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Canada2067

Youth Insights: Imagining the Future of STEM Education


Fort Yukon
Tuktoyaktuk
Fairbanks
Anchorage
Valdez
Cordova
Gulf of Alaska
Yukon Territory
Mackenzie R.
Yukon R.
Victoria Island
Prince of Wales Island
Baffin Bay
Baffin Island
Ikateq
mapsland.com
Davis Strait
Nuuk
(Godthab)
Nanortalik
Whitehorse
Echo Bay
Great Bear Lake
Northwest Territories
Nunavut
Juneau
Yellowknife
Baker Lake
Iqaluit
Great Slave Lake
Rankin Inlet
Hudson Strait
Labrador Sea
Bear Lake
Lake Athabasca
Peace River
Queen Charlotte Islands
Prince Rupert
Dawson Creek
Fort Chipewyan
Churchill
Hudson Bay
Ungava Bay
Inukjuak
Grande Prairie
Fort McMurray
Prince George
Alberta
Saskatchewan
Edmonton
Flin Flon
Thompson
Manitoba
Lake Winnipeg
Red Deer
North Battleford
Prince Albert
Kamloops
Vancouver
Victoria
Kelowna
Calgary
Saskatoon
Saskatchewan River
Columbia R.
Trail
Lethbridge
Labrador City
Newfoundland & Labrador
Smallwood Res.
St. John's
Corner Brook
Newfoundland
Seattle
Olympia
Spokane
Regina
Swift Current
Moosonee
Ontario
Quebec
Lake Nipigon
Gulf of St. Lawrence
New Brunswick
Prince Edward Island
Sydney
Portland
Vancouver
Salem
Albany
Pullman
Pendleton
Montana
Great Falls
Missoula
Williston
Minot
Brandon
Winnipeg
Thunder Bay
Amos
Timmins
Charlottetown
Moncton
Quebec
Trois-rivieres
Maine
Fredericton
Nova Scotia
Halifax
Bangor
Augusta
Montpelier
Concord
Albany
Boston
Rochester
Buffalo
Hartford
Trenton
New York
Cleveland
Detroit
Lansing
Toronto
Ottawa
Kingston
Montreal
North Bay
Sudbury
L. Superior
L. Huron
L. Michigan
L. Erie
L. Ontario
Michigan
Marquette
Iron Mountain
Ironwood
Wisconsin
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Minnesota
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Fargo
Grand Forks
North Dakota
South Dakota
Bismarck
Lake Oahe
Missouri R.
Lake Sakakawea
Miles City
Billings
Buffalo
Rapid City
Sheridan
Wyoming
Casper
Hot Springs
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Cheyenne
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Provo
Salt Lake City
Ely
Elko
Nevada
Carson City
Oakland
Sacramento
San Jose
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Bishop
Monterey
Chico
Reno
Redding
Eureka
Medford
Klamath Falls
Boise
Twin Falls
Idaho Falls
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CONTACT

For more information regarding the results documented in this publication please contact

Let's Talk Science National Office
1510 Woodcock Street, Unit 12
London, ON. N6H 5S1
1.877.474.4081

Visit our websites for more information
Let's Talk Science: www.letstalkscience.ca
Canada 2067: www.Canada2067.ca
1.877.474.4081

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canada2067
The science of a successful tomorrow

"The pace of change has never been this fast. And it will never be this slow again."

The Hon. Justin Trudeau, Prime Minister of Canada, speaking at the World Economic Forum, 2018

Canada 2067

Facilitating a national dialogue to imagine the future of STEM education in Canada.

This publication highlights the context in which this bold initiative took place and summarizes a youth-centred vision for the future of STEM education in Canada that emerged after engaging more than 1,000 Grade 9 and 10 students across the country.

Canada 2067 started as an idea for a single conference and grew to include an extensive research project, five youth summits, six millennial roundtable consultations, a national leadership conference, a youth-focused web series and companion documentary, and a significant social media effort that garnered more than 750,000 engagements.

Preface

Technology is reshaping everything - from the way we work to the way we manage our lives and interact with the world around us.

Addressing critical global challenges such as climate change, sustainable energy, health care and food/water security demand science and technology-based innovation. We regularly tell our kids that we don't know what jobs will be available when they graduate high school and we are beginning to embrace a skills-based approach to learning. Critical thinking, problem solving, coding, collaboration and communication are becoming the new 'basic skills'.

Canadian education is among the best in the world, but we cannot be complacent. In 2016, as Let's Talk Science considered how we might celebrate Canada's sesquicentennial, we decided to be more forward-thinking than celebratory and catalyze the first significant national dialogue about STEM (science, technology, engineering and math) education, focusing on Kindergarten to Grade 12 (K-12). For inspiration we looked to imagine the bicentennial year (2067) in which many of today's high school students will be considering their retirement.

