SPOTLIGHT ON SCIENCE LEARNING:
The High Cost of Dropping Science and Math

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Let's Talk Science is a national charitable organization that helps children and youth fulfill their potential and prepare for future careers and their role as citizens in a rapidly changing world by supporting their learning and engagement through science, technology, engineering and math (STEM). Our programs and resources help youth develop positive attitudes, critical skills and career awareness. Let's Talk Science is a leader in connecting the STEM and education communities to support youth development. We are very proud to contribute this report, in partnership with Amgen Canada, to encourage national discussion and action that will lead to greater engagement of youth in STEM for Canada's future.

Rick Dobson
Chair, Let's Talk Science

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As a leader in innovation, Amgen Canada understands the value of science education and is proud to support the Spotlight on Science Learning program, now in its second year. Spotlight on Science Learning: The High Cost of Dropping Science and Math shines a light on the importance of science learning for the jobs of Canada's future and, ultimately, its economic well-being and quality of life of its citizens. Given our needs as a nation – from filling employment shortages, being more innovative, and growing as a knowledge economy – more needs to be done to attract and retain students in science programs from high school right through to post-secondary. Developing a culture in Canada that supports science and math learning rests on the collective action of our entire society – and we need to act now before Canada is left behind.

Karen Burke, PhD
Director, Regulatory Affairs, Amgen Canada

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REPORT OVERVIEW

Science and technology are increasingly important to Canada's economic well-being and quality of life. A critical element for our long-term success—as individuals and as a country—is learning in science, technology, engineering and math (STEM). In the 2012 Spotlight on Science Learning[1], developed by Let's Talk Science in partnership with Amgen Canada, key benchmarks and recommendations were identified to further STEM learning in Canada.

One key benchmark the 2012 report recommended was monitoring participation in high school STEM courses. The current report goes deeper and recommends that better connections be built between job forecasts and STEM-learning demands so youth and parents are more aware of future employment opportunities. It investigates the financial, opportunity and social costs related to the current drop-off in secondary school participation in science, technology and math courses.

Canada, with its top-rated education system, should be proud. However, we cannot be complacent as other countries around the world increase their focus on developing STEM-based talent. To complement the growing understanding of the *benefits* of a STEM-educated and skilled Canada, this report frames the discussion in terms of *costs*: financial costs to students, their parents, taxpayers, governments, school boards, post-secondary institutions and skills trainers; the opportunity costs for students when they say "goodbye" to STEM learning at the senior secondary school level; the social costs of underrepresentation of women and Aboriginal people in STEM learning; and the costs to Canadian society should we not improve youth participation in STEM learning in secondary school and beyond.

This report is focused on data found in the publicly funded school systems across Canada, with regional examples, where they apply. Dollar figures are calculated based on national averages and generally represent the minimum cost figure available. When available, dollar amounts have been adjusted to 2012 values using inflation calculators.

The report concludes with recommendations to increase the percentage of students completing secondary school with a "balanced education"—one that includes senior level science, technology and mathematics courses. A complex issue requires a multifaceted approach that includes informing students and parents about opportunities; supporting educators in the evolution of teaching practices; rebranding "STEM"; growing industry engagement; providing better roadmaps and information about career pathways; and related policy changes.

METHODOLOGY

Researchers at Let's Talk Science and Impakt, a research-based global CSR consultancy, carried out an environmental scan of peer-reviewed literature, reports, media articles, and institutional and government websites to investigate the financial, opportunity and social costs of student disengagement from science, technology and mathematics courses at the secondary school level.

To augment the environmental scan, interviews were conducted with some of the brightest minds in Canadian business, innovation, media, public policy, economics, governance and skills development. Participants contributed commentary to the initial findings of the study to help frame the "costs of student disengagement" as they apply to Canadian society and point to recommendations to improve the percentage of secondary school students in Canada graduating with STEM courses.

Interviews were conducted with:

Sarah Anson-Cartwright
(director, skills policy, Canadian Chamber of Commerce)

Don Duval (CEO, Northern Centre for Advanced Technology [NORCAT])

Linda Hasenfratz
(CEO, Linamar Corporation)

Kate Lunau
(assistant editor, Maclean's magazine)

Kevin Lynch
(vice chair, BMO Financial Group)

Preston Manning (founder, Manning Centre for Building Democracy)

David Mitchell
(president and CEO, Public Policy Forum)

Daniel Muzyka
(president and CEO, The Conference Board of Canada)

Annette Verschuren
(CEO, NRStor Inc. and member, Science, Technology & Innovation Council)

INTRODUCTION

Less than 50 per cent – The average annual percentage of secondary school graduates, across a selection of provinces, completing Grade 11 and 12 level mathematics and science courses.

Spotlight on Science, 2012

At a point in history when the global economy is undergoing rapid shifts, will Canadian youth be optimally prepared to thrive? Increasingly, STEM underpins global issues such as climate change as well as existing and emerging jobs, yet more than half of Canadian students do not graduate with the prerequisite STEM courses needed for a growing number of post-secondary pathways.

While students must deal with the opportunity costs of disengaging from STEM learning, a variety of other stakeholders including business and industry, post-secondary institutions, and Canadian taxpayers share the financial and societal costs of student disengagement.

A 2010 Angus Reid Study[2] and a 2010 Ipsos Reid[3] national survey revealed that student interest in science declines with age and the majority of senior secondary school students don't see studying science as relevant to their future careers. The studies also showed a strong disconnect between student recognition of the importance of science for society and their *intention* to pursue STEM studies past the minimum compulsory courses in secondary school.

Across Canada, compulsory mathematics, science and technology courses are generally required only up to Grade 10, with most jurisdictions requiring one additional course that can be chosen from a wide menu of options. The only two provinces requiring a Grade 12 mathematics credit for graduation are Manitoba and Newfoundland/Labrador, whereas New Brunswick and Newfoundland/Labrador are the only two provinces requiring a Grade 12 science credit.

Daniel Muzyka

"I see the true importance of science, technology and math education as part of a greater talent challenge in Canada. We do have some issues that need to be addressed and a serious dialogue on STEM learning is required."

WHY SHOULD WE CARE ABOUT SECONDARY STUDENT DISENGAGEMENT FROM STEM COURSES?

Annette Verschuren:

"I'm very concerned about the productivity of Canadians. We have an amazing education system, we have amazing social nets, we live in a country where there is great opportunity. But I think that we're resting on our laurels when we need to look to the future and focus on where we could be as a country."

Kate Lunau:

"In the decades ahead we will have to face many national and global challenges: a booming population around the world and climate change; are we going to be able to feed everyone? Are we going to be able to house everyone? We need to be able to have intelligent conversations about all these issues as voters and as engaged members of society. I think that's a very important reason, in Canada, to think about bolstering STEM education."

Don Duval:

"I think there is a significant national opportunity to capitalize on these fields. As a nation, if we don't look at what is going on around us, for example in India and China, in terms of investment in the STEM fields, we're going to be in a very challenged position in the coming years."

Sarah Anson-Cartwright:

"The job vacancy rates for what the federal government calls the 'Science-based Occupations' was 6 per cent last year, and for skilled trades the rate was 5.2 per cent. Both those rates are well above the rate for all other occupations combined which was 3.6 per cent. It appears that we could have years ahead of a number of jobs going unfilled in many of these occupations, from engineers to welders."

FINANCIAL COSTS: THERE'S A BIG PRICE TO PAY

One of the major costs of students disengaging from STEM courses at the secondary school level is the financial cost (to students/parents, taxpayers, post-secondary institutions) of re-engaging, or making up, secondary school level math, science and technology courses later on.

