Building a Nation of (Young) Innovators:
Supporting Economic Growth Through a National Youth STEM Development System

Submitted by: *Canada's National Youth STEM Organizations*

Executive Summary

Innovation creates jobs, drives growth and improves the lives of all Canadians. Numerous reports, including those from the Canadian Council of Academies, highlight the importance of STEM engagement and skills in the development of an innovation culture. Most Canadian kids think science is important, interesting, and fun, but only about 30 percent take optional secondary school STEM courses, eliminating valuable options – and undermining Canada's aspiration to global innovation leadership.

Canada produces world-class athletes through development systems that start with large numbers of children participating for fun, who then progress through nationally-defined levels that align organizations, support skill development, and ultimately identify top prospects. Canada has an abundance of *Timbits*-type STEM programs that get kids excited, but lacks a development path and a resource to guide parents or teens when they ask, "What's next?"

Canada's National Youth STEM Organizations jointly propose a federal measure to:

- Establish a National Youth STEM Advisory Council;
- Create a national youth STEM program inventory;
- Develop an evidence-based national youth STEM promotion strategy;
- Foster collaboration to enable coordination and enhancement of youth STEM programs; and
- Enable youth, parents, and educators to easily connect with STEM programs, organizations, and resources in their community.

Proposed budget:

Year 1	Year 2	Year 3	Year 4	Year 5	TOTAL
$1.75M	$1.25M	$0.75M	$0.75M	$0.50M	**$5.0M**

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A nation of innovators begins with youth

Innovation creates jobs, drives growth and improves the lives of all Canadians. Nine federal reports and strategies since 2001 – including two from the Canadian Council of Academies (CCA) in 2014 and 2015 – identified youth STEM (science, technology, engineering, and mathematics) promotion as important or essential to the country's economic prosperity and the development of an innovation and entrepreneurship culture.

Studies over the past 15 years have shown that at least two-thirds of Canadian kids ages 12-18 think STEM is important, interesting, and fun. Canadian students rank in the top 10 of 65 OECD countries on international tests of science achievement. Our kids like, and are good at STEM.

Yet, despite this potential, only about 30 percent of Canadian secondary school students take optional STEM courses after grade 10 (Secondary 3 in Quebec), limiting their access to opportunities in STEM-related fields and undermining Canada's aspiration to global innovation leadership. In 2014 the CCA reported that Canada's total employment in STEM occupations was just 30 percent – 22nd out of 37 countries.

Canada has a hockey culture; we *need* an innovation culture

Canada produces great hockey players – and now Olympic athletes – through national development systems. They start by getting large numbers of young kids playing for fun – as in *Timbits* minor sports. From there, they can advance through age groups with different levels based on interest and abilities. Kids build knowledge and skills through coaching, practice, and play – as well as a passion for the game. Ultimately, these development systems identify and cultivate top prospects – those with the potential to pursue their sport at an elite level, or as a career.

A national youth STEM development system would look remarkably similar. It would start with a large number of children exploring a range of fun STEM activities to learn what sparks their interest. As they get older, their interests become focused, and their skills increase, they would move on to more specific and intensive programs. It would be easy to progress from a classroom presentation or science centre visit, to a weekend or summer STEM club or camp, and from there to a challenge or project, with the option of entering a competition – and maybe ultimately representing their community or country.

Building such a system from scratch across Canada would be an enormous and prohibitively expensive undertaking. Fortunately, the *program* elements are already in place.

Building a national youth STEM development system through collaboration

Canada has well over 100 youth STEM related NGOs and associations offering school presentations, workshops, camps, experiences, challenges, and competitions. Most are small-scale, local programs, but seven organizations are national, with activity in most or all provinces and territories:

Actua, Canadian Association of Science Centres (CASC), FIRST Robotics Canada, Let's Talk Science, Partners in Research (Sanofi Biogenius Canada), SHAD, and Youth Science Canada.

The programs offered are excellent and impactful, but there's little collaboration or connection between these organizations, which compete for funding and profile. Further, the lack of even a simple national database of youth STEM programs makes it impossible to identify gaps and redundancies – even among those receiving federal support. For example, engaging under-represented groups (i.e., girls and Aboriginal youth) is an explicit NSERC PromoScience priority; however, there is currently no way for NSERC – or anyone else – to easily determine what proportion of programs target those groups, or to gauge their collective impact. An evidence-based national strategy, derived from a program inventory and analysis, and guided by the organizations that implement it, would enable youth STEM promotion and funding to be more strategic – a coherent rather than a scattershot approach.

Canada is very good at getting kids *interested* in STEM. There is an abundance of *Timbits*-type programs that introduce children to various aspects of STEM and get them excited, but the path from there is often unclear. When parents, kids, or teachers ask, "What comes next?" answers are difficult to find. Building a nation of innovators requires more than generating interest and excitement. We must enable more Canadians, and especially teens, to follow their path – to develop skills and excellence as inventors, makers, engineers, researchers, software developers, and entrepreneurs. We need a development *system*.

