

CANADA'S
PUBLIC POLICY

FORUM

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DU CANADA

Innovation Generation

Roundtable on STEM and Entrepreneurship in K-12

Summary Report
June 2014





The Public Policy Forum is an independent, not-for-profit organization dedicated to improving the quality of government in Canada through enhanced dialogue among the public, private and voluntary sectors. The Forum's members, drawn from business, federal, provincial and territorial governments, the voluntary sector and organized labour, share a belief that an efficient and effective public service is important in ensuring Canada's competitiveness abroad and quality of life at home.

Established in 1987, the Forum has earned a reputation as a trusted, nonpartisan facilitator, capable of bringing together a wide range of stakeholders in productive dialogue. Its research program provides a neutral base to inform collective decision making. By promoting information sharing and greater links between governments and other sectors, the Forum helps ensure public policy in our country is dynamic, coordinated and responsive to future challenges and opportunities.

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Introduction

Adaptability and creativity are essential for individuals and economies to thrive in today's dynamic global economy. To respond to intensifying competition and ever more complex challenges, countries around the world are trying to enhance innovation across sectors.

Canada's global ranking in innovation continues to fall, relative to other high-income countries. The World Economic Forum's 2013-2014 Global Competitiveness Report ranked Canada 27th out of 148 countries in innovation capacity. According to the 2013 Global Innovation Index, Canada placed 25th out of 142 countries in human capital and research, with low rankings in education expenditure and post-secondary education.

Skilled, highly-qualified people not only drive productivity and growth, they also ensure resilience in times of uncertainty. Canada's underperformance in human capital development raises concerns about our ability to stay ahead of the curve.

Advancing the dialogue on innovation, Canada's Public Policy Forum launched a series of conversations with leaders across sectors and regions to better understand the challenges and opportunities facing our country. In 2011, we published [*Innovation Next: Leading Canada to a Greater Productivity, Competitiveness and Resilience*](#), which offered recommendations for building a culture of innovation. Following that capstone report, we shared further findings on regional contexts and perspectives in [*Leading Innovation: Insights from Canadian Regions*](#).

To cultivate the entrepreneurial edge required for innovation, the leaders we engaged emphasized the importance of building our capacity in science, technology, engineering, and math (STEM), as well as developing entrepreneurial skills, mindset, and knowledge at an early age. Some progress has been made

in promoting and expanding STEM and entrepreneurship education; however, complacency in achieving small steps is not an option. While other countries are rapidly upgrading their innovation capacity, Canada continues to grapple with fiscal and jurisdictional constraints that curtail opportunities to modernize education across the country.

On May 21, 2014, the Public Policy Forum convened a roundtable discussion in Toronto that focused on STEM and entrepreneurship education in the K-12 system. Participants included young entrepreneurs, business and government leaders, as well as experienced practitioners in STEM and entrepreneurship education.

Bringing together 40 key stakeholders across sectors, the roundtable provided a platform for sharing diverse perspectives on developing the next generation of innovators. While STEM and entrepreneurship were the starting point, the discussion examined broader issues, highlighting the need for a more fundamental shift in how we define innovation capacity and the implications for education.

Key challenges in education

Although Canada's population is one of the most educated in the world, other countries are increasingly prioritizing and developing human capital to build a skilled workforce. Jurisdictional divisions place Canada at a disadvantage as most countries take a national approach to education that allows for coordination and standardization. Fiscal constraints have also limited education funding in several provinces at a time when further investments are needed to keep up with global competition and technological change. For instance, access to quality STEM and

entrepreneurship programs remains inconsistent across jurisdictions due to differences in resources and capacity. In addition to these broad challenges, roundtable participants elaborated on specific issues regarding approaches to education, quality of teaching, and social barriers to academic success.

Outdated paradigms

A common theme in discussion was the need to modernize education. The paradigm that prevails across the public education system is based on a rigid standard of perfection focused on the ability to follow rules and instructions. This framework has become outdated for today's dynamic environment, where success depends on the ability to adapt to change and uncertainty. Participants emphasized the need to encourage creativity and enable learning through experimentation.

