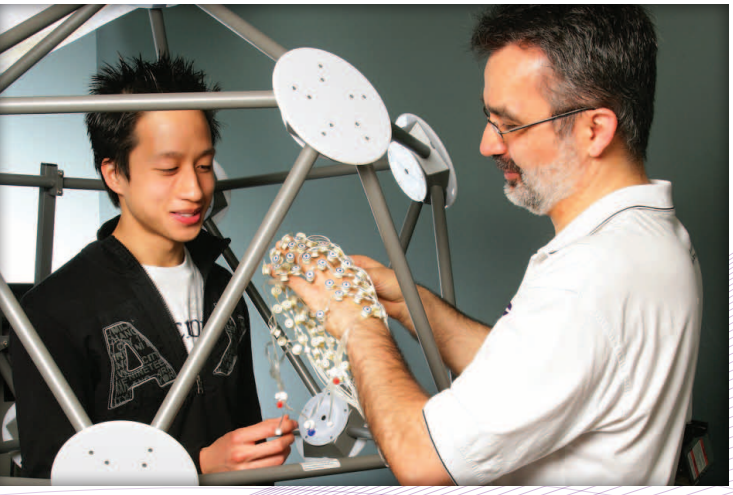

SPOTLIGHT ON SCIENCE LEARNING:
A benchmark of Canadian talent

AMGEN® let's talk science

This publication is also available online at www.letstalkscience.ca/spotlight.html

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At Amgen Canada, we are proud to support initiatives such as the Spotlight on Science Learning: A benchmark of Canadian talent that help raise awareness of science literacy in Canada and encourage youth to engage in science learning now, and for the rest of their lives. We hope you enjoy this report and will join us in a discussion about how to help create and sustain a science culture in Canada by visiting www.letstalkscience.ca/spotlight.

Dr. Clive Ward-Able
Executive Director, Research & Development
Amgen Canada Inc.

AMGEN®

"Science learning is one component of building a science culture in Canada. People of all ages are amazed and delighted by the wonders of science. Science is the most powerful tool we have to address the challenges of our world. At the Ontario Science Centre, visitors of all ages become more informed and innovative citizens who are inspired and equipped to create a better future. This report will stimulate important discussion about encouraging even more science learning in and out of the classroom."

Lesley Lewis, CEO
Ontario Science Centre

ONTARIO SCIENCE CENTRE

This report has been reviewed and is endorsed by Preston Manning, C.C., President and CEO, Manning Centre for Building Democracy

1 EXECUTIVE SUMMARY

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 science learning.

Many jobs that will be in high demand in the coming decades, from health care to skilled trades, directly require a background in science, technology, engineering and math (STEM). Human Resources and Skills Development Canada (HRSDC), in its latest 10-year employment growth outlook, forecasts that some of the biggest growth will occur in STEM-related fields. HRSDC says that almost 75 per cent of new jobs between 2009 and 2018 will be in high-skill occupations.

Young people need to know this: beyond the traditional career paths that call for a background in STEM, today's employers are looking for a certain skill set. Jobs in every field call for people who are analytical, curious and critical thinkers, able to make connections – the very qualities that exposure to STEM learning nurtures.

People who have a quality STEM education will be highly employable – in STEM-related jobs and sectors, in fields that might not be directly or obviously STEM-related, and in occupations they might not envision or that may not even exist yet.

> As a nation, we need to grasp the current state of science learning, understand the full scope of its relevance, discuss whether we're supporting science learning sufficiently and develop innovative ways to generate even more interest in science among Canada's youth.

Amgen Canada and Let's Talk Science have teamed up to produce this landmark study on the key indicators of science learning. (Note: throughout the document, we'll be using the terms science and STEM interchangeably.)

For individuals, strong delivery of and engagement in science can lead to a world of opportunities and a higher quality of life. Apart from the needs of the workplace, a higher degree of science literacy is important for everyday life – everything from making decisions about our well-being, to grappling with societal issues like the environment and health care. If we're to function well in today's society and make prudent decisions about the world around us, then basic science literacy is an essential building block, one that leads to more engaged and informed citizens.

Quite simply, we need "science for all." We need a robust science culture in this country that goes beyond the classroom, one that's evident in a broader interest in, awareness of and involvement with science.

For Canada, strong interest and abilities in STEM is critical. We require it to fill and create rewarding jobs across all sectors. We also need those probing and problem-solving STEM traits to grow a thriving 21st-century economy, foster innovative processes and discoveries and keep Canada competitive. As other countries invest more heavily in their STEM learning, we can't afford to be left behind.

Are we in danger of that?

Here's what we know: Canadian students demonstrate their competencies in STEM learning. Yet they often seem eager to shed science classes later in high school, and the proportion of students studying STEM in colleges and universities remains flat.

One of the most reliable measures for student performance in science and math is PISA – the Programme for International Student Assessment, administered by the Organization for Economic Co-operation Development (OECD). Canadian students perform above the OECD average. In PCAP tests – the Pan-Canadian Assessment Program, developed by the Council of Ministers of Education, Canada – more than 90 per cent of Canadian students in grade eight achieve at or above their expected levels of performance in math and almost half are achieving above their expected level. In many jurisdictions, science results are improving as well.

However, there is a huge drop-off in the uptake of science courses once they're no longer compulsory, usually after grade 10. By the end of high school, the vast majority of students are taking no science at all. At the post-secondary level, enrolment in STEM fields is up – but that's not as encouraging as it might seem, as enrolment is up in all fields, and the proportion of students studying STEM has not moved.

We have learned from attitude surveys that when students are younger they have great interest in science. As they get older, however, science is seen more as "complicated" and "difficult," as one survey said, versus "fun" or "inspiring." Surveys also tell us that as they get older, an increasing number of students not only abandon the idea of STEM-related careers, but fail to see how this education will be relevant at all to any future job. At all ages, we need to ensure that STEM subject matter is delivered in a way that connects to real-world issues.

Making progress in STEM learning starts with identifying some key benchmarks. Using this data, the goal is to promote a national discussion, set measurable goals, and track progress around STEM learning and talent development.

To identify the benchmarks that we need to follow, analyze them, discuss the implications and make recommendations, Amgen Canada and Let's Talk Science assembled an expert panel. The members brought expertise from science teaching, postsecondary institutions, media, industry, youth science learning advocacy and professional associations.

The panel believes that Canada's progress in furthering STEM learning and creating even more of a knowledge-based economy and society can be captured in large part through 11 key benchmarks:

1. Youth attitudes toward STEM, and awareness of related career paths, at ages 14 to 16.
2. Enrolment in optional high school science courses.
3. Student performance on international science and math tests (PISA).
4. Student performance on national science and math tests (PCAP).
5. Applications (number and percentage) to postsecondary STEM programs.
6. Registrations (by year) to and graduation (number and percentage) from postsecondary STEM programs at all levels (e.g. undergraduate degrees, graduate degrees, diplomas).
7. Apprenticeships (registration, completions, certificates) in STEM-related disciplines.
8. Canada's international ranking in postsecondary STEM degree/diploma attainment.
9. STEM workforce – numbers, proportion, wages.
10. Job forecasts and projected employment shortages.
11. Science culture (suite of indicators).

With STEM learning, changing attitudes is critical, but it isn't enough; we need to see behaviour change as well. The only way to assess that is to relentlessly collect and track the key data. In many areas – such as postsecondary participation – the lack of readily available and co-ordinated data was a huge challenge for the study group. What gets measured gets attention. It's equally true that not everything that's important can easily be measured; this study is a start, and there is still work to do on compiling the relevant data.

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 has eight key recommendations:

1. Establish a national forum for ongoing multistakeholder discussion related to STEM talent development.
2. Support and scale effective STEM-teaching and -learning programs, in and outside school, to: revitalize young people's love of science with compelling programming; and help youth see how science education is relevant, i.e. 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 postsecondary applications, registrations and graduation in STEM programs.
4. Build better connections between job forecasts and STEM learning demands – and make 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 postsecondary 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 the science culture in Canada.

Achieving greater success in science learning is a shared responsibility, requiring a collective call to action.

- **Youth**: Take responsibility for your learning, and actively seek connections between school science in everyday life. Ask your teachers and school leadership for the resources needed to do science effectively. Seek information about jobs that benefit from STEM learning.

- **Parents**: Participate in STEM activities with your children. Talk to them about the importance of pursuing STEM courses to the end of high school to keep their options open, and support them in those studies. Seek out information to help them realize the breadth of jobs that are available to people with STEM backgrounds.

- **K-12 educators**: Make STEM learning relevant to students by providing contexts that are meaningful to them. Increase the focus on the nature and processes of science to help students develop competencies needed for 21st-century academic and workplace success.

- **Postsecondary educators**: Make STEM learning more relevant for your students, too, and offer more interdisciplinary programs that link that learning with other non-STEM fields (e.g. business and public policy studies). Help students make the connection between STEM learning and jobs. Support elementary and high school educators as they prepare students for postsecondary success.

- **Non-profit STEM learning and outreach organizations**: Offer engaging programs for all ages. Ensure that programs are available outside formal education systems, as well as in partnership with schools. Provide ample opportunities for volunteers to participate.

- **Industry**: Clarify the connection between the outcomes of STEM learning and jobs. Support STEM learning throughout the full learning continuum. Offer co-op positions and support apprenticeships. As an investment in our future, support employees (with resources and time) who are making a difference to STEM learning.

- **Governments**: Support and scale effective STEM-learning practices. Review school curricula to ensure that programs match desired outcomes. Resource schools, universities, colleges and non-profit organizations appropriately to support STEM learning and outreach efforts.

As countries around the world rise to these challenges, Canada must do the same. Ultimately, the results of these efforts will be evident in how we've moved the needle in the benchmarks – developing a culture that strongly supports STEM learning; fostering a more science-literate and science-loving population; preparing our young people for a future that's filled with opportunity; and creating a more prosperous Canada in which all citizens enjoy a high quality of life.

As everyone is involved in this challenge, we encourage all Canadians to provide their feedback on this report, the benchmarks and its list of recommendations, by visiting http://www.letstalkscience.ca/spotlight.html.

2 INTRODUCTION

How many of Canada's young people do we need to embrace science?

All of them.

That doesn't mean that everyone should aspire to don a white coat and work in a lab, or complete graduate work at a university. Those careers may be the stereotype, but science, technology, engineering and math (STEM) learning is about much more than that. Being a "scientist" isn't just a defined job – it's about a set of skills and attitudes that will prepare us for all sorts of jobs of the future, and provide us with the qualities that employers will demand. It's about opening up possibilities in any pursuit.

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. In a February 2012 speech, the Honourable Gary Goodyear, minister of state for science and technology, said it plainly: "Science and technology means jobs and economic growth."

A greater focus on STEM learning will serve individual Canadians and the country in several respects:

- First, STEM knowledge is directly relevant for many jobs that, according to forecasts, will be in high demand in the coming decades, from health care to skilled trades
- Next, beyond the specific body of knowledge, STEM learning is one of the most effective ways to help anyone become more analytical and curious, problem solve, experiment and explore – the very qualities that are needed in the modern workplace. That will make people more valuable in any job or endeavour
- Finally, a greater degree of science literacy is vital for everyday life, and is a basis for being more engaged and informed citizens, and making better decisions about the world around us

If we look at talent development as a pathway, how are we doing? And what are we doing to increase the number of science-literate Canadians?

