Canada 2067 STEM Learning Framework: An Invitation to Contribute
Canada 2067 STEM Learning Framework: An Invitation to Contribute

Canada 2067 is catalyzing a national discussion about the future of STEM education to help young Canadians prepare to live, learn and contribute to their communities in the economies and societies of the future.

As part of a multi-pronged effort (see Canada2067.ca), this document consolidates key goals and targets that came forward during the first phase of research and consultation.

Canada 2067 goals are organized by the six pillars shown here, all of which are critical to how our youth are educated.

In the following table, we identify overarching questions and statements to define a vision for each pillar. Next, diagnostic questions are designed to illuminate the current situation and finally, potential targets are recommended.

Both this document and its companion Spotlight on Science Learning background report are the result of a lengthy process that has involved extensive research and expert consultations. This effort began with a review of over thirty international and Canadian reports on STEM education published since 2007. 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 Organization for Economic Cooperation and Development (OECD), STEM-focused industry association, 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 focus on STEM education in Canada and seek to provide insight into specific challenges and opportunities that exist in this country. Taken together, the perspectives provided by these two reports offer insight into the rapid changes currently underway in education and the growing attention to STEM among policymakers as it emerges as an education priority.

Finally, 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 a draft. The next step is up to you: we are eager to receive your input for consolidation into the final report, which will be in mid-2018.

QUESTIONS:
Do you agree with the recommendations?
If not, what would you change?
What’s missing?
## Key Recommendations

<table>
<thead>
<tr>
<th>Theme / Pillar</th>
<th>Vision</th>
<th>Diagnostic Questions</th>
<th>Recommended Goals and Targets (by 2023)</th>
</tr>
</thead>
</table>
| **Canada 2067 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 demanding world | • To what extent has K-12 STEM education integrated: ◇ competency-based approaches? ◇ relevant issues-based approaches? ◇ multi-disciplinary approaches? ◇ new technologies to support learning?  
• How do students view STEM learning and its importance for their future careers?  
• How many students complete senior level STEM courses?  
• Do all teachers have access to the supports, including pre-service education and ongoing professional learning and development (PL&D) and resources they need to facilitate STEM learning effectively?  
• Are parents and community partners well integrated into STEM education?  
• How inclusive is STEM education? | • Ensure student and teacher involvement in the design and implementation of STEM education system changes  
• All P/Ts comprehensively integrate into curricula and pre-service education: ◇ competency-based approaches ◇ multidisciplinary and issues-based approaches ◇ new technologies to enable learning and digital literacy  
• All students graduate with at least one senior level multi-disciplinary STEM course  
• Improve the balance of student participation in STEM courses by gender, culture and geography  
• PSE assess entry requirements to align with K-12 education evolution  
• Raise the % of all PSE enrolments that are in STEM fields from the current (approximately) 20% to 25%  
• 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 by 10% (goal of reaching 2 days annually for STEM-based PL&D)  
• All P/Ts collect data to establish a baseline measure of the % of schools that have STEM learning partnerships with community partners and work to increase by 10%  
• Industry aligns 20% of its community investment goals related to education to support achievement of Canada 2067 targets  
• Governments commit 1% of STEM research budgets to support achievement of Canada 2067 targets  
• All parents have access to information and support about STEM education and future careers |
## Recommendations by Pillar