Canadian youth are remarkable innovators

When Canadian kids do advance through programs that foster their interests and abilities, the results can be spectacular:

Ann Makosinski started inventing when she was seven. In grade 10, inspired by the plight of a family friend in the Philippines who was unable to study at night without electricity, she invented the "Hollow Flashlight," which generates electricity from the heat of a human hand to power an LED. Ann has appeared twice on The Tonight Show with Jimmy Fallon – first, to talk about her flashlight, and a year later with the eDrink, a travel mug that uses heat from coffee or tea to charge a mobile phone.

Raymond Wang was concerned about the airborne spread of diseases like SARS and H1N1 among airplane passengers. He developed computer simulations of how pathogens circulate in aircraft cabins and then designed an air deflector that changes cabin airflow, reducing pathogen inhalation by 55 times and increasing the delivery of fresh air by 190 times. Raymond launched a company, applied for a patent, and then started grade 12.

Canada needs more young innovators and entrepreneurs like Ann and Raymond. So, how do we inspire and engage more young Canadians, including those who are traditionally under-represented, to develop their creativity, potential, and prosperity through STEM? How do we equip our youth with the right skills? By working together.

Proposed Measure: Establish a national youth STEM development system

Canada's national youth STEM organizations jointly propose a federal government measure in Budget 2017 to amplify Canada's existing youth STEM promotion activity through the establishment of a national youth STEM and innovation development system, similar to those for hockey and other sports. Over 5 years, support from this measure would enable collaboration on strategies and structures to link programs; provide easy access to all STEM programs across Canada for parents, youth, and educators; and promote the initiative.

The proposed measure includes:

1. National Youth STEM Advisory Council and program inventory

Establish a National Youth STEM Advisory Council comprising leaders of the national youth STEM organizations and selected representatives of regional organizations, other stakeholders, and young Canadians aged 16-24. It would be supported by a small secretariat, providing administrative support for implementation and reporting.

In its first year, the Council would develop a comprehensive national inventory of youth STEM promotion programs, including scope, target audience, reach, age/grade, engagement level, duration, etc. This would generate a baseline profile, which would be analyzed for redundancies, imbalances, and gaps and then used to develop initial objectives, targets, and metrics for the strategy and development system. The inventory would serve as the underlying database for a national youth STEM portal for parents, teens, and educators. It would also support national STEM promotion campaigns, such as NSERC's Science Odyssey.

Annual progress reports to all stakeholders would include an updated profile and analysis with recommended adjustments to the strategy, objectives, and targets.

Year 1	Year 2	Year 3	Year 4	Year 5	TOTAL
$0.75M	$0.50M	$0.25M	$0.25M	$0.25M	**$2.0M**

2. National youth STEM portal

A national youth STEM development system would also require a public information and resource delivery platform capable of supporting interactions ranging from casual searches to personalized updates and recommendations for those who choose to register. A fully bilingual online portal would enable access to, and "push" delivery of, age/grade-relevant and location-aware program, activity, and event information to teens, parents, and educators through web and mobile interfaces – a "one-stop-shop" for all youth STEM opportunities across Canada.

The platform would be developed in parallel with the program inventory database during the first year. It would include administration, program provider, and user access levels with the latter offering specific user experiences for teens, parents, and educators. Additional features would be

available to registered users, which could include social media integration, gamification (incentives, badges, etc.), and other benefits such as discounts, contests, and exclusive opportunities.

Once the strategy and system structure is established, national organizations would populate the system with program information and then focus on identifying and activating inter-program connections and co-promotion opportunities. An exhaustive onboarding process would then engage, support, and train all other youth STEM program providers in using the system to ensure the most comprehensive program information possible at launch.

The launch, supported by a national promotional campaign targeting teens, parents, and educators would take place in May of the second year, during Science Odyssey 2018. Audience-specific promotion would continue year-round through various channels, including social media, program providers, and relevant events (educator conferences, STEM festivals, competitions, etc.)

Partner/user support, system maintenance, updating, analytics, and refinements would continue throughout the five-year period. Private sector partners would be actively pursued to enable growth and long-term sustainability.

Year 1	Year 2	Year 3	Year 4	Year 5	TOTAL
$1.0M	$0.75M	$0.50M	$0.50M	$0.25M	**$3.0M**

Powering youth STEM Innovation through collaborative partnership

Canada's future as an innovation nation depends on engaging its children and youth – challenging and supporting them to develop the right skills for the future economy. Each of the country's national youth STEM organizations offers inspiring, empowering, and life-changing programs, but they work in isolation – and often in competition.

Innovation is accelerated by collaborative partnerships. Canada's Innovation Agenda offers a remarkable opportunity for the country's independent, but like-minded national organizations to collaborate on building a national youth STEM development system. We look forward to working with the government, and with each other, to ensure a bright and prosperous future for Canadian youth – indeed for all Canadians.

Respectfully submitted by *Canada's National Youth STEM Organizations:*

Actua – Jennifer Flanagan, President & CEO
Canadian Association of Science Centres – Stephanie Deschenes, Executive Director
FIRST Robotics Canada – Mark Breadner, Executive Director
Let's Talk Science – Dr. Bonnie Schmidt, President & Founder
Partners in Research – Brent Peltola, Executive Director
SHAD – Tim Jackson, President & CEO
Youth Science Canada – Brad McCabe, Executive Director

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Canada's National Youth STEM Organizations comprises the seven charitable organizations with a primary focus on promoting STEM to children and youth, and offering programs in most or all provinces and territories across Canada.