With this inaugural benchmark study on science learning in Canada, we now have an important resource to inform that discussion.

The study was undertaken by Amgen Canada and Let's Talk Science. Amgen Canada is a leading biotechnology company and a science and innovation thought-leader. Let's Talk Science is a non-profit organization dedicated to helping youth reach their full potential through engagement in science, technology, engineering and math experiences.

Using publicly available data, the study looks at some of the key indicators of STEM learning, starting in elementary and secondary school, moving on through postsecondary education and going into the workforce. This is the first report of its kind in Canada.

To identify the benchmarks that we need to follow, analyze them, discuss the implications and make recommendations, Amgen Canada and Let's Talk Science formed an expert panel of knowledgeable and influential members of the science and education communities.

Talent development requires significant time and investment. This study is a way to gain a better understanding of the current state of science learning in Canada, highlight the need to support that learning and promote a public discussion about this critical issue.

Are Canadian youth engaged in STEM learning? Do they understand its value? Do their interests match their capabilities? Does that interest dwindle over time? How many students are pursuing STEM learning later in high school and postsecondary? Do we have the talent to fill the jobs we need? Are we developing a science-learning culture in Canada?

These are complex issues, ones that require the involvement of a wide group of stakeholders – the education system, students, parents, colleges and universities, industry, the non-profit sector and Government.

This study can help spur these important conversations about ways to increase STEM learning, and will also provide a basis for tracking Canada's progress in this area in the years to come. To get where we want to go with developing talent, we first need to know where we are.

Canadian youth have the abilities to excel in STEM learning. We're doing well as a country in many areas – but we can and must do even better.

Around the world, countries are placing a greater focus on STEM learning for the sake of their national well-being. Canada, too, must put science and technology at the forefront; if we do, we can help ensure a thriving 21st-century economy, and better prospects for our citizens and quality of life.

3 SCOPE AND METHODOLOGY

Project outline

A 2010 survey by Amgen Canada and Let's Talk Science revealed that only 37 per cent of Canadian teens (16 to 18) are interested in taking a science course at the postsecondary level – and these are teens who were enrolled in at least one optional high-school science course. Yet 82 per cent of teens recognize that studying science opens many different career options, and 84 per cent believe that fewer students pursuing science will have a long-term impact on our society. Across the country, Canadians agree; nearly 90 per cent say that our young people's interest in science is essential for Canada's future prosperity.

For young people, there seems to be a disconnect – a gap between their positive perceptions of the importance of science and technology in society and their actual intentions to pursue careers related to those fields.

Why?

The answer has enormous implications for our individual and collective prosperity. So there's a real need to better understand educational and career paths, and identify benchmarks that will inform us about our engagement with and support of science learning. Amgen Canada and Let's Talk Science joined forces again to respond to that need through this study.

In 2011, Let's Talk Science gathered data that sheds light on science learning and ambitions at all educational levels, employment in STEM-related occupations, the growth of those fields, and Canada's science culture. The data came from a wide variety of sources: the OECD; the Pan-Canadian Assessment Program; provincial ministries and departments of education across Canada; Statistics Canada; Human Resources and Skills Development Canada; postsecondary applications and enrolment; industry sector councils; science education and outreach organizations; and more.

To better understand the state of science learning, we assembled an expert panel (see below). These individuals brought expertise from science teaching, postsecondary institutions, media, industry, youth science learning advocacy and professional associations.

This panel met three times to review and discuss data and determine the benchmarks, and had other opportunities to comment on the findings and their implications. Their interpretations and recommendations form the commentary throughout this study.

The findings in this study should spark some lively discourse among Canadians. And the data gives us benchmarks to see if Canada is on track to develop the talent needed for the 21st-century demands of citizenship and employment.

Expert panel members

Dr. Bonnie Schmidt, chair, expert panel and president, Let's Talk Science:

Bonnie Schmidt began her science outreach activities in 1991 while completing her doctoral degree in physiology at The University of Western Ontario. She formally launched Let's Talk Science upon graduating in 1993. Let's Talk Science is an award-winning, national, charitable science (sciences, technology, engineering and math) outreach organization. It creates and delivers programs and services that engage children and youth in science and develop their potential to become 21st-century citizens and innovators.

Bonnie has been active in many national and provincial organizations and initiatives. She served as the founding president of the Science & Technology Awareness Network (STAN) and is a director of the Ontario Genomics Institute. In 2010, she served on the panel for the Coalition for Action on Innovation in Canada (CAIC) by Rx&D/ Canadian Council of Chief Executives, and was also a member of the Ontario Government's Early Learning Experts Panel. She also currently serves on a federal granting program.

For her efforts in education, Bonnie has received several awards, including the Top 40 Under 40; Queen's Golden Jubilee Award; Ontario's "Leading Women, Building Communities"; YWCA's Woman of Distinction; and UWO's Young Alumni Award.

Terry Anne Boyles, vice-president, public affairs, Association of Canadian Community Colleges (ACCC):

ACCC represents Canada's colleges, institutes, CÉGEPs, university-colleges and polytechnics. Terry Anne is responsible for the organization's advocacy efforts with the federal Government, and also guides the ACCC's communications and media relations, leadership-development institutes, conferences and policy research areas. Prior to joining the ACCC, she was the president of Saskatoon Region Community College, following several years on the senior management team at Red Deer College in Alberta.

Dr. David Blades, professor of science education, University of Victoria:

David Blades is professor of science education and curriculum theory and the director of the Centre for Excellence in Teaching and Understanding Science at the University of Victoria. He was one of the executive leaders for the NSERC-sponsored Pacific CRYSTALs project at the university and serves as a senior advisor and mentor for graduate students in his department.

He has multiple awards for his innovative approaches to teaching and scholarship and is widely praised by his students, typically receiving some of the highest course evaluations among faculty.

David recently completed a seven-year study of a partnership between a faculty of science and a faculty of education that used innovative teaching strategies to improve the attitudes and understanding of first-year geology students and teacher candidates.

Dr. Karen Burke, president, Canadian Society for Chemistry (CSC) and director, regulatory affairs, Amgen Canada:

Karen Burke is the 2011-2012 president of the Canadian Society for Chemistry. She is also the director of regulatory affairs, drug safety and quality assurance at Amgen Canada. She is a member of the executive committee and the research and development leadership team of Amgen Canada, and the North American regulatory affairs senior management team of Amgen.

She holds a PhD in organometallic chemistry from McMaster University, and has worked in the pharmaceutical industry in several roles over a career of more than 20 years, including progressive roles in operations and in regulatory affairs at Astra Pharma Inc. (later AstraZeneca Canada Inc.), culminating in the role of vice president. Dr. Burke is also an active member in the biotechnology/pharmaceutical industry associations BIOTECanada and Rx&D.

Nancy Demerling, director of marketing, Intel of Canada Ltd.:

Nancy Demerling is the director of marketing for Intel Canada. She is responsible for all advertising, media, corporate events, internet marketing, marketing communications, agency management and operations across Canada.

From packaged goods to technology, Demerling's career has spanned 27 years. Before joining Intel in 2000, she was the national marketing director at Deloitte & Touche. Prior to that, Demerling spent 10 years as head of the marketing group at RJR Nabisco.

Dr. Ulrich Krull, professor of analytical chemistry, University of Toronto, and vice-principal, research, University of Toronto at Mississauga:

Ulrich Krull completed his BSc, MSc and PhD degrees at the University of Toronto. He is a professor of analytical chemistry at the University of Toronto, and holds the endowed AstraZeneca chair in biotechnology. He presently handles the portfolio of vice-principal, research at the University of Toronto Mississauga (UTM).

His professional interests focus in the area of biosensor research, and development of molecular diagnostics technology for biomedical and environmental applications. His research explores the use of nanoscale materials and microfluidics chip technologies to build devices for detection of DNA and RNA targets, and includes nanotechnology for real-time intracellular determination of expression. Some of these device technologies are presently being commercialized, and work by his research team has been fundamental in the launch of four start-up companies. Krull is recognized as one of the leading analytical chemists in Canada.

He has more than 200 refereed publications, has co-authored 60-plus book chapters, co-edited four books and is an inventor listed on more than a dozen patents. He is a fellow of the Chemical Institute of Canada. He is the recipient of both the McBryde Medal and the Maxxam Award of the Canadian Society for Chemistry (the top awards for analytical chemistry research in Canada); the University of Toronto Faculty Excellence Award (top award for research-teaching service); as well as a Teaching Excellence Award.

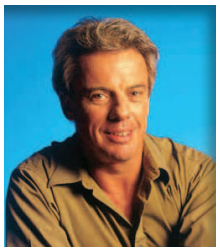
Krull has served as the associate dean of sciences, and also vice-dean, graduate affairs at UTM and vice-president of the Royal Canadian Institute. He is an editor of Analytica Chimica Acta, a major international journal for analytical chemistry. He serves on a number of advisory boards for industry, on boards for organizations that support acceleration of commercialization opportunities, and is chair of the Healthy City Stewardship Centre.

Paul Ledwell, executive vice-president, Public Policy Forum:

Paul Ledwell is the executive vice-president at the Public Policy Forum, where he leads the forum's work in innovation and public governance and contributes to thought leadership in areas such as economic development, and health and the environment. He joined the Forum in April 2009, bringing 20 years leadership experience in policy, research, and public advocacy, and extensive work with partners in government, academe, private and voluntary sectors, and the media. At PPF, he is leading a major multi-year and multi-sector project, Innovation Next, which aims to advance a stronger culture and practice of innovation in Canada.

Previously, Paul served as president of the Institute on Governance, as the first director of government relations at the University of Ottawa, as executive director of the Canadian Federation for the Humanities and Social Sciences and as the chair of the Canadian Consortium for Research. He has provided senior leadership on national initiatives, including the National Dialogue on Higher Education and the Congress of the Humanities and Social Sciences. He has been a commentator in the media, an invited speaker to conferences in Canada and around the world, and has appeared before many parliamentary and other national committees on matters related to economic and social policy.

Bob McDonald, science journalist, CBC Radio:



Bob McDonald has been communicating science internationally through television, radio, print and live presentations for more than 30 years. He is the host of CBC Radio's Quirks & Quarks, and is a regular reporter for CBC Television's The National as well as Gemini-winning host and writer of the children's series Head's Up. Bob has also hosted Greatest Canadian Invention and the seven-part series Water Under Fire.

As a print journalist, McDonald has authored three science books and contributed to numerous science textbooks, newspapers and magazines.

In November 2011, Bob was appointed as an officer of the Order of Canada, which recognizes a lifetime of outstanding achievement, dedication to the community and service to the nation. Bob was recognized for his contributions as a journalist and educator and for promoting the public's understanding of science.

Penny Park, executive director, Science Media Centre Canada:

Penny has an extensive background in radio and TV science journalism. From 1980 to 1995, she was a producer and senior producer on Quirks and Quarks, the award-winning CBC Radio science program. From 1995 to 2009, Penny worked at Discovery Channel, where she helped develop the show now called *Daily Planet*, the world's first nightly TV magazine show about science and technology. Penny has a BA from the University of New Brunswick (linguistics), and a B.Sc (honours) in biology from the University of Guelph.