20,000

The number of Ontario students who return each year for a fifth year of secondary school, after meeting graduation requirements[4].

Leah, a 19 year-old living in Ontario, had enough credits to graduate from secondary school. She applied for a vet tech program at a community college and learned that she needed a senior level science course for admission. She changed her major to police services and learned that she needed senior math for admission so she returned to do a 'victory lap' and upgrade other courses as well.

Leah represents one of 20,000 Ontario students returning for a fifth year of secondary school after meeting graduation requirements. Had Leah completed secondary school with senior level science and math credits in 4 years, she could have worked full-time for one year to save money to put towards her education and living expenses or she could have started post-secondary studies sooner.

$2,790

The average cost of one semester of undergraduate university tuition or two semesters of college courses[5].

Andrea lives in British Columbia where she is the science and medicine manager at Canadian Cycling – but her path to get there was not an easy one. She dropped chemistry after Grade 10 and physics after Grade 11 because she felt science was only taught as 'black and white' and she wanted to be more creative than that. At university, she chose to pursue arts versus sciences for the same reason and spent her first year taking a variety of arts courses. Between first and second year Andrea discovered scuba diving and decided to pursue sciences instead of arts. Upon returning for her second year, Andrea enrolled in all science courses trying to make up for the year she had lost. Lacking the necessary science background, Andrea struggled with some of her science courses and as a result had to attend summer school, re-take a few of her courses and was burdened with an overloaded course schedule. All of which meant additional costs. Andrea believes that if science was taught as the art that it is, rather than as facts to memorize, a lot more bright and creative students would stay in the sciences.

$6,111 to $10,800 per student

The institutional cost for each first-year Canadian college or university student who fails to progress to the second year[6].

Blair from Ontario began her career as an early learning resource teacher. Even though she loved her job, Blair felt unrewarded for her efforts and that she had more to offer. After five years of teaching, Blair decided to switch her career to nursing, where she could continue working with children and be exposed to more job opportunities. Unfortunately, because Blair's high school required only one science course to graduate, she did not have all the necessary prerequisites to enroll into a nursing program.

Blair quit her job and signed up for a one-year pre-nursing college program. She was not accepted as she did not have enough of a science background. Blair then turned to the States for a similar kind of program, but had to withdraw for the same reason. Two years and $10,000 later, Blair begins a six-month accelerated PSW program for another $6,000, in hopes it will give her the practical experience to get into nursing. Blair is currently on the waitlist for a nursing program, with another four years of study and a hefty tuition fee ahead of her. Blair strongly believes that science should be made mandatory in all years of high school, and wishes there was more transparency between educators, students, and community about the kinds of educational programs available.

$12,557

The average annual expenditure per student in publically funded schools (from Kindergarten to Grade 12) in Canada from 2011 to 2012 (ranging from $11,360 in PEI to $22,202 in the Northwest Territories)[7].

Education is the most important investment a nation can make to secure its future. Do we currently have the right mix of pathways and learning opportunities in place to ensure that Canadian youth will be prepared for tomorrow's economy? If not, what needs to be done and how can we achieve change? With the growing importance of STEM for Canada's future, what can—and should—we be doing to ensure better participation by Canadian youth?

While access to public school programs and adult basic education courses across Canada are free to the student, the cost covered by taxpayers at the local, provincial/territorial and federal levels represents a significant investment in Canada's future workforce and citizenry. Further, while post-secondary education and training programs are not free to the user, taxpayer subsidies help keep access to education within reach for many Canadian secondary school graduates.

In 2012, Canada committed 5.5 per cent of GDP towards education at the primary, secondary and post-secondary levels. In 2008/2009, total expenditures for Canada's public elementary and secondary schools amounted to more than $50 billion and post-secondary education to more than $39 billion.

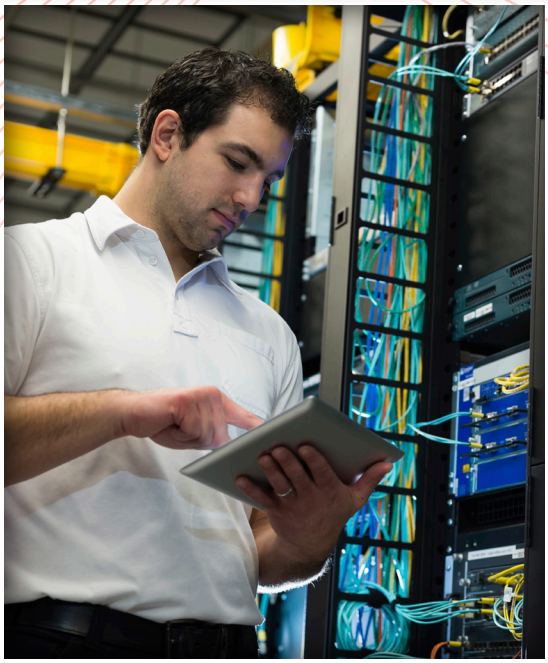
Kevin Lynch

"The three customers [of the public education system] are employers, the students themselves and society in general. And, actually, those are the three we don't engage well in planning. And then we wonder why we're not getting the right outcomes."

Daniel Muzyka

"Are we selling the younger generation on the importance of the knowledge, aptitude, skills and attitudes inherent in science and math education? For instance, I believe that our math curriculum and teaching has often failed students at an early stage—not impressing upon them the value and need for ongoing mathematics education. The consequence is that they reduce their options for learning and employment in areas related to science, engineering, technology and some trades."

OPPORTUNITY COSTS: SAY GOODBYE TO STEM... AND TO JOB OPTIONS



70 per cent of top jobs require STEM education, including the skilled trades.

While formal education cannot fully prepare anyone for all of life's challenges, an effective public education system that develops critical thinking, literacy, numeracy, communication, analytic and technical skills builds a strong foundation for lifelong learning and offers excellent preparation for evolving employment needs. Canadian students who complete secondary school with senior-level mathematics, science and technology courses face futures with greater options and a wider range of career opportunities.

While many students entering Grades eight and nine may not have a clear career path in mind, disengaging from STEM courses after they are no longer mandatory places heavy limitations on future education, training and career options. Secondary school students who graduate with a balanced credit load that includes senior-level math, science and technology courses will be better prepared for the future, whatever it may hold.

Students, parents, teachers and guidance counsellors should be aware of the diverse fields of study, jobs or careers that will not be options if they choose to opt out of senior-level math, science and technology courses at the secondary school level—and early awareness is key. Most students know about "traditional STEM careers," such as physicians, nurses, IT specialists, science teachers and statisticians. However, they may not be aware of the many other college, university and skilled-trades programs and careers that also require STEM-based learning, literacy and skills.

The Career Opportunity Matrix (Table 1) lays out a number of career category "Top 10 lists" that address various motivators such as salary, growth opportunity, future demand, career satisfaction and public respect or acknowledgement. Many students do not firmly decide on a career path while in secondary school and should be aware of their limited future options available should they drop senior-level math, science and technology courses. While not all careers in the matrix are "traditional" STEM careers, the majority of these careers require some STEM literacy or skills as part of the training or job description.

Memorial University of Newfoundland requires ALL incoming students to have Grade 12 math and science credits. In general, students without Grade 12 math can expect to be excluded from 40 to 75 per cent of program areas and those without Grade 12 science can expect to be excluded from 30 to 65 per cent of programs at Canadian universities. Students without Grade 11 or 12 math can also expect to be excluded from half of community college programs[8].