Current approaches to education are perceived to lack the flexibility needed to cultivate the type of entrepreneurial mindset that drives innovation. Speakers and participants alike were critical of the silos created by the education system, where learning is often compartmentalized by subject. Furthermore, the stigma against applied or technical programs discourages students from considering educational alternatives to the university track.

Instead of teaching students to take more initiative and greater ownership of their own education, schools promote a culture of conformity that perpetuates passive learning. When failure is penalized, education becomes a means to an end, with students merely concentrating on getting good grades instead of challenging themselves and defining success on their own terms.

Another obstacle to building innovation capacity is the general bias toward concrete

skills. Participants stressed the importance of so-called soft skills, even though they tend to be difficult to define, teach, and assess. Qualities such as empathy, creativity, and adaptability are essential characteristics of innovative thinkers. However, public attitudes continue to value specific knowledge over the development of core competencies that can enable success in any field of study.

Limited capacity and resources

Many participants expressed concern about disparities in the quality of teaching. Student disengagement in STEM subjects is often linked to classrooms that emphasize rote memorization rather than interactive learning. Some questioned the capacity of educators to teach STEM and entrepreneurship when they have limited background in and passion for these subjects. Despite the range of technologies available, not all teachers may understand how to effectively integrate new learning tools into the classroom.

Cuts to education further undermine teachers' ability to provide quality education, as introducing new initiatives and investing in professional development can be expensive. Participants noted chronic underfunding of education, as well as financial obstacles to enhancing entrepreneurship programs through mentoring and experiential learning. Lack of funding also limits other educational resources, such as career counseling and support for new Canadians.

Social barriers

While innovative programs in STEM and entrepreneurship have been developed through partnerships in educational outreach, their success depends on social factors that influence outcomes at the individual level. Some of these include domestic conditions, such as household income and dynamics, as well as mental health,

self-esteem, and self-identity issues. Many programs target youth who have potential but lack the means or the drive to seek out opportunities.

One particular group facing a variety of complex barriers is indigenous youth. As they make up the fastest growing demographic in the country, improving their educational outcomes will have a major impact on Canada's long-term prosperity. Students with a strong sense of identity and belonging are better able to learn and contribute to their community. Embracing diversity is an ongoing challenge, but there is a national imperative to create inclusive learning environments that respect the needs of all students.

Promising approaches

Increased recognition of the value of STEM and entrepreneurship has led to recent growth in formal and informal education programs. Some schools across Canada are working with government, business, non-profits, post-secondary institutions, and local entrepreneurs to provide real-world learning opportunities that take a more holistic view of innovation. Interdisciplinary incubators and mentoring programs are also pushing entrepreneurial momentum beyond K-12.

The roundtable highlighted some of the groundbreaking initiatives emerging across the education landscape:

- Established in 2010, Ryerson University's Digital Media Zone (DMZ) is one of Canada's largest business incubators and co-working spaces for entrepreneurs. The DMZ provides a multi-disciplinary hub for digital media innovation, collaboration, and commercialization, most often led by young undergraduate students.

- The *Big Ideas* project is a summer camp piloted in 2013 by Actua, a nonprofit organization delivering STEM programming across the country. In partnership with the Rotman School of Management and the Institute for Competitiveness and Prosperity, Actua is cultivating entrepreneurial thinking by teaching students to combine STEM with the business innovation process to solve real-world challenges.

These initiatives, among many others, point to a promising trend toward building fundamental competencies for innovation through experiential learning and interdisciplinary approaches.

Rethinking innovation capacity

As the discussion unfolded, it became increasingly clear that we need to look at innovation capacity not as simply a set of skills, but as a way of thinking that will allow the next generation to have an impact. Participants stressed the importance of developing an innovation mindset focused on making a difference yet flexible enough to adapt to changing contexts. STEM and entrepreneurship are merely platforms for developing this type of thinking because innovation can happen in any role, field, and organization.