Otto Wevers, elementary curriculum committee chair, Science Teachers' Association of Ontario:

Otto teaches science and technology as well as media literacy at Zion Heights Junior High School in Toronto. He has been an associate teacher at Tyndale University College, University of Ontario Institute of Technology, and Queen's University. Otto has written and reviewed science and technology texts for school publishers and was a curriculum consultant and instructional leader for the Toronto District School Board.

Before becoming a teacher, Otto conducted clinical work in rehab medicine and research in orthopedic biomechanics. He holds a B.Sc from the University of Guelph and a bachelor of education from Queen's University.

4 JOBS OF THE FUTURE

Finding the right employment is an art...and a science.

The Canadian workplace is changing. So are the abilities and knowledge that employers require. To ensure that we fill and embrace the jobs of the future, we need to measure:

- **Where are jobs growing in the Canadian economy?**
- **What proportion of those jobs call for STEM skills?**

We do know that, increasingly, a foundation in STEM learning will be in demand. HRSDC, in its latest 10-year employment growth outlook, forecasts that some of the biggest growth will occur in STEM-related fields. On the list of 15 categories with the highest labour demand, health-care professionals and managers, engineering, science, and technical occupations dominate.

Beyond the traditional career paths that call for a background in science, technology, engineering and math, employers are looking for the broad types of skills that exposure to STEM fosters. This is less quantifiable by our benchmarks, but no less relevant.

What we see is that having a STEM education is attractive and desired across a wide range of sectors. The potential STEM workforce will have a significant impact on a diverse swath of the Canadian economy. We need to ensure that we can fill these jobs, something that's critical to employment and to national prosperity.

As they contemplate their careers, here are four points that young people need to know about the value of STEM learning:

One, it leads directly to job opportunities that are on the rise.

Statistics Canada reports that employment is growing in health, natural and applied sciences and related occupations, as well as in trades and related occupations. We see this trend as an overall percentage of the labour force, and also in the dramatic increases in job categories. For instance, between 2001 and 2011, the number of people employed in health occupations rose by 35 per cent. In natural and applied sciences, the growth rate was 20 per cent. And in the trades and related occupations, employment rose by more than 10 per cent.

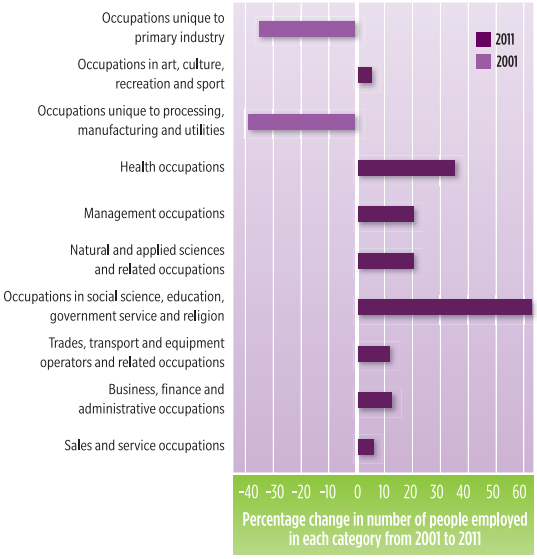
HRSDC says that almost 75 per cent of new jobs between 2009 and 2018 will be in high-skill occupations, and that two-thirds of job openings will be in management or require some type of post-secondary education.

As well, a review of numerous sector councils and industry associations (e.g. plastics, electricity, biotechnology, petroleum, information technology and mining industries) revealed shortages and recruiting difficulties for a range of technology specialists and tradespeople. The supply and demand gap is based on a series of assumptions – around sector growth, graduates in certain fields, retirements, immigration, etc. – but the forecast shortages are acute in many cases.

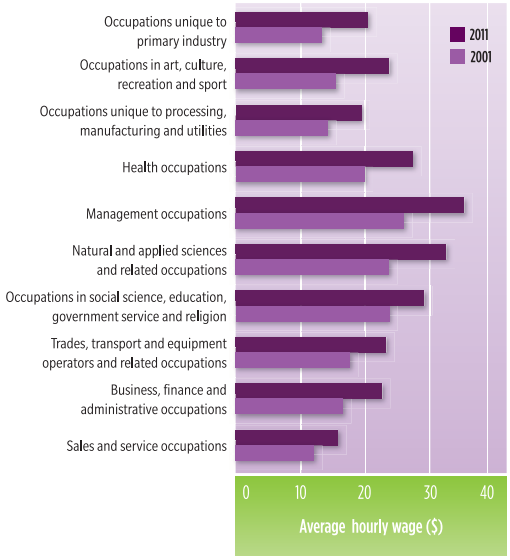
BENCHMARK: STEM WORKFORCE – NUMBERS, PROPORTION, WAGES

Statistics Canada data has been used to examine the percentage of people employed in science- related occupations. Numbers in this chart reflects those who work as employees of a private firm or business or the public sector, not those who are self-employed. For the number of people employed in each occupation, and the percentage of the labour force in each occupation, see the Appendix A.

Source: Statistics Canada, CANSIM tables 282-0069 and 282-073, last modified: 2011-05-06



WAGES FOR STEM-RELATED OCCUPATIONS



The fact that a growing number of jobs in many fields benefit from STEM learning is true not only in Canada but internationally. In 2011, ManpowerGroup, a leader in workplace staffing, surveyed 40,000 employers in 39 countries about the job categories that were the most difficult to fill. No. 1, technicians. No. 3, skilled trades workers. No. 4, engineers.

Youth need to recognize the range of paths that are accessible through STEM learning. From the lab to the trades, manufacturing to resources, the frontlines to management positions, there are endless possibilities for fulfilling careers.

Two, STEM-related jobs are well-compensated.

Not only do STEM-related jobs pay well – no small consideration to young people considering career options – but the wages are growing.

According to Statistics Canada, the average hourly wage for natural science and related occupations, health occupations, and trades and related occupations all grew by healthy margins from 2001 to 2011. In fact, wages in these job categories grew well beyond the inflation rate in many cases. For the job seekers of tomorrow, the areas of employment that are in high demand also happen to be ones with attractive compensation.

ManpowerGroup conducts an annual talent shortage survey. In 2011, results from almost 40,000 employers from 39 countries indicated that the following job categories were the most difficult to fill (most difficult = 1, least difficult = 10).

Position	2006	2011
Technicians	3	1
Sales representatives	1	2
Skilled-trades workers	5	3
Engineers	2	4
Labourer	—	5
Management/Executives	10	6
Accounting & financial staff	9	7
IT staff	6	8
Production operators	4	9
Secretaries, personal assistants, administrative assistants, office support	7	10

Developing a sense of CurioCity

Where can you go to nurture a curiosity about science? To CurioCity. The interactive, web-based program (www.explorecuriocity.org) connects students in grades eight to 12 with graduate students in science and science professionals. Through the online community, youth can ask questions, get help with homework, and learn about science-related careers. Classrooms can also use the site to participate in real science projects.

Launched by Let's Talk Science, CurioCity also features insightful articles and videos that cover topics relevant to 13- to 17-year-olds: current events, health issues, technology, entertainment, sports and the environment. This content is produced for CurioCity by Masters and Doctoral students, as well as science, engineering and technology professionals. Through CurioCity, educators can also join a community of peers to access a variety of science learning strategies.

What Can You Do With a STEM Degree? Anything!

W. Brett Wilson understands the value of STEM education. He puts it to work every day, not in science but in finance.

Wilson is one of Canada's best known entrepreneurs. A graduate of the University of Saskatchewan with a Bachelor of Science in Civil Engineering, he began his career with Imperial Oil in Alberta. Pairing his engineering degree with an MBA from the University of Calgary, Wilson was the first person from the program to graduate with a specialization in entrepreneurship.

He co-founded one of Canada's most successful energy-focused investment banking firms, and is now Chairman of Canoe Financial, one of Canada's fastest growing mutual fund companies.

What accounts for his success? Wilson gives much of the credit to his strong science background, and says that sort of education opens many doors. "Science learning has helped me think analytically, problem solve, and be innovative – key skills for everyone, no matter what your career," says Wilson. "I encourage future entrepreneurs and innovators to pursue science learning as an excellent foundation for whatever field you pursue in business or life."

Three, just about any career, in any field, benefits from STEM learning.

Apart from academic credentials, training and technical knowledge related to any given job, what are employers looking for? The expert panel discussed how STEM nurtures the qualities that are beneficial in any work setting.

The U.S.-based National Association of Colleges and Employers, for instance, recently released their Job Outlook 2012 report, 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 those happen to be a byproduct of STEM learning.

Yes, STEM learning is about a knowledge base: facts, concepts, theories, principles and models. But it's about more than that. The nature of what STEM learning demands of students – probing, making connections, investigating, questioning, communicating – can help train their thinking in all sorts of ways that pay off in life and at work.

The bottom line? Young people who have a high-quality STEM education will be highly employable, in occupations they might not even envision yet, in STEM-related jobs and sectors and also in endless fields that might not be directly or obviously STEM-related.

Four, keep an open mind...and keep your options open.

In many ways, STEM education is the "secret to success" across multiple industries and positions. Its learnings and discipline are like a tool box that can be applied to help access a dream job and achieve a fulfilling career. Students don't always realize that when they're younger. Many adults find they have to return to school because they lack the tools, the STEM prerequisites, to access the opportunities they now want.

While high-school students might recognize that STEM learning is beneficial in theory for the jobs of the future, they aren't always putting that understanding into practice. We need young people to think in terms of careers – not just narrow jobs; you open a world of possibility with STEM learning.

"In high school I was involved in science fairs which fostered a passion for science and engineering that has continued with me throughout my academic and work life," said Michael Serbinis, CEO of Kobo Inc. and former Team Canada Intel-ISEF member. "The skills and knowledge received through my personal and professional curiosity has led me from my first job with a leading high-tech company, to developing patented technologies, to founding and selling a company and ultimately my role today as CEO of Kobo Inc. If only 37 per cent of Canadian teens are interested in taking a science course at the post-secondary level, what does that mean to Canada's future? Science, technology, engineering and math education is about more than just facts and figures; it's about rewarding jobs in a wide variety of fields, a thriving economy, not to mention new innovations and unlocking a bright and successful future for our children. That's why as a parent, I hope my children's imaginations will spark new ideas through science. The opportunities are boundless."

Michael Serbinis
Chief Executive Officer
Kobo Inc.

What matters most

We know that a strong foundation in STEM learning will serve Canadian students well in a wide variety of careers and in everyday life, too. Here's what we need to track:

- How are our students faring in science and math?
- Does that interest translate into postsecondary plans related to STEM fields?

While strong skills in the science and math curriculum are important, performance alone isn't enough. That's only one element in the formula. The abilities of Canadian students must be matched by interest and intention. Do students have a love for science and an appreciation for where it can lead, and does that sustain their desire to learn? If so, we can expect to see a change over time in academic and career paths.

The value of STEM education is clear. The issue is whether our students are positioned to fill the opportunities available to them. That's a key question for their futures – and for Canada's.

How we're doing, part 1: Science and math students make the grade

Above average in PISA tests

Start with student performance in science and math. One of the most reliable measures is PISA – the Programme for International Student Assessment, administered by the OECD.

PISA is a standardized test focused on reading, math and science, given to 15 year olds in participating schools around the world. Tests are held every three years. Typically, between 4,500 and 10,000 students take the test in each country, allowing PISA to gather data on the knowledge and skills of students, and the respective performance of each jurisdiction's education system.