BOX COLOUR KEY:

- STEM career
- Skilled Trade
- Requires STEM literacy/skills
- STEM background not required, but skills may be beneficial

Table 1:
CAREER OPPORTUNITY MATRIX

1. Top-paying jobs in Canada	2. Top starting salaries	3. Canada's top jobs	4. U.S. top jobs	5. Jobs of the future	6. Career satisfaction	7. Recession-proof careers	8. Most respected occupations
Specialist physicians $179,514	Doctor $100,000	Oil and gas drilling supervisor	Dentist	Mining, oil & gas supervisor	Real estate agent	Computer software engineer	Nurses/doctors (tied)
Judge $178,053	Dentist $90,000	Head nurse and health care manager	Registered nurse	Pilot	Senior quality assurance engineer	Veterinarian	Farmers
Senior managers – communications, financial and other business services $162,376	Petroleum engineer $86,200	Petroleum engineer	Pharmacist	College instructor	Senior sales representative	Financial analyst	Scientists
Senior managers of goods production, construction, utilities, transportation $160,947	Data security analyst $83,250	Electrical and telecommunications contractor	Computer systems analyst	Railway & transportation supervisor	Construction superintendent	Database administrator	Veterinarians
General practitioner and family physician $132,615	Lawyer (first-year associate, large firm) $81,750	School principal and administrator	Physician	Power systems operator	Senior application developer	Dental hygienist	Dentists
Dentist $131,552	Website developer/ user experience designer $80,000	Lawyer	Database administrator	Health care managers	Logistics manager	Forensic science technician	Teachers
Senior managers of trade, broadcasting and other services $124,080	Mobile applications developer $72,500	Real estate and financial manager	Software developer	Education administrator	Construction manager	Mental health counsellor	Engineers
Lawyer $123,632	Chemical engineer $72,407	Senior government manager	Physical therapist	Head nurse	Executive administration assistant	Performance makeup artist	Military officers
Engineering manager $113,403	Financial controller $70,000	Chemical engineer	Web Developer	Railway conductor & brakemen/ women	Network engineer	Skin care Specialist	Architects
Credit, investment, banking manager $101,845	Lawyer (first-year associate, midsize firm) $64,000	Aerospace engineer	Dental hygienist	Dental hygienist	Assistant controller	Personal and home care aide	Police officers

1. www.cric.ca "The Top Highest-Paying Jobs in Canada." 2012 Statistics Canada data of top 10 occupations that earn average salaries amounting to more than $100,000.
2. www.globeandmail.com "Top 20 starting salaries" August, 2012. Average starting salaries for some of the top-paying jobs in Canada, based on figures from jobsites, Canadian Association of Career Educators and Employers, and industry groups.
3. www.canadianbusiness.com "Canada's top 50 jobs. 2013 edition." Statistics Canada and Human Resources and Skills Development Canada data and ranked on job growth, projected job demand, median wage and change in compensation.
4. www.money.usnews.com "The 100 Best Jobs. 2013." Data from overall best jobs lists and ranked on projected job growth over next 10 years, median salary, job prospects, employment rate, stress level and work-life balance.
5. www.canadianbusiness.com "Canada's top 50 jobs. 2013 edition." Statistics Canada and Human Resources and Skills Development Canada data and ranked on projected demand in 2020.
6. www.forbes.com "The Happiest and Unhappiest Jobs in America." On-line job site Careerbliss.com analysis of employee-generated reviews evaluating 10 factors contributing to workplace happiness: relationship with boss/co-workers, work environment, job resources, compensation, growth opportunities, company culture, company reputation, daily tasks and control over the work on a daily basis.
7. www.businessinsider.com "The Top 10 Recession-Proof Jobs. 2011." Based on US labour market trends, all careers are high-projected growth rates (28-51%) from 2010-2016, ranked here by median pay.
8. www.angus-reid.com "Nurses, Doctors Are Most Respected Jobs in Canada, U.S. and Britain." Public opinion poll of 25 professions conducted in August 2012.

People in STEM fields can earn 26 per cent more money on average and be less likely to experience job loss. The STEM degree-holders also tend to enjoy higher earnings overall, regardless of whether they work in STEM or non-STEM occupations.

US Commerce Department, 2011.

Increased awareness of career options along with experience, skill set and required education and training must start early in a student's educational path. Science, technology and innovation are rapidly changing the employment landscape in Canada and internationally; there will be jobs and careers in high demand 10 years from now that don't even exist today—but you can bet they will likely require a strong foundation in STEM learning!

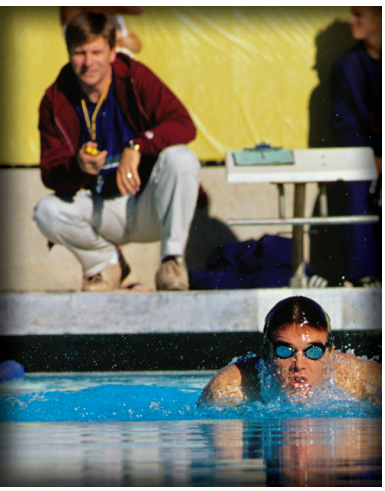
Jobs of the future will require a balance of analytical skills, an understanding of science and technology and a great deal of creativity. Encouraging students to graduate with a broad, balanced secondary school education—which includes science, math and technology courses—will keep their options open, increase their opportunities in the job markets of the future (in Canada and internationally) and optimally prepare them for the life-long learning required in a changing society.

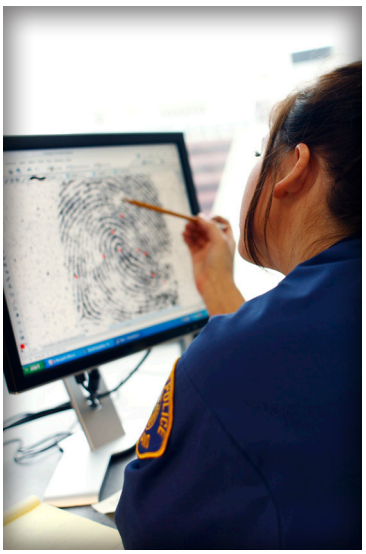
"Involvement in STEM gives people literacy, empowerment and economic freedom to shape their world and everyday life." [9]

Many teenagers choose their post-secondary path without realizing the magnitude of the decision they're making until they are in their mid-20s. Saying "no" to non-compulsory math, science and technology courses in secondary school limits options and the flexibility to change career paths later on. While it is easy to see that you need science to be a research scientist, math to be a mathematician or engineer, or technology to be a technologist, there are a number of surprising training and education programs that not only require senior secondary school STEM credits as prerequisites for admission but also include STEM learning and skill development in their course of study (see Table 2).