Some of the key qualities that can spark innovation include empathy, agility, initiative, resilience, creative problem solving, and the ability to work collaboratively. To prepare young people for an uncertain future, they must learn to adapt quickly, but also take the initiative to seize opportunities throughout their lives. Empathy and collaboration enable problem solving, as finding workable solutions to complex issues requires an understanding of other people's needs and the capacity to leverage a range of expertise and resources.

Multidisciplinary thinking is another core component of innovation. The skills needed to develop and get an idea off the ground span across disciplines. Both STEM and entrepreneurship focus on solving problems, but they add value in different ways. At the DMZ, the multi-disciplinary approach brings together a broad mix of expertise in design, business, engineering, and other fields to develop successful start-ups. It is not enough to come up with ideas. Innovators need a keen awareness of the marketplace to identify where and how they can have the greatest impact.

Focusing on experiential learning

Another way to enable students to develop an innovation mindset is to provide hands-on learning opportunities that allow them to tackle real-life challenges and discover their own potential. Based on the outcomes of Actua's *Big Ideas* camps, experiential learning can help increase youth engagement in STEM subjects as they begin to see how specific skills can be applied in ways that are relevant to them. Through hands-on experiences, students learn about their strengths and begin to realize that they can make a difference in their communities.

A competency common to most of the young entrepreneurs at the roundtable was self-management. Experiential learning programs that allow students to choose their own focus and approach help them become creative, autonomous learners who take responsibility for their own outcomes. For instance, moving from fact to inquiry-based learning can involve the use of experiments in STEM courses and case studies in business classes.

Another way to cultivate innovative thinking is by teaching youth to learn from failure. Since entrepreneurship can be glamorized, creating a learning environment where failure is accepted as a necessary part of the learning process will help develop resilience in the face of hardships.

Both the DMZ and Actua fully embrace the “fail fast and pivot” model of learning to teach students to see failure as an opportunity to identify mistakes and find a different path to success. As noted in the discussion, competitive sports may be one way to develop this type of resilience, since teams must learn to move on from losses or mistakes.

Building a culture of innovation

Based on some of the promising approaches discussed and the growing trend of youth entrepreneurship, most participants expressed a sense of optimism about Canada's future. Although budget cuts add further pressures to an already overburdened education system, access to innovative programs has increased tremendously over the years through unique partnerships and greater involvement across sectors. From the expansion of extracurricular STEM initiatives to the integration of entrepreneurship education in schools, a wider range of opportunities are now available to K-12 students.

To ensure that Canada continues to build a strong foundation for innovation, further effort is needed to redefine objectives, build on the progress achieved, and to address some of the systemic barriers to modernizing education across the country.

Redefining success

As we begin to rethink the competencies needed for innovation, our educational goals and how we measure learning success will need to change. With high youth unemployment and student debt, public debate around the role of education is certainly on the rise. Rather than favouring particular fields of study based on predictions about the future job market, a **holistic approach** that enables all kinds of talent to thrive may be more effective in an increasingly dynamic environment.

Focusing on broader goals and indicators of success, participants discussed the need for stakeholders to work together to define a set of foundational skills that will prepare future generations for a fast-changing, interconnected world. With experiential learning, schools must also develop **new metrics** to appropriately assess a more self-directed approach to education. As public perceptions tend to dictate how the education system defines success, shifting from simple, concrete metrics to more nuanced evaluations will require a significant investment in **community engagement** to ensure that everyone is on the same page.

Expanding opportunities

While many good practices are emerging in STEM and entrepreneurship education, funding constraints and geographic barriers limit access to innovative programming. **Technology** can provide the tools to expand educational opportunities in remote communities and support collaborative projects that connect students and educators across the country and around the world.