The tests assess concepts/content, processes (e.g. the ability to analyze and interpret), situations where science and math are used (e.g. in life not just the classroom), and attitudes.

For this study, we examined the PISA test scores of Canadian students over time, and also how our students compare to their international peers.

Canadian students perform above the OECD average, with fairly consistent PISA results in science for 2006 and 2009, and in math for 2003, 2006 and 2009. Moreover, Canadian participation rates in school activities that promote science learning – such as science clubs, fairs, competitions and extracurricular science projects – also exceed the OECD average.

PCAP shows encouraging trends

The PISA numbers are just one sign of how Canadian students are performing in science and math. Another important measure is PCAP – the Pan-Canadian Assessment Program, which was developed by the Council of Ministers of Education, Canada, in 2003.

The first PCAP was administered in 2007 to 13-year-old students, with testing planned every three years. Every PCAP has a major focus and a minor focus. The major focus was reading in 2007 (math was the minor focus then) and math in 2010; science was also assessed both times. (Science will be the major focus in the 2013 PCAP.)

For PCAP 2010, close to 32,000 grade eight students from more than 1,600 schools across the country were tested. The results indicate that more than 90 per cent of Canadian students in grade eight are achieving at or above their expected level of performance in math. Almost half are achieving above their expected level. In many jurisdictions, science results are improving as well.

In looking at these and future PCAP results, it's important to focus on whether Canada is improving as a whole. There will always be some differences between jurisdictions, some movement in the relative rankings, but as we saw between 2007 and 2010, the performance in many jurisdictions was trending up. That's the good news.

Raising thoughtful thinkers

"Science education is vital to every child's education because it teaches them how to think and process facts and information across a multitude of domains. Inspiring curiosity along with a keen understanding for the scientific process ensures we raise a society of thinkers who are not swayed or duped, but rather are wise, skeptical thinkers who know how to dig and inquire and add to humanity's knowledge base."

– Alyson Schafer - psychotherapist, author, and parenting expert

BENCHMARK: STUDENT PERFORMANCE ON INTERNATIONAL SCIENCE AND MATH TESTS (PISA)

Countries performing better than or the same as Canada in science in PISA tests

Dimension	Countries performing significantly better than Canada	Countries performing as well as Canada
Science – combined scale	Finland, Hong Kong-China	Chinese Taipei, Estonia, Japan, New Zealand
Science – identifying scientific issues	Finland	New Zealand, Australia, Netherlands, Hong Kong-China
Science – explaining phenomena scientifically	Finland, Hong Kong-China, Chinese Taipei, Estonia	Czech Republic, Japan
Science – using scientific evidence	Finland	Japan, Hong Kong-China, Korea, New Zealand, Liechtenstein

Countries performing better than or the same as Canada in math in PISA tests

Content area	Countries performing significantly better than Canada	Countries performing as well as Canada
Overall mathematics	Hong Kong-China, Finland	Korea, Netherlands, Liechtenstein, Japan, Belgium, Macao-China, Switzerland, Australia, New Zealand
Space and shape	Hong Kong-China, Japan, Korea, Switzerland, Finland, Liechtenstein, Belgium	Macao-China, Czech Republic, Netherlands, New Zealand, Australia
Change and relationships	Netherlands	Korea, Finland, Hong Kong-China, Liechtenstein, Japan, Belgium, New Zealand, Australia, Switzerland
Quantity	Finland, Hong Kong-China	Korea, Liechtenstein, Macau-China, Switzerland, Belgium, Netherlands, Czech Republic, Japan
Uncertainty	Hong Kong-China	Netherlands, Finland, Korea, New Zealand, Macao-China

BENCHMARK: STUDENT PERFORMANCE ON NATIONAL SCIENCE AND MATH TESTS (PCAP)

Mathematics

Jurisdiction	2007—Mean score and confidence interval	2010—Mean score and confidence interval	Change
Canada mean scores	**496 ± 4**	**495 ± 2**	**-**
Alberta	500 ± 7	495 ± 4	-
British Columbia	484 ± 7	481 ± 4	-
Manitoba	479 ± 8	467 ± 4	-
New Brunswick	462 ± 6	466 ± 5	-
Newfoundland & Labrador	478 ± 7	472 ± 5	-
Nova Scotia	457 ± 6	473 ± 4	↑
Ontario	508 ± 7	507 ± 5	-
Quebec	510 ± 10	507 ± 7	-
Prince Edward Island	449 ± 8	460 ± 10	-
Saskatchewan	461 ± 6	474 ± 4	↑
Yukon	448 ±19	468 ± 8	-

Science

Jurisdiction	2007—Mean score and confidence interval	2010—Mean score and confidence interval	Change
Canada mean scores	**496 ± 4**	**504 ± 3**	↑
Alberta	524 ± 6	515 ± 3	-
British Columbia	488 ± 7	497 ± 4	-
Manitoba	477 ± 8	486 ± 5	-
New Brunswick	468 ± 6	489 ± 5	↑
Newfoundland & Labrador	485 ± 7	487 ± 6	-
Nova Scotia	479 ± 6	489 ± 4	-
Ontario	499 ± 7	510 ± 4	-
Quebec	467 ± 10	490 ± 6	↑
Prince Edward Island	464 ± 8	493 ± 11	↑
Saskatchewan	480 ± 7	488 ± 4	-
Yukon	458 ± 21	478 ± 9	-

From PCAP document: In this assessment, the reported mean scores provide estimates of the achievement results students would have demonstrated if all students in the population had participated in the assessment. In addition, a degree of error is associated with the scores describing student skills because these scores are estimated, based on student responses to test items. This error is called the error of measurement. Because an estimate that is based on a sample is rarely exact, and because the error of measurement exists, it is common practice to provide a range of scores within which the actual achievement level might fall. This range of scores expressed for each mean score is called a confidence interval. A 95 per cent confidence interval is used in this report to represent the high- and low end points between which the actual mean score should fall 95 per cent of the time. A difference is statistically different when there is no overlap of confidence intervals between different measurements.

Inspiring kids in the classroom

How do you help students to bridge the gap between concepts and real-world applications? Sometimes, with a bridge.

Tracey O'Toole, an Ontario elementary school teacher, uses a "Bridge for the City of Whitney" challenge to bring science to life in the classroom. She received the 2011 Amgen Award for Science Teaching Excellence (AASTE). The award honours extraordinary science teachers at the K-12 level who significantly impact their students through exemplary science teaching, and who achieve demonstrated results in student learning.

Tracey's approach is to get students excited by a subject and therefore more engaged in the learning process. A prime example is "Bridge for the City of Whitney", where students are asked to construct a bridge to help residents cross the lake to work.

The students participate in various tasks and conduct experiments to develop an understanding of structural design, strength and purpose. They must also construct and test structures that support objects and span gaps. Through this process, the students learn to assess what does and doesn't work well, and apply the learning to their design. They also gain an appreciation for the importance of good workmanship, understand the differences between natural and man-made structures, and get a sense of the design impact on the environment.

Tracey brings other curriculum areas into the mix, to show students how the science-related skills – such as predicting, inferring, investigating and communicating – can be applied to many learning situations. Most of all, she engenders a curiosity in her students about the world around them – one that may continue long after schooling has ended.

How we're doing, part 2: aptitudes and attitudes

Gap between abilities and interests

Canadian students demonstrate strong abilities in STEM. Yet their interest in continuing that education in their later high school years and post-secondary isn't as strong. We see that by the decisions they make when they have a choice about science classes.

Across Canada, compulsory science and technology courses are generally required to grade 10. After that, most provinces require one additional credit in science or technology to graduate.

A look at enrolment in math, biology, chemistry and physics in grades 11 and 12 – courses needed as university prerequisites – is telling. It's clear that fewer and fewer students take these courses over time, and that the drop off is very pronounced in some cases. For example:

- In Alberta, in grade 11 roughly 50 per cent of students take biology, 49 per cent take chemistry and 33 per cent take physics; in grade 12, the enrolment for the next level in those courses drops to 44 per cent, 38 per cent and 21 per cent
- In B.C., 44 per cent of students in grade 11 take chemistry, 43 per cent take biology and 36 per cent take physics; by grade 12, those percentages are down to 38 per cent, 25 per cent and 16 per cent
- In Ontario, looking at the university track, 37 per cent of grade 11 students take biology, 34 per cent take chemistry and 24 per cent take physics; in grade 12, those percentages are 16 per cent, 17 per cent and 10 per cent. For the college and university tracks combined, 33 per cent of grade 12 students in Ontario take biology, 23 per cent take chemistry and 14 per cent take physics

A majority of students – often a strong majority – are shutting themselves out of many college and university options, and the ensuing careers, as they'll lack the prerequisite courses. Or they'll have to catch up with additional preparatory courses later on to get into certain postsecondary programs – the likelihood of which is uncertain.

Three questions:

1. Do students see the potential and relevance in taking math and science?
2. Do they understand how those studies can lead and contribute to all sorts of career paths, giving them transferrable and valuable skills?
3. Do these courses keep them engaged?

BENCHMARK: ENROLMENT IN OPTIONAL HIGH SCHOOL SCIENCE COURSES

The following shows the proportion of Canadian youth who pursue optional science courses in high school.

A note on the selection of this data. Education is a provincial/territorial mandate, and each jurisdiction provides courses that are required for university entrance. Because students can attend universities outside their home province, university-track courses in each province must be equivalent. While we have not included every possible optional course, the courses shown here are comparable across provinces. For Ontario, students have the choice, starting in grade 11, of university-track, college-track or workplace courses; the university-track and college-track enrolment taken together provides the appropriate point of comparison.

Subject Area	Course enrolment as % of total Grade 12 enrolment								
	Alberta		British Columbia	Newfoundland & Labrador		Ontario-combining university and college level		Saskatchewan	
	2009-10	2010-11	2009-10	2009-10	2010-11	2006-07	2007-08	2008-09	2009-10
English	Not received		77%	75%	76%	75%	75%	80%	79%
Mathematics	51%	50%	42%	51%	50%	N/A	42%	49%	48%
Biology	43%	44%	38%	57%	54%	32%	32%	60%	59%
Chemistry	34%	38%	25%	29%	34%	23%	23%	38%	40%
Physics	20%	21%	16%	16%	18%	14%	14%	30%	30%

Course enrolment data for grades 11 and 12 have been obtained by request from the ministry/department of education for Alberta, British Columbia and Ontario and obtained from the ministry web site for Newfoundland & Labrador and Saskatchewan.

Where did the love go?

To explore the attitudes of Canadian students toward science education, Amgen Canada and Let's Talk Science commissioned an Angus Reid study in 2010. The company surveyed 500 students aged 16 to 18.

What's encouraging is that a high percentage of students recognize the importance of a science education. Just more than eight in 10 (82 per cent) agree that science offers them many different career options, and 92 per cent agree that studying science can lead to a well-paid career. Aside from career paths, almost three-quarters of students (72 per cent) agree that science has relevance to their everyday lives.

The percentages fall when students are asked about their actual intentions. Just 25 per cent of the students say they have a lot of interest in taking science at a postsecondary level. Another 38 per cent say they have some interest. Looking at the students who are taking only one science course or none at all, what are the reasons?