Table 2:
SURPRISING STEM REQUIREMENTS FOR PROGRAMS AND CAREERS [10]

Program/Career	Course Requirements/ Prerequisites	Also Known As...
Acting for film and television	Introduction to arts and science	Science
	Electronic media	Computer technology
Dance	Anatomy	Biology
Chef/baker	Nutrition	Biology and chemistry
	Math foundations and hospitality math	Mathematics
	Fermentation theory and application	Chemistry
Carpenter	Estimating and planning	Mathematics
Welder	Trade math	Mathematics
	Production and properties of metals	Chemistry
Esthetician	Anatomy and physiology	Biology
	Diseases/pharmacology	Biology and chemistry
	Epidemiology	Mathematics
	Nutrition	Biology and chemistry
Journalism	Quantitative research methods	Science and mathematics
	Digital design	Computer technology
Fitness/health promotion	Anatomy and physiology	Biology
	Nutrition	Biology and chemistry
	Business management	Mathematics and computer technology
Industrial design	2D/3D modeling	Mathematics
	Quantitative research methods	Science and mathematics
	Computer aided design	Computer technology
Crime scene investigator	DNA analysis	Biology and chemistry
Agriculture/agribusiness	Genetics	Biology
	Nutrition	Biology and chemistry
	Plant and soil science	Biology and chemistry
	Farm management	Science, mathematics and computer technology
Computer animation	Anatomy and biomechanics	Biology and physics
	Computer science	Computer technology
Early childhood education	Health, safety and nutrition	Science
Business administration/ retail management	Mathematics of finance	Mathematics
	Accounting	Mathematics
	Business economics	Mathematics
Weather forecaster	Understanding weather	Science
	Climate change	Science
	Atmospheric chemistry	Chemistry
	Cloud physics	Physics





Many skills acquired during STEM education and training are applicable in occupations other than traditional STEM fields. Indeed, many individuals with STEM degrees are employed outside traditionally defined STEM occupations. The U.S.-based National Association of Colleges and Employers released a Job Outlook 2012 report based on a survey of employers' hiring intentions for the year. Among the most sought-after skills: the ability to solve problems and make decisions, obtain and process information, and analyze data. All of these skills are developed through STEM learning.

Students may also not make the connection between chemistry and culinary arts, physics and biology with sports management, technology with animation arts, or mathematics with public relations. Therefore, it is critical to inform students about the variety of careers and training programs in which STEM learning is essential or beneficial.

MATH + SCIENCE + TECHNOLOGY + CREATIVITY = YouTube STAR!

Excerpt from Metro News May 14, 2013 interview with YouTube's Global Head of Content, Robert Kyncl

What's the key ingredient to success in new media?

On the Internet, you can go directly to the consumer, but you have to do the other parts yourself: analyzing trends and your consumers and quantifying them.

This means that you have to be good in math. Your ability to, for example, expand your YouTube channel will rely on your ability to spot and measure trends with data. ***Creativity and analytical skills are a phenomenal mix.***

So teenagers should brush up on their math?

That's what I tell my daughters every day. And science. And learn how to code!

SOCIETAL COSTS – WILL WE BE AN INNOVATION NATION?

GENDER AND CULTURAL GAPS REMAIN IN STEM EDUCATION/EMPLOYMENT

13 per cent - The percentage of females registered as major trade apprentices in Canada in 2010. Focusing on STEM-heavy trades, the percentage drops to single digits.[11]

A greater diversity of experiences and perspectives among STEM professionals can increase Canada's innovation potential, helping us adapt to a rapidly changing society. Canada needs the contributions of *all* its people, regardless of gender, cultural descent or age to maintain our labour force, sustain a higher standard of living and remain competitive in the evolving world economy.

While women now comprise the majority of students in three broad fields at the college, university undergraduate and master's levels (physical and life sciences/technologies; recreation and fitness; natural resources and conservation), males continue to outnumber females in math and engineering undergraduate programs, master's programs in architecture and engineering and doctoral studies in math and engineering. And, although there has been an increase in the percentage of females registered as major trade apprentices (from 7 per cent in 1995 to 13 per cent in 2010), males continue to dominate the skilled-trades sector as shown in Table 3, with the exception of early childhood educators/assistants (93 per cent female), hairstylists/estheticians (89 per cent female) and user-support technicians (50 per cent female). The average age of skilled tradespersons in Canada is 55, with many set to retire within the next 10 to 15 years. Without increased participation by females undertaking and completing apprenticeships, Canada stands to have a severe shortage in the skilled-trades workforce.

Table 3:
THE PERCENTAGE OF FEMALE REGISTERED APPRENTICES IN "STEM-HEAVY" TRADES[12]

TRADE	1995	2000	2005	2010
Electronics	3	4	5	9
Heavy-duty equipment mechanic	1	0	1	2
Machinists	2	2	3	3
Millwrights	1	1	2	2
Plumbers, pipefitters	1	1	1	2
Welders	1	3	4	6

While women are now outpacing men in post-secondary education enrolment and university graduation rates, there remains a gender gap in earnings across many fields. And while STEM programs generally lead to higher career earnings compared to arts programs—such as English, film studies or music—gender also remains an important factor in earning potential in STEM careers. This persistent gender wage inequity, shown in Table 4, in combination with other sociological factors that have been reported elsewhere may represent an ongoing barrier to women engaging in traditional male-dominated skilled trades, mathematics and technology programs.

Table 4:
A COMPARISON OF AVERAGE EARNINGS OF MALE AND FEMALE DEGREE HOLDERS IN VARIOUS PROGRAMS OF STUDY[13]

AREA OF STUDY	MALE GRADUATE EARNINGS	FEMALE GRADUATE EARNINGS
Physics	$40,216	$31,545
Civil engineering	$60,000	$49,242
Nursing	$53,764	$47,985
Business administration	$48,405	$39,295

Canada's Aboriginal peoples remain under-represented in STEM fields in the education system and workforce. In addition to lower graduation rates when compared to the general population, Aboriginal peoples between the ages of 15 and 24 years old are significantly under-represented in scientific fields of study such as mathematics, computer science, physical science, engineering science and applied science. Compared to non-Aboriginal Peoples, Aboriginal are employed at lower rates in professional scientific and technical services and in occupations related to natural and applied sciences, as shown in Table 5.

"Choosing careers in science and technology will benefit Aboriginal students directly through employment; but, more important, they can make a tremendous contribution to Canada from the unique perspectives to science and technology based on the values implicit in Aboriginal knowledge and ways of knowing."[14]

Table 5:
POST-SECONDARY QUALIFICATIONS OF THE FIRST NATIONS, MÉTIS AND INUIT (FNMI) POPULATION IN VARIOUS PROGRAMS OF STUDY[15]

MAJOR FIELD OF STUDY	Percentage of the total non-FNMI population with post-secondary qualifications in each category	Percentage of the total FNMI population with post-secondary qualifications in each category
Education	7.7%	7.1%
Visual and performing arts, and communications technologies	3.7%	2.7%
Humanities	5.6%	3.7%
Social and behavioural sciences and law	9.8%	9.2%
Business, management and public administration	21.5%	21.1%
Physical and life sciences and technologies	3.5%	1.2%
Mathematics, computer and information sciences	4.4%	3.3%

A 2011 Statistics Canada report[16] also reveals that Aboriginal youth have a median delay of 15 months before starting post-secondary education compared to non-Aboriginal youth, who begin on average three months after completing secondary school. Studies show that the more time spent out of school before commencing post-secondary education reduces the chance of actually completing those courses. More can and should be done to increase Aboriginal student engagement in our education system, including STEM courses.

A UNIVERSITY EDUCATION IS NO LONGER THE GOLDEN TICKET

FROM THE HEADLINES:

"Young Money: You're going to need more than a degree to get a job."

Financial Post, 13-6-26

"The graduate's million dollar promise: A university degree was once a guarantee of higher incomes. Those days are gone, argue two profs."

Maclean's 13-1-16

"Skilled trades workforce facing a 'crunch'."

The Windsor Star 13-6-27

"Canada's youth at risk for chronic unemployment."

Canadian Press 13-6-20

"The issue is not just how much education and training is required for individuals and the economy as a whole, but what kinds of education, which specific skill sets and for whom these will be of most value in the global knowledge economy."[17]

A generation ago, successful completion of a university undergraduate degree was strongly correlated with quick and substantive employment upon graduation. It is clear that investment in university education remains critical, but may no longer be adequate.