Broadening the reach of **mentorship** programs is another way to enrich learning. Mentors serve as role models who can expose students to diverse perspectives and prepare them for real-life challenges. In addition, placing students in leadership roles and engaging them in reverse mentorship arrangements can help build their confidence and allow organizations across sectors to leverage young talent.

To improve educational outcomes among Aboriginal youth, community engagement is critical. Some recommendations for consideration include developing intergenerational initiatives and increasing access to programs that help build **self-esteem** and strengthen **cultural identity** among Aboriginal youth.

Regardless of the quality and range of programs available, their impact is dependent on **public awareness**. Rather than relying on youth to seek out educational opportunities and career guidance, such information and support needs to be actively promoted by schools through educators and counselors, especially in light of student disengagement.

Advancing systemic change

Faced with limited resources, class diversity, and changing needs, the role of teachers has become increasingly complex. In the context of growing demands, educators need better access to tools and resources to continually challenge students and upgrade their own teaching skills. To develop innovation capacity, we also need teachers who value open learning environments that support the development of self-directed, critical thinkers. Experimenting with different approaches in teacher training may help contribute to **classroom innovation**.

To truly improve teaching quality, we need fundamental change across the education system. From championing a new paradigm to implementing new metrics, system-wide transformation depends on the commitment of leaders to invest the time and resources to modernize education.

Change needs **leadership**, but it also requires **collaboration**. With the rapid growth in STEM and entrepreneurship programming, building networks among educators will help foster a community of practice to share approaches and scale innovation. Students and parents can also be valuable change agents, but this requires genuine, ongoing engagement in reshaping the education system. With the range of stakeholders involved in education, further collaboration across sectors could help maximize collective resources to develop the next generation of innovators.

This discussion was intended as a starting point for encouraging dialogue and building networks among key stakeholders. While the roundtable highlighted a number of issues, identifying key priorities and developing sustainable solutions will certainly require more consideration and collaboration. The Public Policy Forum looks forward to continuing the conversation on education to help develop a stronger culture of innovation in Canada.

Appendix 1

Innovation Generation

Roundtable on STEM and Entrepreneurship in K-12

May 21, 2014
8:00am – 1:30pm
Room CR3, MaRS Discovery District, Toronto

AGENDA

8:00 – 8:15am	Arrival and Breakfast
8:15 – 8:25am	Welcome by Paul Ledwell, Executive Vice-President, Public Policy Forum
8:25 – 8:35am	Opening Remarks by Sheldon Levy, President and Vice Chancellor, Ryerson University
8:35 – 9:30am	<i>From Education to Innovation: Student panel moderated by Annie Kidder, Executive Director, People for Education</i> <ul style="list-style-type: none">• <i>Kaylie Greaves, Co-Founder, Kahoots</i>• <i>Aaron Libfield, Co-Founder, Business Development, Physicalytics</i>• <i>Allison Rhodes, Co-Founder, Kahoots</i>
9:30 – 10:45am	<i>The State of K-12 STEM and Entrepreneurship Education</i> <i>Cross-sector perspectives on trends, gaps, and innovations</i> <ul style="list-style-type: none">• <i>Jennifer Flanagan, President and CEO, Actua</i>• <i>Lea Konforte, Head of Business and Technology Department, Runnymede Collegiate Institute, Toronto District School Board</i>• <i>Mary Jane Loustel, National Aboriginal Program Executive, IBM Canada</i>
10:45 – 11:00am	Break
11:00 – 11:30pm	<i>Building Canada's Innovation Capacity</i> <i>Reflections on key priorities identified by participants</i>
11:30 – 12:45pm	<i>Working Lunch: How can we develop the next generation of innovators through K-12 education?</i> <i>Table discussions focused on future directions</i> <ul style="list-style-type: none">• <i>What should we prioritize?</i>• <i>How can we achieve results?</i>• <i>Who needs to be involved?</i>
12:45 – 1:15pm	Reporting Back
1:15 – 1:30pm	Closing Remarks

Appendix 2

Innovation Generation

Roundtable on STEM and Entrepreneurship in K-12

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