<table>
<thead>
<tr>
<th>Theme / Pillar</th>
<th>Vision</th>
<th>Diagnostic Questions</th>
<th>Recommended Goals and Targets (by 2023)</th>
</tr>
</thead>
<tbody>
<tr>
<td>How we teach: teacher training and professional learning and development</td>
<td>Education faculties recruit and train sufficient number of student teachers with STEM experience</td>
<td>• What is the demand for new STEM teachers? • What is the supply of new teachers specializing in STEM currently and likely to be in the near future?</td>
<td>• The number of STEM teacher vacancies is matched by the # of graduating teaching candidates with a specialization in STEM • # of projected STEM teacher vacancies is appropriately exceeded by the # of incoming teaching candidates with a background or interest in teaching STEM subjects</td>
</tr>
<tr>
<td>Key Questions: How can teachers enhance the delivery of STEM education to make it more relevant, engaging and exciting for youth?</td>
<td>STEM education is delivered by teachers with specialized training and confidence in STEM disciplines and pedagogy in elementary and secondary schools.</td>
<td>• Do teachers receive adequate pre-service education and ongoing PL&amp;D aimed at increasing their subject specific STEM pedagogical content knowledge?</td>
<td>• Pre-service teachers are trained to facilitate multidisciplinary, competency-based learning experiences and mentored during their practicum experiences by teachers versed in inquiry and competency-based approaches • Raise the % of Grade 4 mathematics teachers who have specialized training in mathematics or mathematics education from the current 6% to the international average of 27% • Raise the % of Grade 4 science teachers who have specialized training in science from the current 14% to the international average of 28% • Raise the % of Grade 8 mathematics teachers who have specialized training in mathematics or mathematics education from the current 42% to the international average of 85% • Raise the % of Grade 8 science teachers who have specialized training in science from the current 60% to the international average of 90%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>There are sufficient opportunities for ongoing STEM-based PL&amp;D and for the development of collaborative learning communities (in school and online) for teachers. • Do teachers have sufficient ongoing PL&amp;D opportunities to successfully embrace a multi-disciplinary approach with STEM underpinnings? • What is the quality of the STEM PL&amp;D opportunities for teachers? • Are teachers able to collaborate in their STEM PL&amp;D opportunities with other teachers? • Are STEM teachers able to access high quality opportunities? • Teachers receive at least 2 days of PL&amp;D annually that focuses on building capacity to facilitate multi-disciplinary, competency-based STEM 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</td>
</tr>
<tr>
<td>How we learn: pedagogy, curriculum and assessment</td>
<td>Inquiry-based and experiential learning are comprehensively integrated and supported in STEM education.</td>
<td>• How much of the curriculum is delivered using inquiry-based learning techniques? • What % of students has access to inquiry-based or experiential learning opportunities? • How much access do teachers have to PD&amp;L and other resources on how to design and deliver inquiry-based STEM learning opportunities? • Are teachers allotted sufficient planning time and resources to design effective inquiry-based lessons? • All P/Ts collect data to establish a baseline measure of the # of students who have access to experiential STEM learning opportunities and work to increase participation in the future • All teachers are allotted sufficient prep time to design effective inquiry-based lessons • All teachers have access to sufficient PL&amp;D and other resources on how to design and deliver inquiry-based STEM learning • All students taking a STEM class participate in at least one inquiry-based project each year that students design/co-create • Assessment activities, including standardized testing, evolves to accommodate competency-based learning.</td>
<td></td>
</tr>
<tr>
<td>Key Questions: How can we create programming that is rooted in inquiry-based learning?</td>
<td>Diagnostic Questions</td>
<td>Recommended Goals and Targets (by 2023)</td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td></td>
</tr>
</tbody>
</table>
| STEM education takes advantage of the teaching and learning possibilities offered by new information and communications technologies (ICTs) | • Do teachers have access to training on how to use ICT technologies to offer new teaching and learning opportunities?  
• Is ICT being used to enable new pedagogies and forms of assessment?  
• Is ICT being used to collect data on students’ progress and create rich feedback for students and teachers?  
• Are teachers sufficiently technologically literate for their teaching to be relevant to their students? | • All Faculties of Education include training in effective use of ICT for teaching and assessment improving the distinction between learning to operate the technology and learning to leverage it to change pedagogy, impact learner experience and improve outcomes.  
• All teachers have access to ongoing PL&D opportunities focused on effective use of ICT for teaching and assessment  
• 20% of teachers participate in PL&D annually that builds capacity to use ICT for learning |
| Interdisciplinary and co-operative approaches are welcomed and used by STEM educators, and STEM learning is woven into other disciplines | • Do teachers have the required support from principals and sufficient curriculum flexibility to implement co-operative multi-disciplinary issues/phenomenon-based learning approaches?  
• How well are interdisciplinary and co-operative approaches being integrated into STEM learning?  
• How often do teaching teams meet across departments to discuss interdisciplinary learning?  