The 2011 National Household Survey (Statistics Canada) shows a slight increase in the number of Canadians with a university degree since 2006, yet concurrently the Organization for Economic Co-operation and Development reports the unemployment rate for Canadians aged 25 to 36 increased by almost 3 per cent from 2008 to 2011.[18] It appears that university participation no longer simply translates into employment. And while some programs of study, such as medicine, continue to offer a good return on investment for students, others do not appear to materialize in timely employment.

In general, employment rates increase with overall educational achievement. However, there are fields of study with higher employability rates; for example, engineering graduates and master's degree holders are more likely to find employment compared to those graduating with a liberal arts and bachelor's degrees.

This improved employment rate appears to be leading to increased participation in university STEM programs. While the overall number of all university degrees from 2006 to 2010 increased by 5.4 per cent in Canada, there was a substantial 31.8 per cent increase in the number of science degrees and a 7.3 per cent increase in engineering degrees. STEM programs make up approximately one-quarter of all fields of study at university in Canada. According to the 2011 National Household Survey (Statistics Canada), however, only 20 per cent of Canadians have a STEM-related degree, with immigrants accounting for half. [19]

Table 6:
CONFERENCE BOARD OF CANADA REPORT CARD: EDUCATION AND SKILLS IN CANADA 2013[20]

Overall	A
Secondary school completion	A
College completion	A
University completion	B
PhD graduates	D
Science, math, computer science and engineering graduates	C

One million

The number of skilled workers needed in Canada by 2020.

Conference Board of Canada

While public recognition of the need for more skilled trades is growing, few acknowledge the pivotal connection with STEM learning. Simply put, most skilled trades demand strong STEM expertise. As outlined in the 2012 Spotlight on Science Learning report, the skilled trades continue to be in the top 10 projected talent gaps. Yet, most young people are not aware of the importance of science, technology and math learning needed for proficiency in many skilled trades.

In 2011, fewer young adults, ages 25 to 34, held a trades certificate than in the 55 to 64 year age group.[21] To economic forecasters and industry experts, this suggests a growing labour shortage. Work is needed to confront negative social perceptions that exist related to trades, especially given the strong potential they offer for meaningful employment. Clearer information about pathways through college and the skilled trades that are dependent upon STEM learning would help showcase the diverse employment opportunities, good wages and potential for career advancement.

Annette Verschuren:

"We're missing the opportunity to encourage young people to take the technical skills like welding, plumbing, electrical, and carpentry, which are very dependent on STEM learning."

Linda Hasenfratz:

"Skilled trades offer a great pathway to earn a lot of money and it's exciting to learn a skill that you can then build on—if you're an entrepreneurial kind of person you use that skill and start a company."

FUTURE OF "PEOPLE WITHOUT JOBS AND JOBS WITHOUT PEOPLE"

$24.3 billion – The amount of economic activity lost in Ontario because employers cannot find people with skills they need to innovate and grow in today's economy.[22]

"The challenge is clear. To compete in the 21st century and prosper as a nation, we need to foster a knowledge-based and creative economy. Policy makers and business groups, educators and academic bodies, research institutes and think tanks all agree: Canada has to be more innovative and productive, and Canadians have to think even more critically to meet work and societal challenges. That's the outcome we all want to see; the process to get there is talent development. Increasingly, that talent will need a strong STEM background." *Spotlight on Science Learning, 2012.*

There is a global concern with talent mismatch: there are not enough sufficiently skilled people in the right places at the right time. Simultaneously, employers are seeking ever more specific skill sets and combinations of skills – not just technical capabilities alone, but in combination with critical thinking skills, problem solving, communication and teamwork, along with other qualities that help drive companies forward through innovation. A key reason for perceived skill shortages is not only the mismatch in terms of numbers but also a consistent mismatch between the capabilities that employers require and the skills and experience of job-seekers. Engagement in effective, experiential STEM learning opportunities builds those critical skills as well as technical competence.

It is critical for Canada to build brains at home for long-term prosperity. Given the projected shortages, a multi-pronged approach that includes immigration and outsourcing is likely needed to fill the employment gaps in high demand fields. However, we cannot minimize the critical importance of developing Canadian talent, starting young.

Given this national need – to fill employment gaps, increase our innovation talent and grow as a knowledge economy – more needs to be done to attract and retain students in STEM programs from elementary and secondary school through post-secondary education and training.

STEM TALENT AND INNOVATION: BUILDING A COMPETITIVE CANADA IN THE WORLD ECONOMY

D – Canada's grade on the Conference Board of Canada's Innovation Report Card. Canada ranked 13th out of 16 countries.

The Conference Board of Canada defines innovation as a process through which economic or social value is extracted from knowledge—through creating, diffusing and transforming ideas—to produce new or improved products, services, processes, strategies or capabilities. Countries with the highest overall scores have successfully developed national strategies around innovation, including talent development, giving them a substantial lead over their peers in one or more areas.

A 2011 Report on Canada by the Institute for Competitiveness and Prosperity[23] further shows the strong link between STEM talent, expressed in its report as skilled workers and science and engineering talent, and innovation and productivity. As shown in Figure 1, it also found that among small and medium enterprises, which are an engine of the Canadian economy, the majority of entrepreneurial founders—those who create companies and employment—had science or engineering backgrounds.

AREA OF STUDY BY FOUNDERS

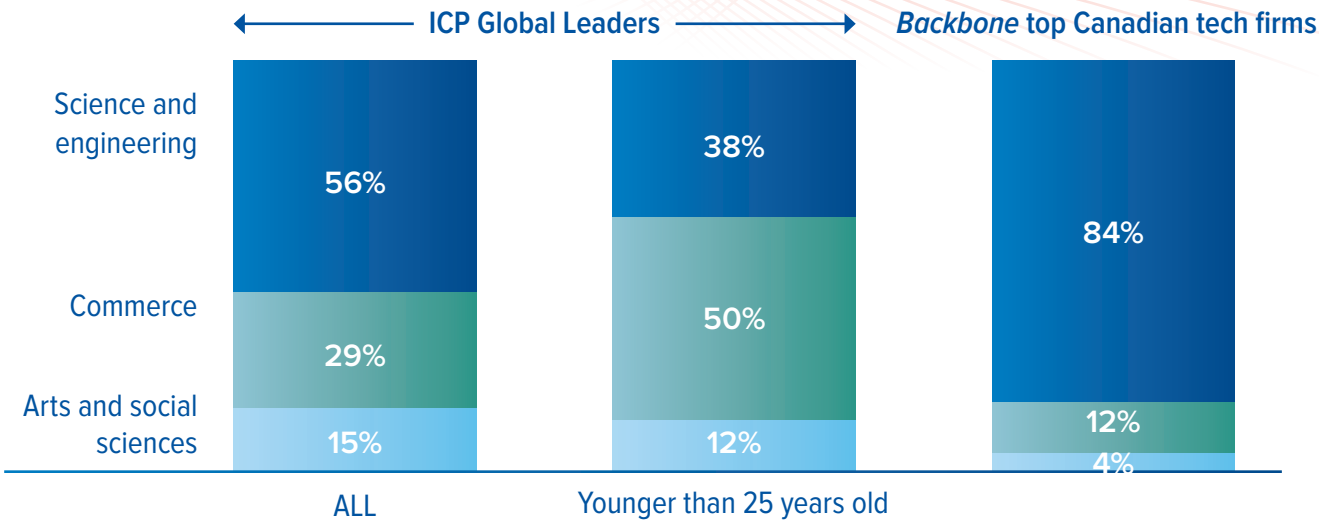


Figure 1. The proportion of young leaders with backgrounds in science and engineering, commerce and arts and social sciences globally and in Canada.

