learning experience with a STEM industry or community partnership. • All teachers have access to ongoing PL&D and support from their schools for making and integrating STEM learning partnerships with external stakeholders. • Governments commit at least 1% of STEM research budgets to support achievement of Canada 2067 targets. • Businesses support education outreach through the engagement of their employees.
	Businesses and community partners maximize opportunities to enhance STEM learning and career awareness in K-12 education by supporting experiential and co-operative learning.	• All P/Ts collect data to establish a baseline measure of the percentage of schools that have STEM learning partnerships with community partners • % of businesses and community partners that support K-12 STEM learning increases. • Businesses align 20% of their community investment goals related to education to support achievement of Canada 2067 recommendations. • Community partners align the focus of their own STEM education programs with the Canada 2067 recommendations.

WHO'S INVOLVED		
Theme / Pillar	**Vision**	**Recommended Goals and Targets (by 2023)**
	Effective coordination of education partners enhances learning outcomes of students.	• Annual national and regional conferences exist for STEM-focused organizations to attend and at which they can organize collaborations and share ideas and best practices. • Effective coordination and networking enhances the learning experiences of students and teachers, improving overall outcomes. • Subject associations use their resources and partnerships to support the realization of the Canada 2067 recommendations.

WHERE EDUCATION LEADS		
Theme / Pillar	**Vision**	**Recommended Goals and Targets (by 2023)**
Where education leads: career information and education guidance **Key Questions:** How can we better promote educational and career pathways to youth? How can we promote STEM learning beyond the classroom?	Students in Canada receive good guidance on careers from an early age, including through experiential learning opportunities and community partnerships.	• All P/Ts integrate career guidance as an explicit learning objective or expected outcome in all STEM courses. • All P/Ts integrate information about the changing nature of work and the growing demands for STEM skills into career education. • Increase the number of community partnerships with STEM-focused organizations and businesses that include mentoring of students by a STEM practitioner. • Students access information about STEM education and future careers on an everyday basis in the classroom in the context of the regular school curriculum, and not just in separate careers classes or through career counseling. • The provision to students of information about STEM education and future careers is strengthened by improving links between STEM learning in the classroom and experiential learning involving community and workplace partnerships. • All parents have access to information and support about STEM education and future careers.

EQUITY AND INCLUSIVITY		
Theme / Pillar	**Vision**	**Recommended Goals and Targets (by 2023)**
Equity and Inclusivity: *Learning opportunities for all students* **Key Questions:** How can we create a more diverse and inclusive STEM community?	There is a sufficient focus in Canada on STEM education at all levels of education, beginning in the early years of school.	• All P/Ts work to increase the percentage of elementary teachers who have specialized education in a STEM discipline.

	Educators in Canada identify, understand and address inequities in STEM education.	• Student participation in STEM courses is made more equitable and inclusive in terms of gender, culture, socio-economic background, and region.
		• All P/Ts work to achieve balanced representation of youth participating in senior level STEM courses, starting by establishing baseline measures related to:
		  ○ gender;
		  ○ Indigenous and racialized students;
		  ○ students from economically disadvantaged backgrounds;
		  ○ rural, urban, and suburban students .

	STEM education evolves to address the specific needs of Indigenous students and to incorporate Indigenous perspectives and cultures as well as other non-European worldviews into STEM teaching and learning.	• STEM education evolves to address the specific needs of Indigenous students and to incorporate other worldviews. • All P/Ts collect data to establish a baseline measure of the percentage of Indigenous students who complete a senior level STEM course and work to increase it. • All P/Ts incorporate Indigenous ways of knowing and perspectives into their curricula as learning objectives and expected outcomes. • All teachers and education partners have access to ongoing PL&D focused on recommendations from the Truth and Reconciliation Commission to improve their cultural proficiency, guard against undue cultural appropriation, and improve their ability to incorporate culturally sensitive teachings and techniques into their teaching practice.

For more information and to get involved please visit

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Glossary

STEM:

The acronym STEM stands for Science, Technology, Engineering, and Mathematics, but it has come to be understood as also including a diverse set of skills, characteristics, and ways of thinking about (and solving) problems that are critical to success in today's increasingly global economy and society. The foundations of STEM learning are associated with "competencies," a term which generally encompasses knowledge, skills and attitudes. STEM competencies include but are not limited to an understanding of scientific methods, numeracy, digital literacy, effective communication and creative problem-solving.

Experiential learning:

Experiential learning focuses on enabling "learning by doing". Experiential learning involves the practical application of ideas and concepts by students. It can be implemented in a variety of ways, including through projects that have been designed to require learners to take concepts learned in the classroom and apply them in practical settings. Experiential learning can also take the form of simulations where learners are required to actively apply concepts in a self-directed manner in simulated environments structured to incentivize deep and motivated engagement with concepts. Finally, experiential learning can also encompass work-integrated learning experiences where learners are able to observe and participate in the application of previously abstract knowledge and concepts in practical "real world" or professional settings.

Inquiry-based learning:

Inquiry-based learning begins with the posing of questions instead of the transmission of facts. Inquiry-based learning, which is sometimes understood to be synonymous with or to include problem-based learning, involves learners analyzing a problem, identifying issues or areas of knowledge that they require to solve it, and then researching accordingly. In inquiry-based learning, teachers act as facilitators who guide learners towards uncovering answers themselves. Instances of inquiry-based learning are often tied to specific projects that have been devised intentionally by teachers so as to result in students learning particular pieces of knowledge or gaining understandings of specific concepts. Moreover, while not synonymous with student-led learning – an approach in which students identify for themselves the concepts and knowledge that they learn – inquiry-based learning can provide opportunities for student-led learning to occur within a larger structure of learning objectives defined by curricula.

Interdisciplinary learning:

Interdisciplinary learning is a form of learning in which the achievement of learning objectives is not organized within disciplinary compartments. Rather, students are encouraged to achieve these objectives by focusing their studies on phenomena and themes that cross disciplinary lines. Phenomenon-based learning, a form of interdisciplinary learning used in Finland, accomplishes this by setting aside a period of time for learners to learn about a specific phenomenon that has implications across disciplinary boundaries (e.g., climate change which can be studied from multiple disciplinary perspectives including climatology, biology, chemistry, physics, business, economics, political science, law, etc). Through the careful selection of phenomena, interdisciplinary learning approaches can ensure that all learning objectives identified for learners are covered.

Competency-based learning:

Competency-based learning focuses less on the transmission of factual information and more on instilling the critical foundational aptitudes (knowledge, skills and attitudes) that learners will require to direct their own lifelong learning and to participate successfully in society and the economy. Different organizations use a variety of similar terms to describe these aptitudes including "critical competencies", "global competencies", and "21st century skills". Each of these terms is usually accompanied by a slightly different list of specific aptitudes. Regardless, the underlying ideas tend to be quite similar and these different terms and lists all focus on inculcating aptitudes like effective communication, the ability to collaborate, creativity, and critical thinking.