• Do non-STEM subject teachers perceive that they have a role in supporting STEM learning? | • 50% of secondary school STEM courses are issues-based and interdisciplinary  
• All P/Ts gradually replace subject-specific curricula with competency-based, interdisciplinary curricula  
• Completion of at least one grade 12 level STEM-based multi-disciplinary course required for graduation  
• All students participate in at least one co-operative project that integrates STEM methods across all subjects each year |
| All students receive an appropriate amount of STEM education | • How much STEM education should be required for a student to be able to graduate?  
• How compulsory should STEM education be in secondary school? | • Increase, from the current 2, the # of P/Ts that require a grade 12 mathematics credit to graduate  
• Increase, from the current 2, the # of P/Ts that require a grade 12 science credit to graduate |
| Assessment tools are designed to measure the learning outcomes we value most | • Are assessment tools effectively measuring students’ progress in competency acquisition?  
• Are digital tools and techniques being used to enable differentiated and individualized assessment? | • All Faculties of Education teach prospective teachers techniques for assessing competency acquisition, such as reflective self-assessment  
• All teachers have access to ongoing PL&D opportunities focused on the assessment of competencies  
• All teachers have access to ongoing PL&D opportunities focused on using digital tools to enable differentiated and individualized assessment of competency acquisition  
• Assessment strategies, including standardized testing evolve to incorporate new pedagogies |
<table>
<thead>
<tr>
<th>Theme / Pillar</th>
<th>Vision</th>
<th>Diagnostic Questions</th>
<th>Recommended Goals and Targets (by 2023)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>What we learn:</strong> skills and competencies</td>
<td>The focus of teaching and learning is on cross-cutting competencies as well as bodies of disciplinary knowledge</td>
<td>• Do curricula have explicit competency learning objectives or expected outcomes?</td>
<td>• Increase the number of P/Ts that have moved to competency-based curricula from the current five (Québec, Nunavut, The Northwest Territories, British Columbia and Alberta) to 13</td>
</tr>
<tr>
<td><strong>Key Questions:</strong> How can we promote digital literacy amongst youth?</td>
<td>Definition of literacy is expanded to include digital literacy and skills</td>
<td>• Is there recognition that there is a difference between digital literacy/ skills (ie broader and more basic skills) and computer science?</td>
<td>• 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/or train teachers with the skills required to teach it</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• How are computing and digital literacy integrated into the curriculum?</td>
<td>• Participation of Canada (all P/Ts) in the International Computer and Information Literacy Study 2018 with a placement by Canada in top group of countries</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Do teachers have sufficient training and institutional support to support student development of digital skills effectively?</td>
<td>• Non-technical ICT skills to ensure good digital citizenship are explicitly incorporated into the learning objectives and expected outcomes of all K-12 programs</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Are students learning the non-technical skills, such as privacy protection and ethical use and behaviour, needed to use ICT safely and appropriately?</td>
<td></td>
</tr>
<tr>
<td><strong>Who’s Involved:</strong> stakeholders, partnerships, leadership and coordination</td>
<td>Consideration is given to the responsibilities of learners and the role of the student in bringing about change in education</td>
<td>• How are students involved in designing their learning experience and bringing about change in STEM education?</td>
<td>• All P/Ts integrate student involvement in the design of learning activities as an explicit learning objective or expected outcome in their curricula</td>
</tr>
<tr>
<td><strong>Key Questions:</strong> How can we establish and nurture strong relationships with partners outside the education system?</td>
<td>Parents are active partners who are well integrated into their children’s STEM learning</td>
<td>• How knowledgeable are parents about STEM learning in school?</td>
<td>• Increase the number of parents who often talk to their children about taking optional STEM courses in secondary school from the current 28% to 50%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• How well informed are parents about the importance of STEM for career opportunities?</td>
<td>• Reduce by half the % of parents who mistakenly believe that science and mathematics courses are compulsory to the end of high school from their current levels of 31% and 59%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• To what extent do parents encourage their children to pursue STEM opportunities?</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Are post-secondary institutions entry requirements appropriate for modern society and the modern economy?</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Are post-secondary institutions sufficiently active in partnering with schools in support of STEM learning?</td>
<td>• PSE assess entry requirements to align with K-12 education evolution</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• All post-secondary institutions conduct an inventory of the # of STEM learning partnerships they have with schools and then work to coordinate and increase this #</td>
</tr>
<tr>
<td>Theme / Pillar</td>
<td>Vision</td>
<td>Diagnostic Questions</td>
<td>Recommended Goals and Targets (by 2023)</td>
</tr>
<tr>
<td>---------------</td>
<td>--------</td>
<td>----------------------</td>
<td>----------------------------------------</td>