Note: All Global Leaders based on 61 founders (no information on 71 founders). "Younger" based on 24 founders (no information on 4 founders). *Backbone* based on 25 founders (no information on 14 founders). Source: Institute for Competitiveness & Prosperity analysis.

Innovation is essential to a high-performing economy and increased quality of life as measured by income per capita and the quality of social programs. It is also critical for environmental protection, a high-performing education system, a well-functioning system of health promotion and health care, and an inclusive society. Without innovation, all of these systems stagnate and Canada's performance deteriorates relative to that of its peers. A balanced education that includes STEM learning will help drive innovation and productivity.

WHAT DOES FALLING BEHIND IN INNOVATION MEAN FOR CANADA?

Linda Hasenfratz

"Competitiveness is determined by the level of innovation you have in your company and your ability to run efficiently. Innovation at Linamar is driven by skilled trades people, engineers, process technicians, quality technicians—people in science, engineering and trades. So, if we don't have people who have that capability, have that skill set, we will not be able to drive innovation and we will not be able to drive efficiency. And if we can't do those things we will not be competitive and we will not be able to grow our business. If you can't grow the business here you'll grow the business somewhere you can and that's where the brains are. So, it's highly detrimental to the economy of Canada to not prioritize these critical careers."

David Mitchell

"STEM disciplines certainly play a critically important role if we're serious about wanting to make Canada a more competitive, productive, innovative country in the years ahead."

HOW CAN WE ENGAGE YOUNG PEOPLE IN STEM LEARNING?

WHY IS SCHOOL STEM ENGAGEMENT SO IMPORTANT?

STEM engagement at secondary school opens pathways to college, university and skilled-trade opportunities. However, too few realize this and, ultimately, the costs to everyone are too high when youth unintentionally close doors to their futures. We must support student success by optimally preparing them for the training and higher education they need in a complex and changing environment. What worked twenty years ago won't work for tomorrow's economy. Collective action is urgently required by all stakeholders to address the STEM skills gap, increasing the number of people who will be prepared for and thrive in STEM-based employment.

WHAT IT WILL TAKE TO MAKE THAT CHANGE HAPPEN?

Diverse strategies and approaches are required to increase the number of Canadian secondary school students who complete high school with senior-level math, science and technology courses. It is a complex issue and there are no simple solutions.

Recommendations from the thought-leaders interviewed reinforce the recommendations and calls-to-action that were presented in the 2012 Spotlight on Science Learning report and are shown throughout this report. They include improving student motivation; involving students in experiential learning opportunities; curriculum reform; and/or making senior science, technology and math courses compulsory. We all have a stake in the issue and must be prepared for collective action to align ourselves with the common purpose of optimally preparing Canada's youth.

RECOMMENDATIONS FROM THE 2012 SPOTLIGHT ON SCIENCE LEARNING

To achieve improvements in the benchmarks, and in tracking the key measures that will help us monitor and evaluate the positive outcomes of science learning, the panel made eight key recommendations:

1. Establish a national forum for ongoing multi-stakeholder discussion related to STEM talent development.
2. Support and scale effective STEM-teaching and learning programs, in and outside of school to revitalize young people's love of science with compelling programming and help youth see how science education is relevant (i.e. that it will serve them well no matter what career they envision—and in life, too).
3. Establish or improve tracking and reporting systems required for effective data collection, around participation in high school STEM programs, and post-secondary applications, registrations and graduation in STEM programs.
4. Build better connections between job forecasts and STEM-learning demands—making this information available to schools in a relevant way—so youth and parents are more aware of future employment opportunities.
5. Build awareness about the breadth of career opportunities that are available with STEM learning.
6. Conduct a system-wide review of STEM curricula across Canada to develop programs that increase interest and participation in STEM studies (optional high-school courses and post-secondary programs).
7. Assess the factors that affect the capacity of universities and colleges to support and maintain STEM studies.
8. Determine a suite of benchmarks, with public input, that can be used to measure the state of science culture in Canada.

HOW WE CAN ENHANCE YOUTH ENGAGEMENT IN STEM LEARNING

As described throughout this report, the societal and personal costs of youth dropping out of STEM learning are unacceptably high. In the short term, when young people take longer to graduate if they need to return to make up courses, they incur significant, real financial and opportunity costs in terms of tuition and income loss. Longer term, when the pathways to university, college and the skilled trades are closed, the cost of underemployment, lack of employment, retraining, social services and support aren't fully known but represent a significant cost to Canadian society.

It will take a concerted effort by all stakeholders—educators at all levels, parents, youth, industry, government and non-profit organizations—to engage youth in STEM learning for Canada's future prosperity and quality of life.

Keeping youth engaged in STEM will require a long-term commitment from stakeholders in the education system, government funders, policymakers and industry. It will also depend on a high degree of collaboration, agreement on specific objectives and a means of tracking progress. Furthermore, our most vulnerable youth need to be taken into consideration and specific approaches must be developed that begin to address their unique circumstances.

1. Engage students in STEM from a very young age.

Not enough students and parents are aware that 70 per cent of Canada's top jobs of the future require STEM learning. We need to engage students in STEM earlier and make it fun and relevant to their present and future lives!

Annette Verschuren

"I think it starts in early childhood development; it starts very young. And I think math and science need to be introduced earlier and we need to have more fun with the different ways we can teach and encourage children in this area."

Preston Manning

"I know from personal experience the importance of becoming interested in science early—an interest which then can last through your whole lifetime."

Kate Lunau

"STEM isn't sitting at a desk looking at a blackboard of insufferable numbers and symbols. It's actually the world all around you; it's a lens through which to see the whole world."

David Mitchell

"There's a branding problem on some fundamental level and STEM shouldn't be seen as geeky subjects for nerds but as exciting disciplines that are changing the world for the better."

Preston Manning

"Start with entry points that the student understands and is interested in; with young people, it might be their own bodies and the environment or the fact that some of them may want to have a job someday. Then share that science has something to say on this. Science can help you. Science is very fascinating. Getting into science that way is more effective than just proclaiming the importance and value of science."

2. Present STEM in integrated and relevant ways, to promote a balanced education.

A balance of critical thinking, analytical skills and creativity is key for innovation. STEM, arts and humanities can be integrated to engage students in pursuing a balanced education—an education that will create more employment opportunities and options in the future and make learning fun!

Kate Lunau

"The fact that art and science are treated as two separate silos is wrong because the two actually interact in a lot of ways. Art and science shouldn't exist in two silos and be completely separate. I mean, ideally as good citizens of society we should all have some understanding and fluency in lots of different topics in art and science."

Kevin Lynch

"Balanced education is one that allows the kids to achieve their potential in a society and economy that is changing a lot."

Don Duval

"Look at what Chris Hadfield did—how many kids are going to be enthused by science as a result of having a Canadian 'science rock star' who has been very active in the media and making science "cool"? I think that is a critical part of it. We need to celebrate these science rock stars to show that it's interesting, it's fun and it's creative."

3. Resource, train and support educators to evolve teaching practices, including the use of emerging technologies.

Teachers play a pivotal role in motivating, inspiring and preparing youth for their futures. It is critical that they have the resources, training and support needed to engage students in meaningful STEM learning. STEM-trained professionals have many options and more should be encouraged to choose the teaching profession. Teachers also need resources, support and training to equip them properly.

Today's high school students are very tech savvy. Identifying new, interesting and challenging ways to use technology in teaching to replace book-learning should be explored to engage students in STEM courses.