- Forty-seven per cent say they don't need another science course to graduate from high school
- Twenty-seven per cent say they're not interested in science
- Fourteen per cent say they feel as though the courses they've already taken have adequately prepared them for everyday life

In response to another survey question, 15 per cent of students say that their favourite thing about science classes is that what they learn can be applied to everyday life. Yet an even higher percentage, 20 per cent, dislike science precisely because what they learn is *not* relevant, they say, to everyday life.

When it comes to science, why are we losing students along the way? In 2010, the Canada Foundation for Innovation commissioned Ipsos Reid to conduct the Canadian Youth Science Monitor, a national survey of the views of 2,600 students, ages 12 to 18, about the sciences. Some observations:

- Interest in science falls by age. Seventy-eight per cent of 12 and 13 year olds are very or somewhat interested in science, compared to 67 per cent of 14 to 16 year olds and 58 per cent of 17 to 18 year olds (this seems to be an international trend too)
- Science careers have great appeal...when you're younger. As with interest in science generally, interest in pursuing a scientific career also declines with age, from a high of 43 per cent among 12 to 13 year olds to 32 per cent among those 17 to 18
- Two in five don't see how science will have relevance in their work. Overall, just over half of students (52 per cent) think studying science will be at least somewhat important to the careers they eventually pursue, but 39 per cent say studying science won't be important at all to their future careers
- Science is important, but not that much fun. Putting aside their personal interests in science as a school subject or career choice, nearly four in five students (78 per cent) say it's important to have an understanding of science. In fact, "important" was the word that students picked more than any other to describe science. Three in five (59 per cent) say "interesting" describes science, compared to only one in five (22 per cent) who used the term "boring." Yet many more students described science as "complicated" (59 per cent) and "difficult" (52 per cent) than "fun" (46 per cent), "cool" (46 per cent) or "inspiring" (39 per cent).

Spurring Canadian youth to international heights in science

In the largest international pre-college science competition, Canada consistently shines. Every year, Intel Canada, as part of its partnership with Youth Science Canada, sponsors a team of Canadian high-school students to participate in the Intel® International Science and Engineering Fair® (Intel ISEF). Team Canada has a tremendous record, with 80 per cent of its members, on average, returning home with awards. In 2011, Team Canada-ISEF brought home 17 awards, including nine Grand Awards, continuing a trend of winning a disproportionate share of prizes.

Intel ISEF annually provides a forum for more than 1,500 high-school students from more than 65 countries, regions and territories to showcase their independent research and offers nearly $4 million in scholarships, tuition grants, internships and scientific field trips to the winning competitors. The Canadian team is annually selected by a distinguished panel of university faculty, industry researchers, educators and Team Canada-ISEF alumni through a competitive national selection process.

Intel ISEF is just one element of Intel's commitment to education, which includes extensive teacher training and employee volunteer programs to help improve education around the world.

Interest and awareness drives decisions about higher education. The expert panel agreed that we need to:

- **Engage youth in science at a young age**
- **Foster that curiosity throughout school**
- **Ensure a basic level of science literacy**
- **Encourage youth to keep doors open when making education decisions**
- **Educate them about the many careers available to them when they choose to pursue STEM studies**

Young people want to make a difference in their world. Apart from their possible careers, so many areas that interest them – like the environment, alternative energy or third-world health issues – are all about science. Those are important buttons that science learning can push.

How we're doing, part 3: Postsecondary STEM activity stays flat

How is Canada developing science and technology talent at the next level, postsecondary? For this study, we planned to look at three areas: apprenticeships in the trades, college participation in STEM fields, and university participation in STEM. However, when studying the college enrolment results from Statistics Canada we discovered serious reporting inconsistencies across jurisdictions and between institutions. Given the challenges of reconciling the college-specific data on STEM participation, the panel decided to withdraw it from this report. It's essential to get better systems of data collection.

Growth in apprenticeships, but skilled trades still face shortages

Let's start with apprenticeships. Young people don't always equate STEM with skilled trades, yet these are among the most varied career opportunities that are accessible with a STEM foundation.

Apprenticeship is the major training mechanism for the skilled trades, as well as other practical occupations. It generally consists of in-class theory and practice, as well as significant on-the-job training. This results in certification as a "journeyperson." This refers to someone who is recognized as skilled and qualified in the trade, and who can train registered apprentices. Certificates can also be granted to "trade qualifiers." These are people who can demonstrate their skill and knowledge through examinations, but who have not necessarily completed all or any of the in-class portions of the training.

An apprentice may complete the in-class portion of the training through community colleges on their own. He or she must then find an employer with the required journeypersons in order to complete the on-the-job portion.

An apprentice is paid a proportion of a journeyperson's salary—typically 25 per cent during the first year and increasing each year thereafter. Finding an employer to complete this portion of the apprenticeship can prove difficult, especially in times of economic downturn. One of our calls to action is for industry to be more active in offering co-op positions and supporting apprenticeships.

Statistics Canada identifies 22 major trade groups, and eight of these in particular involve considerable STEM training. Although there is often no specific course pre-requisites for the in-class portion for training in the trades, the training does involve math and other STEM-related courses. (This was determined by examining STEM content for community college programs that

BENCHMARK: APPRENTICESHIP (REGISTRATIONS, COMPLETIONS, CERTIFICATES) IN STEM-RELATED DISCIPLINES

	% change from 2005-2008		
	Registrations	Completions	Certificates
Total major trade groups	**33**	**42**	**50**
Automotive service	18	21	27
Electricians	19	29	40
Electronics and instrumentation	32	35	29
Heavy duty equipment mechanics	48	37	23
Landscape and horticulture technicians and specialists	21	324	237
Millwrights	22	20	11
Refrigeration and air conditioning mechanics	30	6	24
User support technicians	1,315	3,250	3,250

Source: Statistics Canada, CANSIM table (for fee) 477-0055. Last modified: 2011-09-19

form part of the apprenticeship process.) This is especially true for trades that involve building, maintenance and repair:

- Automotive service
- Electricians
- Electronics and instrumentation
- Heavy duty equipment mechanics
- Landscape and horticulture technicians and specialists
- Millwright
- Refrigeration and air conditioning mechanics
- User support technicians

While we are seeing an increase in the number of people who are pursuing and completing apprenticeships, many of the skilled trades report that it is still difficult to fill their needs now, and project continued shortages. (See Appendix B for more trades and full data.)

STEM enrolment is up, but the proportion of students in STEM fields is not

Moving on to universities, we looked at applications, enrolments and degrees granted in STEM fields. The numbers tell a mixed story.

Statistics Canada categorizes instructional programs into 13 major groups. The STEM-related fields of study fall into five areas:

- Physical and life science and technologies
- Mathematics, computer and information sciences
- Architecture, engineering and related technologies
- Agriculture, natural resources and conservation
- Health, parks, recreation and fitness

Brewing up a career with science

Jamie Mistry may spend some of his time working in a lab, but what he produces there is not your traditional science experiment – he creates beer.

It was in university that Mistry decided to pursue fermentation science and was amazed by how complex beer-making actually was. Today, as a brewmaster with Amsterdam Brewing Company, Mistry uses his science knowledge every day: “I could not do my job without a strong understanding of microbiological techniques, chemistry and engineering science,” says Mistry. “And I would not be able to mentor my staff without a strong science background.”

Mistry says that understanding science is beneficial in other ways, helping him be creative, try new approaches and develop ideas to improve a product or process. A background in science can lead to all sorts of rewarding careers, says Mistry, as his proves: “Not all scientists wear white lab coats and work with Bunsen burners.”

The following table illustrates areas that are included in STEM-related categories.

Physical and life sciences and technologies	Mathematics, computer and information sciences	Architecture, engineering and related technologies	Agriculture, natural resources and conservation	Health, parks, recreation and fitness
Physical science-astronomy, astrophysics, chemistry, geology, physics Biological and biomedical sciences-biology, biochemistry, biophysics, botany, microbiology, genetics, physiology pharmacology, toxicology, bioinformatics, biotechnology, ecology, evolution, zoology Natural sciences Nutrition sciences Neuroscience Science technologies and technicians	Mathematics Applied mathematics Statistics Computer and information sciences and support services, general Computer programming Information science/ studies Systems science and theory Library science	Architecture (BArch, BA/BSc, MArch, MA/ MSc, PhD) City/urban, community and regional planning Architectural technology & technician Landscape architecture (BSc, BSLA, BLA, MSLA, MLA, PhD) Historic preservation and conservation Engineering-general, aerospace, aeronautical and astronautical, agricultural, architectural, biological, bioengineering, biomedical and medical, ceramic sciences, chemical, civil, computer, electrical, electronics, communications Environmental, materials, mechanical, metallurgical, mining, naval architecture marine, nuclear, ocean, petroleum, systems, textile sciences, polymer, construction, forest, industrial, manufacturing, geological/geophysical Engineering technologies & technicians Construction trades-masonry, carpentry, electrical, plumbing, Technologies/technicians-mechanics, electricians, electronics, heating, A/C, stationary engineer, vehicle maintenance & repair	Agriculture, agriculture operations and related sciences Animal sciences Food science and technology Plant sciences Soil sciences Natural resources conservation and research Fishing and fisheries sciences and management Forestry Wildlife and wildlands science and management	Chiropractic (DC) Dentistry (DDS, DMD) Clinical/medical laboratory science and allied professions Medicine (MD) Medical scientist (MSc, PhD) Nursing Optometry (OD) Osteopathy Podiatry Dietetics and clinical nutrition services Bioethics/medical ethics Veterinary medicine (DVM) Veterinary biomedical and clinical sciences (Cert., MSc, PhD) Dental, medical and veterinary residency programs Parks, recreation, leisure and fitness studies

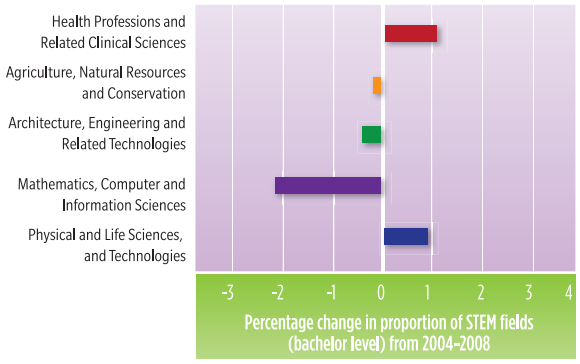
Don't drop math! The top jobs in Canada require STEM

In its April 30, 2012, issue, Canadian Business magazine reported on the top 50 jobs in Canada (demand and recent salary growth). Many on the list required some level of STEM learning, including the top five:

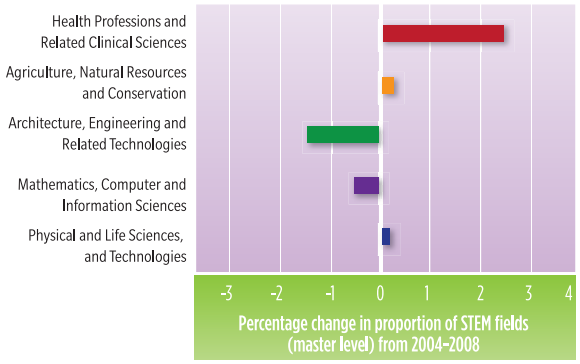
1. Petroleum engineer
2. Nursing supervisor
3. Electrical and telecommunications contractor
4. Data analyst
5. Chemist and chemical engineer

Let's start by looking at the change in the proportion of degrees granted in STEM fields at the undergraduate, master's and doctoral levels, from 2004 to 2008 (the last year of available data).