</tr>
</tbody>
</table>
| There is a sufficient focus in Canada on STEM education at all levels of education, beginning in the early years of school | • What are the critical components of an informal STEM education system?  
• Where does Canada have strengths and shortcomings in this area of informal STEM education?  
• To what extent are STEM stakeholders outside the education system (e.g. community organizations, industry) collaborating to improve STEM education? Where are the gaps?  
• How well are community partnerships integrated into the curriculum?  
• How well are teachers supported in integrating community partnerships into STEM learning?  
• How are education partners involved in measuring STEM learning outcomes? What are the most common forms of engagement (school presentations; mentoring; field trips; job shadowing; etc)? | • Every student is engaged by at least one STEM community partner every year of their K-12 education  
• Every student graduates secondary school with at least one work-integrated learning experience from a STEM learning community partnership  
• All teachers have access to ongoing PD&L and support from their schools for making and integrating STEM learning partnerships with external stakeholders  
• Government invests 1% of total STEM research funding into STEM education and outreach  
• Industry supports education outreach through the engagement of employees |
| Businesses maximize opportunities to enhance STEM learning and career awareness in K-12 education by supporting experiential and co-operative learning | • To what extent is industry financially supporting K-12 STEM-based learning?  
• To what extent are industry and community organizations collaborating to support K-12 STEM learning?  
• How active are industry associations in promoting and facilitating involvement by businesses in STEM education? | • % of companies that support K-12 STEM learning increases  
• Industry aligns a minimum of 20% of its community investment goals in education to support achievement of Canada 2067 targets |
| Effective coordination of education partners enhances learning outcomes of students | • What entities exist for the coordination of efforts to improve STEM education in Canada?  
• To what extent is coordination taking place?  
• Does coordination result in scaling of reach to all K-12 learners? | • 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 system enhances the learning experience for students and teachers, improving overall outcomes |
<table>
<thead>
<tr>
<th>Theme / Pillar</th>
<th>Vision</th>
<th>Diagnostic Questions</th>
<th>Recommended Goals and Targets (by 2023)</th>
</tr>
</thead>
</table>
| **Where Education Leads:** career information and education guidance | Students in Canada receive good guidance on careers from an early age, including through experiential learning opportunities and community partnerships | • Currently, how well is career guidance integrated into the STEM curriculum and vice versa?  
• Is career guidance currently identified as a learning objective for 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 that demands STEM-skills into career education  
• Increase the number of community partnerships with STEM-focused organizations and companies that include mentoring of students by a STEM practitioner |
| **Cross-cutting Issues:** learning opportunities for all students | There is a sufficient focus in Canada on STEM education at all levels of education, beginning in the early years of school | • Is there recognition that advanced education in a STEM discipline or STEM education is as important for primary teachers as it is for secondary teachers? | • All P/Ts work to increase the % of elementary teachers who have specialized education in a STEM discipline |
| **Edcucators in Canada identify, understand and address inequities in STEM education** | Educators in Canada identify, understand and address inequities in STEM education | • How well are girls and boys represented across various senior level STEM courses in secondary school?  
• How well are students from economically disadvantaged backgrounds represented in senior level STEM courses in secondary school?  
• How well are racialized students represented in senior level STEM courses in secondary school?  
• How well do minority language STEM classrooms compare to majority language ones?  
• How does geography affect access to STEM learning resources? | • All P/Ts work to achieve balanced representation of youth participating in senior level STEM courses, starting by establishing baseline measures related to by:  
  ◦ 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 Indigenous perspectives and cultures as well as other non-European worldviews into STEM teaching and learning | • How well are Indigenous students represented in STEM in secondary school?  
• How well do STEM courses integrate Indigenous ways of knowing and perspectives?  
• How well are culturally appropriate teaching techniques integrated into STEM courses?  
• To what degree are cultural awareness and cultural proficiency actively cultivated within and amongst all education stakeholders? | • All P/Ts collect data to establish a baseline measure of the % of Indigenous students who complete a senior level STEM course and work to increase this % in the future if appropriate  
• 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 toimprove their cultural proficiency, guard against undue cultural appropriation, and improve their ability to incorporate culturally sensitive teachings and techniques into their teaching practice |

These figures are drawn from TIMSS 2015. To arrive at these percentages, we have combined the percentages of teachers who had any specialized training at the post-secondary level in the field in question (i.e. mathematics and science). This includes, for example, both teachers with degrees or specializations in mathematics and in mathematics education.