Don Duval

"Technology has changed our world. Youth of today and their ability to multitask with 10 apps open at the same time, participate in online-collaboration platforms and actively engage in social media is the new normal."

Kevin Lynch

"How can we use technology? For example, if a 16-year-old male can spend five hours on a video game, why can't we create, with the same technology, a five-hour science class that actually captivates him just as much?"

Linda Hasenfratz

"Specialization should be supported. Every school doesn't have to have a construction math course; you can have only a few of them and then have kids all over the region coming in virtually to that classroom and getting that learning in that way though a computer lab, and they're all in there learning online. They're virtual."

4. Increase awareness of lost options.

By the time students apply for skilled-trades training, college or university, it's too late to find out that they are unprepared in prerequisite courses or the experience required to pursue a number of career options. Students, their parents, teachers and guidance counsellors need to be aware of the options and opportunities lost when they say goodbye to STEM learning in secondary school and the financial and time costs involved of later re-engaging in STEM learning.

Annette Verschuren

"If you want to go after only 50 per cent of the potential jobs in the world, you may restrict yourself by not going into math and sciences; but if you want the opportunity to be in exciting new, innovative markets, to contribute to change, to deal with economic and social change that's happening out there, you're going to be so much better off with a basic math and science program—the gift of greater capacity and therefore greater ability to get better jobs and to do better."

Sarah Anson-Cartwright

"Talk to students. Ask if they've ever thought about becoming a biologist or working in environmental sciences or about being a physiotherapist or a health care worker, or name any type of occupation and then track back to the fact that they may need some science courses. It's not about becoming a mathematician or not. It's about having some level of math that keeps the doors open."

David Mitchell

"Encourage them to stick with it because the world is complicated and challenging. If you're going to be successful and rise to the top in whatever choice in profession or discipline you end up working in, basic skills or knowledge of STEM is only going to stand you in good status; it's going to position you for success."

5. Offer a curriculum that inspires STEM learning.

As recommended in the 2012 Spotlight on Science Learning, revisiting curricula across the country to foster a classroom experience that is relevant and interesting to today's students is equally important. The landscape has changed dramatically in the last few decades; however, in general, the way mathematics and science is taught in secondary schools has not kept pace.

Don Duval

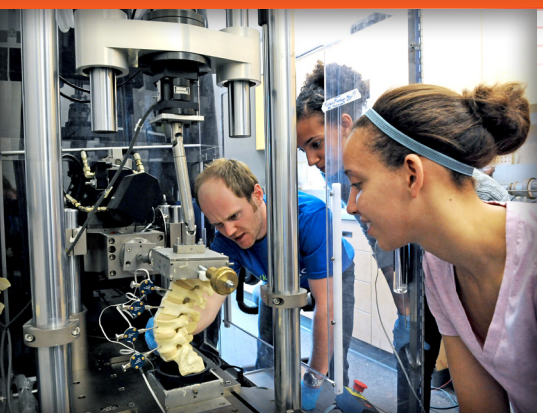
"Let's make a decision and decide that the STEM fields in our learning system are critically important to our country's future economic and social prosperity. With this, what a great opportunity for our education system to say, "Many of our students are not engaged in a core piece of curricula that we as a country deem to be important. Let's treat it as a call-to-action and work to identify ways to get them engaged. We need to understand that technology is changing the way students are learning today. We need to embrace this and integrate it into our delivery mechanisms. "

Daniel Muzyka

"We haven't moved sufficiently in curriculum. We haven't transformed learning sufficiently to keep up with the times. I think we need to do more to change the learning experience."

Preston Manning

"It's ironic and perplexing that something as exciting and interesting as science can be rendered dull and disinteresting, but somehow we've managed to make it so."



6. Deliver experiential learning, which offers a window to the many career opportunities afforded by STEM.

Experiential learning offers an opportunity to involve industry with secondary schools. By breaking down walls and creating opportunities for students in their local community businesses, industries and trades, students can gain insight into the value of STEM in a variety of employment scenarios.

A study published in the International Journal of Science and Education adds to the growing evidence that attitudes to science outside of school are more positive than attitudes to school science, and that experience of school science between ages 11 and 14 are crucial in shaping students' attitudes and subsequent behaviours in relation to subject choice (Bennet and Hogarth, 2009).

Co-op placements, internships, workplace volunteering and creating opportunities in part-time or summer employment for secondary students, particularly in high-demand STEM fields and skilled trades, offers experiential learning opportunities and increase exposure to variety of career options, where students can see the value of STEM-based skills in action.

Sarah Anson-Cartwright

"There is an experience gap; education needs to be combined with work experience."

David Mitchell

"Focus not only on community-service learning but business-service learning, making it part of the core curriculum."

Daniel Muzyka

"I am a big believer in co-ops and internships. Experiential learning is absolutely critical in and of itself but especially when combined with traditional educational or 'book learning' experiences. Intermingling the two creates an impactful and enduring learning experience."

Linda Hasenfratz

"What I would like to see is for every student to pick a skill—it can run the gamut from medical to business to mining, manufacturing, construction, environment, IT, arts and media. There's something for everybody; this isn't just electrical and millwrights and machinists. We should tailor secondary school education to provide some practical skills in those areas. Every student, every school majoring in a skill. What a fantastic education that would be!"

David Mitchell

"I'm talking about breaking down the walls of the school so that the community becomes the school."

Daniel Muzyka

"It's also about letting students bring the real world into the classroom. These are the kinds of things that you can be doing; it's about connecting jobs in STEM education. We need to start being more deliberate about that. We need to bring business into STEM."

Sarah Anson-Cartwright

"We really feel very strongly about improving those connections between educators and employers."

7. Provide better roadmaps and clearer pathways throughout school to work.

There are many stakeholders with a vested interest in engaging students in STEM learning and careers in Canada. Governments, business and educators at all levels need to work together to identify the skills, learning and experience Canadian students need to succeed in a competitive global economy. STEM engagement needs to start early and guide students towards fulfilling, meaningful and satisfying careers in Canada and around the world. Better and timely information about post-secondary and career pathways is needed by guidance professionals, teachers, parents and students.

Annette Verschuren

"I see three separate entities: I see government both federal and provincial, with conflicting perspectives; I see business with not enough in the game. I see secondary, universities, colleges, etc., all challenged to coordinate and match our education planning for future jobs. Canada needs to be a leader in competitiveness and sustainability."

Kate Lunau

"Not all teenagers have a crystal clear idea of where they want to be at in their careers in 10 years but at least having those conversations, tying a degree to the courses and the future job, I think can help kids; it can help motivate them. Forecasting is important to look ahead at what jobs we're going to need and then bolstering some of those programs."

Kevin Lynch

"I think we need to provide information about the nature of work and educational options that will get you to work that you might be interested in."

Sarah Anson-Cartwright

"Students and their parents invest a lot in young people's education. They probably need to invest a lot more time and effort in understanding where the job opportunities will be either before students start, or once they are in high school. Look at the continuum from the high school student into the post-secondary system. There are pathways between university and college education and then into the work place. That's the continuum that we need to really pay attention to in terms of what's needed."

David Mitchell

"Business leaders need to be involved in this dialogue at a senior level; sometimes this can be done directly with businesses, sometimes with business associations."

Daniel Muzyka

"It's also about letting students bring the real world into the classroom. These are the kinds of things that you can be doing; it's about connecting jobs in STEM education. We need to start being more deliberate about that. We need to bring business into STEM."