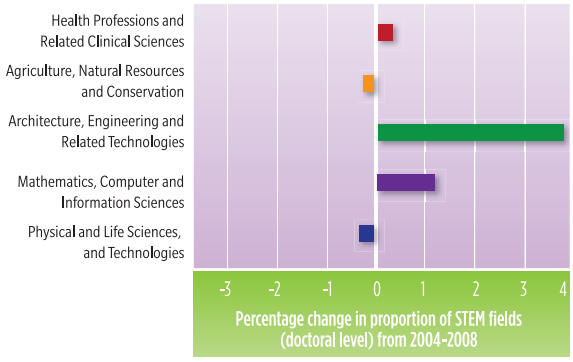
BENCHMARK: REGISTRATIONS (BY YEAR) TO AND GRADUATION (NUMBER AND PERCENTAGE) FROM POSTSECONDARY STEM PROGRAMS



http://www40.statcan.gc.ca/l01/cst01/educ52d-eng.htm



http://www40.statcan.gc.ca/l01/cst01/educ52g-eng.htm



http://www40.statcan.gc.ca/l01/cst01/educ52h-eng.htm

Are parents sparking an interest in science?

At school, teachers can make science, technology and math engaging and help students think about careers related to those fields. But parents play an even greater role in fostering that interest.

In a 2011 Angus Reid survey done for Amgen Canada and Let's Talk Science, 82 per cent of Canadian youth (ages 7 to 18) say they turn to their parents for guidance on making decisions about education and careers. Of the 60 per cent of youth who plan to pursue science beyond grade 10, 75 per cent say they were influenced by their parents.

The survey revealed that parents understand the importance of science education, for their children and in their own lives:

- Eighty-four per cent of parents believe that a basic understanding of math and science is useful to them in their jobs – and this includes people whose careers are not "science-related"
- Ninety-four per cent of parents say science is useful for everyday life outside of work
- Sixty-two per cent of parents surveyed believe jobs in Canada will require more training in science during the next 15 years

While these statistics may not come as a surprise, what's curious is that only 23 per cent of parents take the time to discuss their children's goals when they clearly wield much influence in these decisions – especially when 74 per cent of parents agree that it is very important to be involved in their children's education.

Meanwhile, 70 per cent of the youth said that personal interests drive their decisions about higher education. So cultivating a passion for science at a young age can make a difference.

That can happen far beyond the classroom. Parents can work on science projects or watch science shows with their children. Children can do experiments at home or visit science websites. Families can do activities that may not immediately seem science-based, like cooking and gardening together, or visiting the zoo. While parents appreciate how vital science education can be, that belief should also translate into discussions with children about possible career options.

When analyzing the data, it's important to make a distinction between increases in applications, registrations and degrees granted, and the actual proportion of students in STEM fields.

For instance, in bachelor and other undergraduate degree programs, from 2004 to 2008, enrolment in health and related areas increased by 15 per cent, and enrolment in agricultural and related areas increased by almost 13 per cent. However, enrolment in mathematics and computer and information sciences has declined steadily since 2004, with 25 per cent fewer students enrolled by 2008.

It is difficult to get clear and consistent national reporting on university applications and registrations in STEM fields, for the purposes of analysis and comparison. (Continued development of the national Postsecondary Student Information System should help to collect and aggregate all of the relevant data.) The panel therefore decided to take a closer look at one jurisdiction, Ontario, as a case study, to see if it can glean some important trends.

From 2001 to 2009, we see an increase of 50 per cent in the number of applications in STEM fields. It seems like something worth celebrating, until you realize that figure actually lags behind the 57 per cent increase in applications for all areas. Overall, the proportion of applicants for STEM program areas actually decreased slightly. (Note that applications refers to separate applications not individuals, as one student may apply to several universities and programs.)

The same trend is evident in the number of university registrants. Registrations in STEM fields were up almost 42 per cent in Ontario between 2001 and 2009. During the same period, university registrations were up almost 46 per cent in general. Again, STEM registrations as a proportion of all registrations fell slightly over the period.

Apart from math, we also see a significant growth in the number of bachelor degrees awarded in STEM fields in Ontario over the nine years. Yet the proportion of STEM degrees has remained almost constant, averaging less than 27 per cent.

APPLICATIONS (NUMBER AND PERCENTAGE) TO POSTSECONDARY STEM PROGRAMS

University applications and registrants in Ontario

	2001	2005	2009
Applications all program areas	237,740	327,941	372,862
Applications for STEM* program areas	82,444	101,951	124,202
STEM applications as % of all applications	35%	31%	33%
Registrations all program areas	42,024	54,110	61,406
Registrations STEM program areas	14513	16781	20541
STEM registrations as % of all registrations	35%	31%	33 %

**STEM includes the following categories; science; engineering; other related science*

Data provided by the Senior Policy and Data Analyst for the Council of Ontario Universities (Dec. 5, 2011)

Growth of Women in STEM Studies

When it comes to post-secondary STEM studies, is there a gender gap? It depends on the field. According to Statistics Canada:

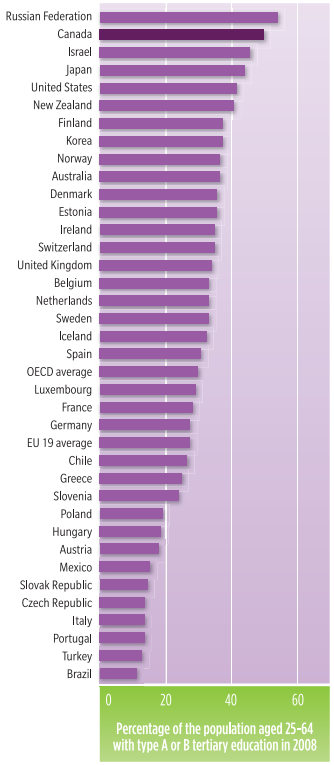
- Women now comprise the majority of students in three broad fields – physical and life sciences and technologies; health, parks, recreation and fitness; and agriculture, natural resources and conservation – at the community college, university undergraduate, and Master's levels.
- However, more than 75 per cent of university undergraduates in math and engineering are male, as are two-thirds of Master's students in architecture and engineering, 75 per cent of Doctoral students in math, and about 80 per cent of Doctoral students in engineering.
- At the doctoral level, women are still in the majority in health-related areas, and comprise a significant (40-45 per cent) of students in agricultural fields.

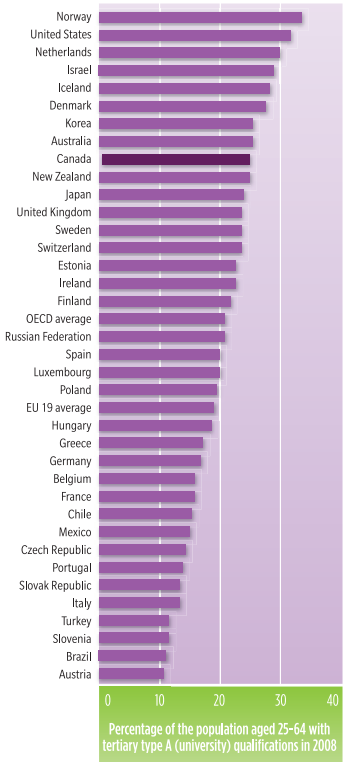
Sustained efforts to get females more interested in science, and pursuing it at the post-secondary level, have shown at least some strong results. As well, in the 2010 PCAP results, females performed significantly better than males. Now, perhaps, we should be mindful of the risk of male students falling behind in science, and track that data. The goal is improved science performance for all.

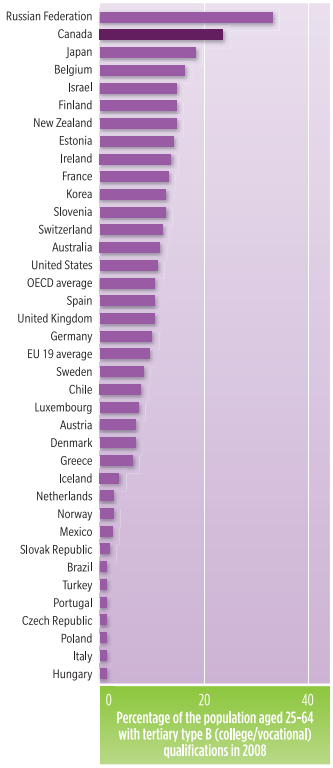
BENCHMARK: CANADA'S INTERNATIONAL RANKING IN POSTSECONDARY STEM DEGREE/DIPLOMA ATTAINMENT

Proportion of the population, aged 25-64 with tertiary education, 2008 data

When university (tertiary type A) and college (tertiary type B) qualifications are combined, Canada is second only to Russia in the proportion of the population with tertiary education. When only college diplomas are considered Canada still places second but when only university degrees are considered, Canada's ranking falls to ninth.

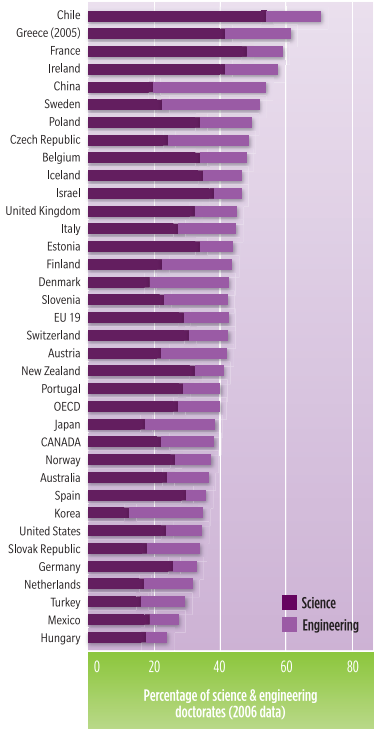






Science and engineering degrees at doctoral level as a percentage of all new degrees at doctoral level for 2006

In 2006, Canada ranked 25th in the proportion of science and engineering doctorates, well below EU average (18th) and just below OECD average (23rd).



Sources: OECD Science, Technology and Industry (STI) Scoreboard and the OECD Science, Technology and Industry Outlook.

In master's degree programs from 2004 to 2008, we've seen an enrolment increase in health areas of almost 40 per cent, and in architecture and engineering of a modest three per cent, while mathematics showed an enrolment decline of almost 12 per cent.

In doctoral programs, health areas again showed the greatest enrolment increase with 35 per cent, followed by mathematics with 27 per cent, physical and life sciences and technologies with 21 per cent, architecture, engineering and related technologies with 28 per cent and agriculture, natural resources and conservation by 14 per cent.

Given the increases in enrolment numbers, the number of degrees conferred in STEM fields is up in absolute terms. But post-secondary enrolment in general has been on the rise. So when we look, for instance, at the proportion of bachelor degrees that are STEM-related, those numbers have only increased minimally or have decreased in some cases.

We have to be careful, too, about what to read into the numbers. Although the proportion of students in STEM field postsecondary is relatively static, applications are increasing (as they are for postsecondary spots in general). Does that indicate a growing interest in STEM fields or merely a growing postsecondary population? If interest is indeed rising but not the proportion of STEM students, we could be looking more at a capacity problem in postsecondary institutions. This key issue and its implications require deeper analysis.