Kevin Lynch

"The reality is, the biggest constraint on growth is going to be talent. So how do we organize for that? Part of it is the business thing, which is why I think there is much greater scope for partnership between the business community and the education system, especially the colleges and the K-12 system."

Preston Manning

"Industry and business themselves have to take a more direct role in communicating the kind of skills that they need their workers and in providing some of the training."

David Mitchell

"Have more interaction at the K-12 level with the world outside of the formal education system, by inviting business people to come and talk about what they're doing and what it takes to be successful in their fields. It could be done in a more meaningful way by taking the students out of the classroom and into the real world rather than the other way around, so that the exchange can go both ways."

8. Consider policy changes around the secondary school curriculum and course credit requirements for graduation.

In 2013, federal and provincial governments announced a variety of strategies, investments and policy changes to deal with current and projected employment gaps in high-demand fields. However, most focused on post-secondary programs, employer incentives and immigration policy.

Without engaging students in elementary and secondary science, math and technology courses and improving the rates of secondary school students in Canada graduating with senior STEM credits, there may not be an appropriate group of students to benefit from government investment in post-secondary STEM programs. Policy change of the secondary school curriculum and course credit requirements for graduation offer possible approaches to increasing the number of students transitioning into the post-secondary system with STEM learning and trade skills.

Don Duval

"What if each province did this: We believe math and science learning to be an important aspect in the development of our children, therefore, we're going to make it compulsory in our education system. Yes, we are going to have some short-term groans and pains to learn what the right level of "compulsory" is, but once you do that, it becomes ingrained in the social fabric of our nation's learning system. It's not like we're dictating a future career to these students. We are saying that the correlation between math and science and the contribution to community and engagement in society requires enhanced knowledge and engagement with math and science. Make this new learning compulsory, determine how we raise the bar, treat it as a call-to-action, and then, and perhaps most importantly, make it fun and exciting."

Annette Verschuren

"To be able to opt out of math in this day and age – I really wonder about that. And if the real need for future jobs is in these areas, why aren't we taking a bit of a harder line? Or having a broader vision?"

Kevin Lynch

"I'd make it mandatory all through high school. I graduated high school in 1967 and it was required then and the world just seems a little bit more STEM-oriented today than it was then."

Preston Manning

"It seems to me that encouraging greater engagement with STEM courses is really required at two levels. The provincial education departments need to be encouraged to make STEM education a higher priority, even a requirement, and then of course students need to be encouraged that taking such courses is a good thing to do."

David Mitchell

"It needs to be seen as a positive incentive rather than simply something that is a penalty that they have to endure before they graduate."

CONCLUSION

Canada is at an important place in its history. We are facing a changing economy, global pressures that call for increased attention to sustainability and evolving demands for talent. Science, technology and innovation underpin it all and yet as a country we are not investing adequately to ensure that Canadian youth will be prepared for the changing landscape. Too many youth leave STEM studies early in secondary school, and, often unwittingly, close doors to many post-secondary pathways that include university, college and skilled trades. The social, financial and opportunity costs related to this disengagement are very high—for youth and for our society.

This report builds on the 2012 Spotlight on Science Learning and calls for the engagement of more Canadian youth in meaningful and relevant STEM learning. There was significant alignment from several Canadian thought-leaders who offered their perspectives on what it will take—from curriculum and policy reform to educator support and industry engagement.

It takes a country to raise a child in the 21st century. A concerted, sustained effort is required to develop innovative and creative people who will lead Canada in a global economy that is underpinned by science and technology.

Let's Talk Science is a national, charitable organization, dedicated to improving science, technology, engineering and math literacy in Canada. The organization strives to prepare youth for their future careers and role as citizens in a rapidly changing world. Spotlight on Science Learning: The High Cost of Dropping Science and Math is the latest research report from Let's Talk Science, made possible by Amgen Canada. For more information about Let's Talk Science, please visit www.letstalkscience.ca.

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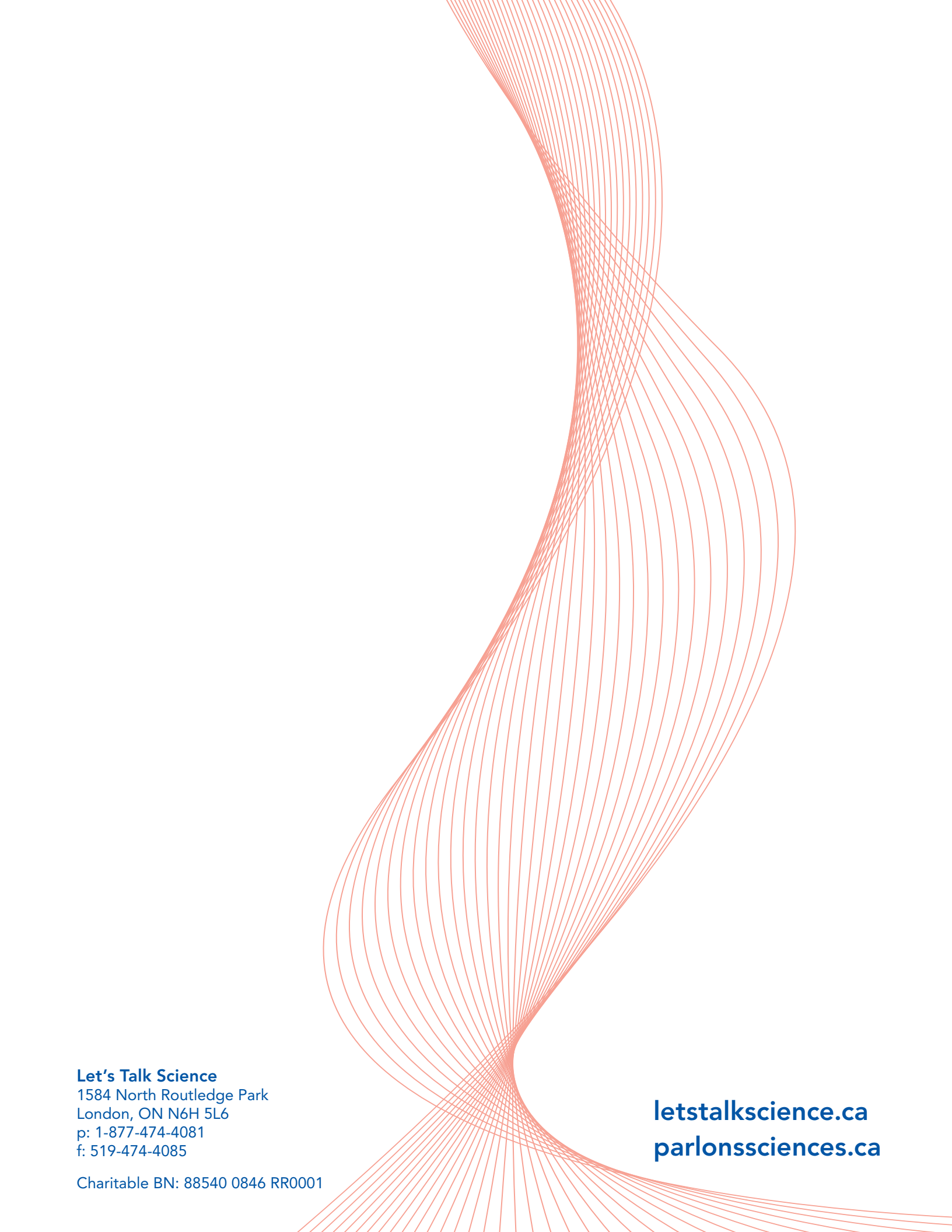
NOTES



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