In looking at STEM enrolment, and postsecondary participation overall, we can't afford to be complacent.

Just considering the raw numbers, Canada appears to be among the best-educated countries in the world. In its latest 2011 report, the OECD placed Canada first in postsecondary achievement, with 50 per cent of Canada's population between ages 25 and 64 having obtained college or university credentials.

That's worth celebrating...and yet the Conference Board of Canada places Canada 14th out of 17 OECD peer nations on the innovation scale.

We need to look at education attainment at all advanced levels, and in all fields. Is there an ideal percentage of students who we want to see entering the STEM fields of study? That's a complex question, and should be a topic for public discussion.

But there's a consensus that given our needs as a nation – the need to fill employment shortages, to be more innovative, to grow as a knowledge economy – the status quo isn't good enough. Considering the current postsecondary trends in STEM fields, and looking at the uptake in optional enrolment in science at the high school level, we're looking at a continuation of the status quo.

We'll need to employ a wide range of strategies to engage young people in STEM learning, to show how that can benefit them in any career path, and to influence their postsecondary plans. Beyond changing attitudes, we need to change behaviours and decisions. That will be evident in how we've moved on the benchmarks.

The art of science

In high school, Shizuka Aoki had to make a choice – would she study art or science in university?

"I was an artist by nature, but had a passion for science," says Shizuka. "Thankfully, my 10th-grade art teacher introduced me to the idea of medical illustration as a career, and I instantly fell in love with the prospect."

A medical illustrator can be broadly defined as someone who communicates medical and scientific concepts in a visual way, such as anatomical drawings or 3D molecular animations.

While it would seem that art and science were theoretical opposites, each had attributes that complemented her studies.

"At Queen's University, I saw how my art classes gave me a creative edge in the science lab, and how my physiology and anatomy courses improved the accuracy of my figure drawings," says Shizuka. "I spent much of my time in a paint-splattered lab coat."

Over the last two years, Shizuka has worked for an array of international clients and her illustrations have been published in National Geographic magazine. Shizuka is now the Creative Director of her own medical illustration company, PictorDoctus Studios.

6 CREATING A SCIENCE CULTURE

What matters most

Looking at the jobs of the future is all about demand, while developing talent is about supply. These are two of the most fundamental ways to assess Canada's progress in creating a knowledge-based and innovative economy and society. But they're not the only ways.

Here's another important question: Does Canada have a strong science culture?

We usually define culture by geography or background, but it also refers to behaviours and attitudes, the prism through which we view our world. Beyond demand and supply, the study group wanted to explore the broader interest in science.

How do you measure that? To start somewhere, we talked to four national organizations that are engaged in various aspects of science learning and outreach: Let's Talk Science; Actua; Youth Science Canada; and Canadian Association of Science Centres.

We asked each organization to consider which of their benchmarks might contribute to an overall understanding of whether more people are getting involved in science. Essentially, these indicators tell us about the level of free-choice participation in science-related activities.

How we're doing

LET'S TALK SCIENCE

Who they are: Let's Talk Science (http://www.letstalkscience.ca/) is an award-winning, national, charitable organization that delivers science-learning programs and services. Founded in 1993, Let's Talk Science has inspired and engaged more than 2.5 million children, youth, educators and volunteers. One program offered by the organization, Let's Talk Science Outreach, uses relevant, exciting hands-on/minds-on activities that improve the understanding of physical and life science, engineering, mathematics and technology. This approach builds critical life skills, engages children and youth in science and helps develop 21st-century citizens and innovators.

The benchmark: In the four years measured (2006-2007 to 2010-2011), Let's Talk Science experienced huge increases in the numbers of organizations and individuals who became involved with the organization. This includes a 50 per cent increase in the number of partner university and college host sites; a 118 per cent increase in volunteers (who work with the youth); and a 349 per cent increase in volunteer hours. All of this indicates a growing interest in bringing science to life for Canada's youth.

ACTUA

Who they are: Actua (http://www.actua.ca/) is a national science, engineering, technology and math (STEM) outreach organization. It has a 20-year record in providing interactive education-enrichment experiences to youth aged 6 to 16, reaching 225,000 kids in 500 communities annually. The organization focuses on engaging youth who are typically underrepresented and underserved in STEM (e.g. Aboriginal youth, girls, underprivileged youth and youth in remote and inner city communities). Actua aims to build youth's confidence and interest in pursuing STEM studies and careers.

The benchmark: Summer is a time of recreation for children. With all of the choices, from swimming to sports to outdoor adventures, can science possibly compete? Yes. During a four-year period, Actua reported a 50 per cent increase in the number of young people attending their summer science camps. The majority of these camps have waiting lists. Parents say that the draw includes a desire for summer educational experiences for their children, the positive role models in the camps and early exposure to possible careers.

YOUTH SCIENCE CANADA

Who they are: Youth Science Canada (http://www.youthscience.ca/), formed in 1962, provides or partners with programs to: increase awareness and involvement of youth in science, engineering and technology; engage, mentor and recognize young scientists; set standards for scientific experimentation by young people; promote science and technology fairs; and engage scientists, engineers, educators, parents and leading organizations in developing a national science, engineering and technology network of youth. The organization is best known for its annual Canada-Wide Science Fair.

The benchmark: Since 2002, Youth Science Canada has seen a 14 per cent increase in the number of finalists in the Canada-Wide Science Fair. These are the youth selected by the 100-plus regional science fairs. The benchmark is only partly revealing, as Youth Science Canada says it could involve even more young people in the national fair if it had the physical capacity. Still, as noted earlier in this report, we know that Canadian participation rates in such voluntary events – science clubs, fairs, competitions and extracurricular science projects – exceeds the OECD average.

CANADIAN ASSOCIATION OF SCIENCE CENTRES

Who they are: The association (http://www.canadiansciencecentres.ca/) was founded in 1985 to create synergy among Canada's science centres and science-related museums; to assist in finding solutions to the challenges faced by these important public institutions; and to provide a single voice before Government. The organization has 44 members, which include science centres/museums, technology museums, planetariums, nature centres, natural history museums, interpretation centres and children's museums.

The benchmark: Members of the association represent a diverse range of science and technology based activities from award winning exhibitions and programs to leading edge partnerships with post-secondary institutions. Based on CASC's most recent member study in 2011, they reported that annually more than eight million visitors attended their member institutions in 2010-2011. More than half of the institutions stated that attendance is increasing. Of these visits, 45 per cent were from adults; 33 per cent from children under 12; 14 per cent from ages 12 to 17; and eight per cent from seniors. In this case, we have a starting benchmark, looking at both overall attendance and the demographic breakdown.

	2006-07	2010-11	Growth
Let's Talk Science		**www.letstalkscience.ca**	
Number of partner university and college host sites	22	36	50%
Total # of volunteers (including industry-based volunteers as well as postsecondary volunteers)	1,427	3,110	118%
Total volunteer hours	7,306	32,806	349%
Actua		**www.actua.ca**	
Number of campers attending summer camps	18,339	27,593	50%
Youth Science Canada		**www.youthscience.ca**	
Finalists	447 (2002)	509 (2011)	14% (since 2002)
Attendance		8,000,000 + visitors 45% adult 14% youth 33% children < 12 8% seniors	

The benchmarks here are selective but a start, and provide some insight into involvement in informal science-learning experiences. The panel brainstormed a number of other possible science culture indicators, like the increase of NGOs that are involved in science activities; the interest in media about science (publications and shows); science tourism; start-up companies in STEM fields and patents; the science literacy of our politicians; and more. We recommend a suite of benchmarks be developed, and encourage the public to suggest their own. By thinking creatively, we can assess the growth of a science culture that will further our students' academic and career interests, and support the science literacy of all Canadians.

Viewers tune in to science

Science has never been more popular...on TV at least. Programs that feature science in the field, such as CSI, NCIS and Big Bang Theory, have been steady contenders in the 30 most-watched shows according to BBM Canada. The popularity of these shows seems to have had an effect on student choices. For instance, CSI seems to have sparked an increase in enrolments in forensic science; as CSI grew in popularity in the 1990s, there was an increase in applications to the University of Toronto's forensics program to more than 500 applications for 50 positions.

Science in pop culture

"Quirks & Quarks has been on the air for more than 35 years and its ratings have never fallen. Science-based movies, especially about space, always do well at the box office. Young people are very interested in the way science sees the world and they embrace new technology. Since CSI has been on the air, enrollment in forensic science has skyrocketed. Young people are watching and learning fast. It is up to our education system to maintain that excitement and bring science knowledge from fiction to reality."

Bob McDonald, host of Quirks & Quarks

Ontario Science Centre and Science Learning

The Ontario Science Centre supports science learning every day. We provide hands-on, interactive educational opportunities for nearly 200,000 school children every year who come on class trips. More than 30,000 of these children attend schools in underserved neighbourhoods and visit the Science Centre through our Adopt-A-Class access program. For all of the children who visit, coming to the Centre is an inspirational experience that helps shape curiosity about science and the world.

We partner with the education system and run the Ontario Science Centre Science School, a formal school within a free-choice science learning environment. Sixty students each year are immersed in science communication experiences as part of the curriculum in their university preparation courses. The School is embedded within the fabric of the Centre, with its students engaging all other school visitors to create a peer science learning community.

Paul Kortenaar, Director, Education
Weston Family Chair of Innovative Education
Ontario Science Centre

7 CONCLUSION

What do you want to be when you grow up?

It's a question that every young person gets asked. The answer is key to his or her future – and the collective response also shapes our national welfare.

Directly and indirectly, a huge and growing number of jobs require some sort of science knowledge, from understanding the basics to having a more deep-rooted foundation. And all jobs demand the sort of thinkers – analytical, curious, problem solvers – that exposure to science education nurtures.

This isn't just a matter of fostering more interest in science as a narrowly defined career. It's about conveying the idea that STEM knowledge increasingly applies to careers of the future, and is important throughout your life.

To open up wider opportunities – for our people and our country – we need youth to become more engaged in science, and pursue some sort of STEM learning at higher levels in high school and beyond.

How is Canada faring? In some areas, we're doing well, like the relatively strong test scores of students in science and math. Clearly, our students have the abilities.

Yet, just as clearly, we're not doing well enough at keeping them interested or helping them understand the importance and relevance of science education. Quite simply, we're not seeing increases in the proportion of youth who pursue science once it becomes optional in high school, or in the proportion who study STEM fields postsecondary.

By standing still, we risk falling behind.

That's a concern given the jobs of the future, the need for our institutions to remain innovative and competitive, and the requirement for a scientifically literate population.

The benchmarks collected here are an important start. They're the basis for measuring progress in science learning, and the impact of that education. We hope that these benchmarks are the beginning of something else, a more urgent dialogue in Canada – among educators, parents, policy bodies, the science community, Government – around the state and goals of science learning.

By understanding the data that's vital to track, and by having a robust national conversation about science learning, we can take steps that will benefit our citizens and economy for decades to come.

RECOMMENDATIONS

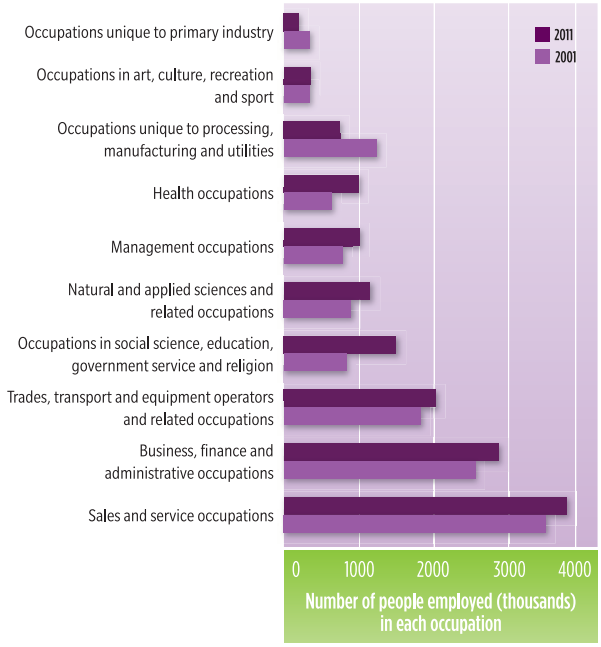
To achieve improvements in the benchmarks, and in tracking the key measures that will help us monitor/evaluate the positive outcomes of science learning, the panel has eight key recommendations:

1. Establish a national forum for ongoing multistakeholder discussion related to STEM talent development.
2. Support and scale effective STEM-teaching and -learning programs, in and outside school, to: revitalize young people's love of science with compelling programming; and help youth see how science education is relevant, i.e. 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 postsecondary applications, registrations and graduation in STEM programs.
4. Build better connections between job forecasts and STEM learning demands – and make 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 postsecondary 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 the science culture in Canada.

APPENDIX A

BENCHMARK: STEM WORKFORCE – NUMBERS AND PROPORTION OF THE TOTAL WORKFORCE

Source: Statistics Canada, CANSIM tables 282-0069 and 282-073, last modified: 2011-05-06



APPENDIX B

BENCHMARK: APPRENTICESHIP (REGISTRATIONS, COMPLETIONS, CERTIFICATES) IN STEM-RELATED DISCIPLINES

Registrations, completions and certification by major trade group from 2005-2008												
	2005			2006			2007			2008		
	Registrations	Completions	Certificates	Registrations	Completions	Certificates	Registrations	Completions	Certificates	Registrations	Completions	Certificates
Total major trade groups	293,838	20,556	31,839	328,167	20,853	38,949	358,557	24,495	42,867	390,705	29,145	47,739
Automotive service	37,254	2,706	3,906	39,891	2,610	3,822	41,685	3,396	5,103	44,007	3,261	4,974
Carpenters	39,927	1,743	2,391	43,533	1,965	2,598	47,871	2,469	3,264	51,390	2,871	3,642
Early childhood educators and assistants	3,681	150	150	4,440	240	240	5,214	261	261	6,174	282	282
Electricians	49,038	3,813	5,502	53,898	4,137	6,495	59,424	4,611	7,203	58,158	4,926	7,701
Electronics and instrumentation	4,218	312	510	4,638	351	546	4,872	315	498	5,586	420	660
Exterior finishing	11,073	525	624	12,123	525	615	12,909	642	753	13,743	837	954
Food service	10,947	561	894	11,892	477	765	12,504	591	1,005	15,015	717	1,224
Hairstylists and estheticians	15,954	1,704	2,367	16,797	1,581	1,917	16,374	2,082	2,790	18,006	2,106	2,772
Heavy duty equipment mechanics	8,460	714	1,146	10,197	762	1,278	11,505	828	1,287	12,492	981	1,413
Heavy equipment and crane operators	10,701	957	2,118	11,646	972	2,091	11,781	1,005	2,370	11,025	1,008	2,346
Interior finishing	14,787	633	945	15,999	630	834	16,266	714	921	17,553	900	1,230
Landscape and horticulture technicians and specialists	2,160	63	90	2,454	69	84	2,265	108	1,275	2,604	267	303
Machinists	10,488	729	936	10,824	630	798	10,893	696	945	11,724	861	1,065
Metal workers (other)	5,796	627	849	6,399	483	774	7,473	594	873	8,355	615	843
Millwrights	10,170	915	1,860	11,409	942	2,103	11,427	1,020	1,707	12,363	1,098	2,067
Oil and gas well drillers, servicers, testers and related workers	450	–	–	2,193	–	1,464	3,774	3	1,368	5,445	69	774
Plumbers, pipefitters and steamfitters	27,783	2,025	2,982	31,161	2,172	3,489	35,106	2,481	3,474	38,562	3,435	4,698
Refrigeration and air conditioning mechanics	5,208	465	654	5,628	447	993	6,168	537	930	6,774	495	813
Sheet metal workers	6,552	369	420	7,227	453	519	8,007	522	591	8,652	552	621
User support technicians	753	12	12	2,937	3	3	8,448	9	9	10,656	402	402
Welders	10,944	1,134	1,998	14,142	1,005	2,325	16,371	1,206	2,748	18,030	1,461	3,015
Other major trade groups	7,497	408	1,488	8,745	405	5,205	8,217	399	3,486	14,388	1,578	5,943

Human resources and social development Canada

http://www.hrsdc.gc.ca/

Human Resources and Skills Development Canada (HRSDC) is a department of the Government of Canada. HRSDC's mission is to build a stronger and more competitive Canada, to support Canadians in making choices that help them live productive and rewarding lives, and to improve Canadians' quality of life.

The following information is taken from Looking-Ahead: A 10-Year Outlook for the Canadian Labour Market (2006-2015)

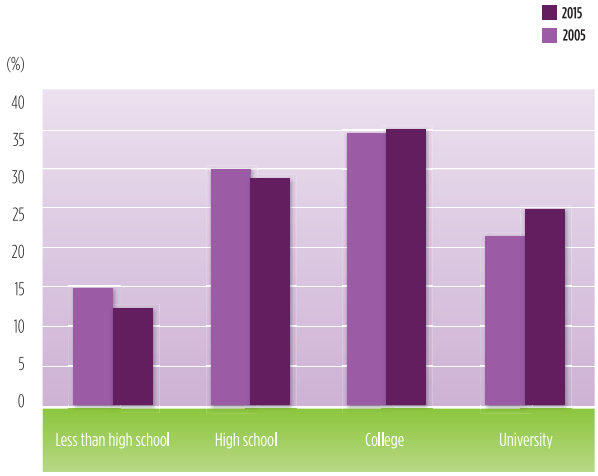
http://www.hrsdc.gc.ca/eng/publications_resources/research/categories/labour_market_e/sp_615_10_06/page06.shtml#future

The labour force with postsecondary education (university and college) is projected to continue to be the fastest-growing component of supply mainly due to a large proportion of young people with postsecondary education (PSE) replacing less educated, older workers.

Individuals with a university degree, which accounted for 13.8 per cent of the labour force in 1990 and 21.8 per cent in 2005, is expected to rise by 2.2 per cent on average over the next 10 years to reach 24.4 per cent of the labour force by 2015. The shares of the labour force with a college or high school education are expected to remain fairly constant – at 34 per cent and 30 per cent, respectively while those with less than high school education is expected to continue to decline by an average of 1.0 per cent a year.

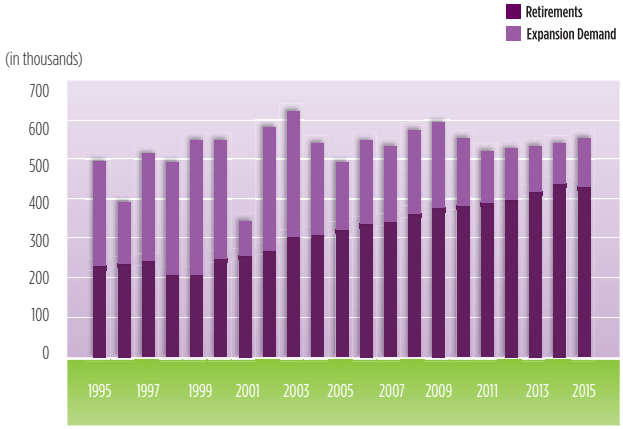
Over the past 10 years, about half of all job openings were the result of expansion. The next 10 years will see this pattern change due to the significant number of retirements expected as the first of the "baby boomers" reach 65 in 2011. Job creation due to expansion is expected to grow at an annual average rate of 1.1 per cent creating 1.7 million jobs over the next 10 years; approximately 3.8 million people are expected to retire – an average of 2.4 per cent of the workforce each year. More than double the number of jobs will open up due to retirements than due to expansion.

Share of Labour Force by Education, 2005 and 2015



Sources: (2005) Statistics Canada, Labour Force Survey (2015) HRDSC - SPRD, Labour Market and Skills Forecasting and Analysis Unit, 2006 Reference Scenario

Job Openings: Retirements and Expansion Demand, 1995-2015



Sources: (1995-2005) Statistics Canada. Labour Force Survey (Expansion Demand), and HRDSC - SPRD, Labour Market and Skills Forecasting Unit, 2006 Reference Scenario (Retirements) (2006-2015) HRSDC - SPRD, Labour Market and Skills Forecasting and Analysis Unit, 2006 Reference Scenario

The following chart illustrates the occupations in which shortages are expected over the next 10 years.

Occupations Currently Showing or Expected to Show Shortages			
Occupational Group	**Occupations**	**Currently showing signs of shortages**	**Expected to face shortage pressures over the next 10 years**
Business, finance and administration	Senior management	Yes	Yes
	Human resource managers	Yes	Yes
	Human resources and business service professionals	Yes	Yes
Natural and applied sciences	Civil engineers	Yes	Yes
	Mechanical engineers	Yes	No
	Computer engineers	Yes	No
	Software engineers	Yse	No
Health	Managers in health, education, social and community services	No	Yes
	Physicians, dentists and veterinaries	Yes	Yes
	Optometrists, chiropractors and other health diagnosing and treating professionals	Yes	Yes
	Therapy and assessment professionals	Yes	Yes
	Head nurses and supervisors	Yes	Yes
	Other technical occupations in health care (such as registered nursing assistants, audiology technicians and physiotherapy technicians)	Yes	Yes
	Medical radiation technologists	Yes	Yes
	Nurse aides and orderlies	Yes	Yes
	Other aides and assistants in support of health services	Yes	Yes
Social science, education, government service and religion	Managers in Public Administration	No	Yes
	Lawyers and Quebec notaries	Yes	No
	University professors	Yes	No
Art, culture, recreation and sport	Editors	Yes	No
	Professional occupations in public relations and communications	Yes	No
Sales and service	Accommodation service managers	Yes	No
	Real estate agents and salespersons	Yes	No
Trades, transport and equipment operators and related occupation	Residential home builders and renovators	Yes	Yes
	Contractors and supervisors trades and related workers	Yes	Yes
Occupations specific to primary industry	Supervisors, oil and gas drilling and service	Yes	Yes
	Contractors and supervisors trades and related workers	Yes	Yes
Occupations specific to processing, manufacturing and utilities	Supervisors, processing occupations (such as in petroleum, gas and chemical processing and utilities, and plastic and rubber products manufacturing)	Yes	Yes

Source: HRDSC, Strategic Policy Research Directorate, Looking-Ahead: A 10-Year Outlook for the Canadian Labour Market (2006-2015), October 2006.

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