With that lens we set out to hear from Canadians and craft short-term measurable goals that could be used to align the efforts of all education stakeholders and unlock tremendous energy and impact.

Let's Talk Science is a national charitable education and outreach organization with a deep commitment to supporting youth development. Since our inception in 1993, we have impacted more than 6 million youth and educators with programs and learning resources that build confidence, critical skills, and interest in STEM.

Deeply committed to partnerships, we mobilize an impressive national network of volunteers who are wonderful role models to youth and we train educators to bring inquiry-based learning to life in classrooms and community settings. We also work with an enviable array of community organizations, universities, colleges, governments, industries and schools. Canada 2067 has benefited greatly from Let's Talk Science's commitment to positive relationships.

This publication is a testament to the critical importance that Canadians place on our youth. We want them to thrive. We want them to be well prepared for their futures. The youth insights gathered through Canada 2067 informed the overall recommendations, *(www.canada2067.ca)* but they deserve special attention. This publication focuses primarily on those insights gathered through the five youth summits which were held with Grade 9 and 10 students across Canada.

To our knowledge, nothing like Canada 2067 has happened anywhere in the world. It exceeded all expectations. We sincerely thank the team that anchored this exciting and complex project and our founding partners who supported the dream as it evolved.

PROGRAM PARTNERS

Let's Talk Science

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Groundswell Projects

Institute without Boundaries

Hill + Knowlton Strategies

Global Shapers

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3M Canada

Bonnie Schmidt, C.M., Ph.D.
President, Let's Talk Science

Hilary Foulkes, P.Eng.
Chair, Let's Talk Science
Board of Directors

Section 1

Context

Creating a national strategy for meaningful and authentic stakeholder engagement at an inflection point for change in the education system.

Canada's education system is among the best in the world, however it must respond to the changing technological and socio-economic landscape. This context provides a brief description of the drivers that led to the development of Canada 2067 and why it is essential to inspire a dialogue regarding the future of education that will enable Canada to remain at the forefront of innovation. It also highlights the components of the Canada 2067 initiative, which allowed for diverse stakeholder input, facilitated discourse and led to insights that can help shape the future of STEM education in Canada.

"Do you want to do the things that matter? Do you want to put the ability to address really challenging problems into your own hands? If you want to protect the environment, if you want to protect the vulnerable people in our society, if you want to create technology that's cool and disrupts an industry or the entire world - that is what a STEM education can do for you."

Sheila Buttery, Senior Regulatory Affairs Associate, 3M Canada. Vancouver summit

Introduction to Canada 2067

Developed through a landmark national engagement program, the vision of Canada 2067 is to enable students to graduate with doors open to diverse careers, with the capacity to be active and informed citizens, and with the full range of skills needed to navigate an increasingly complex and demanding world.

The quality of a society's education system underpins its ability to meet present and future challenges. Through formal education citizens acquire many of the skills and characteristics they will rely on throughout their adult lives. In the face of complex challenges such as climate change and the rise of new information and communication technologies, questions have arisen over whether education systems are adapting as they should.

In this context, few issues have attracted as much public attention as the STEM disciplines- science, technology, engineering and mathematics. STEM disciplines are seen as crucial in equipping citizens to meet the challenges of an increasingly knowledge- and technologically-intensive society.

Societies where students do not receive a sufficiently strong foundation in core subjects such as science and math that equip everyone with a new level of literacy, and which find themselves without an adequate supply of specialists with advanced scientific skills are at a substantial disadvantage as they compete for economic opportunities and engage in collective decision-making.

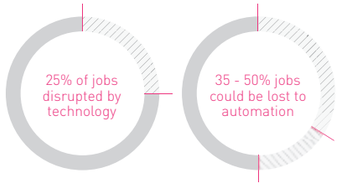
For this reason, both governments and non-governmental organizations are asking how well their STEM education systems are doing and how they might need to evolve in the years to come.

Canada's stellar – albeit complex – education systems continue to thrive (we currently have 22 provincial/territorial education ministries that oversee early years through post-secondary education and no national ministry or department of education). However, we now face global competition and mounting demand for graduates who excel at teamwork, interdisciplinary approaches and critical thinking and who are confident and curious.

Education systems have historically trained people for jobs in manufacturing, agriculture and service industries where tasks were routine and easy to define. Today, we need citizens who are prepared for a world where routine tasks are automated, information flow accelerated, and established industries quickly disrupted.

Citizenship and work demands have changed enormously since the public education system emerged over 100 years ago. Over the past decade, the pace of change has been exponential. Rapid technological advancement is transforming everything from healthcare to agriculture and manufacturing, and these changes are being fueled by innovations in science, technology, engineering and math. These innovations further accelerate the pace of change.

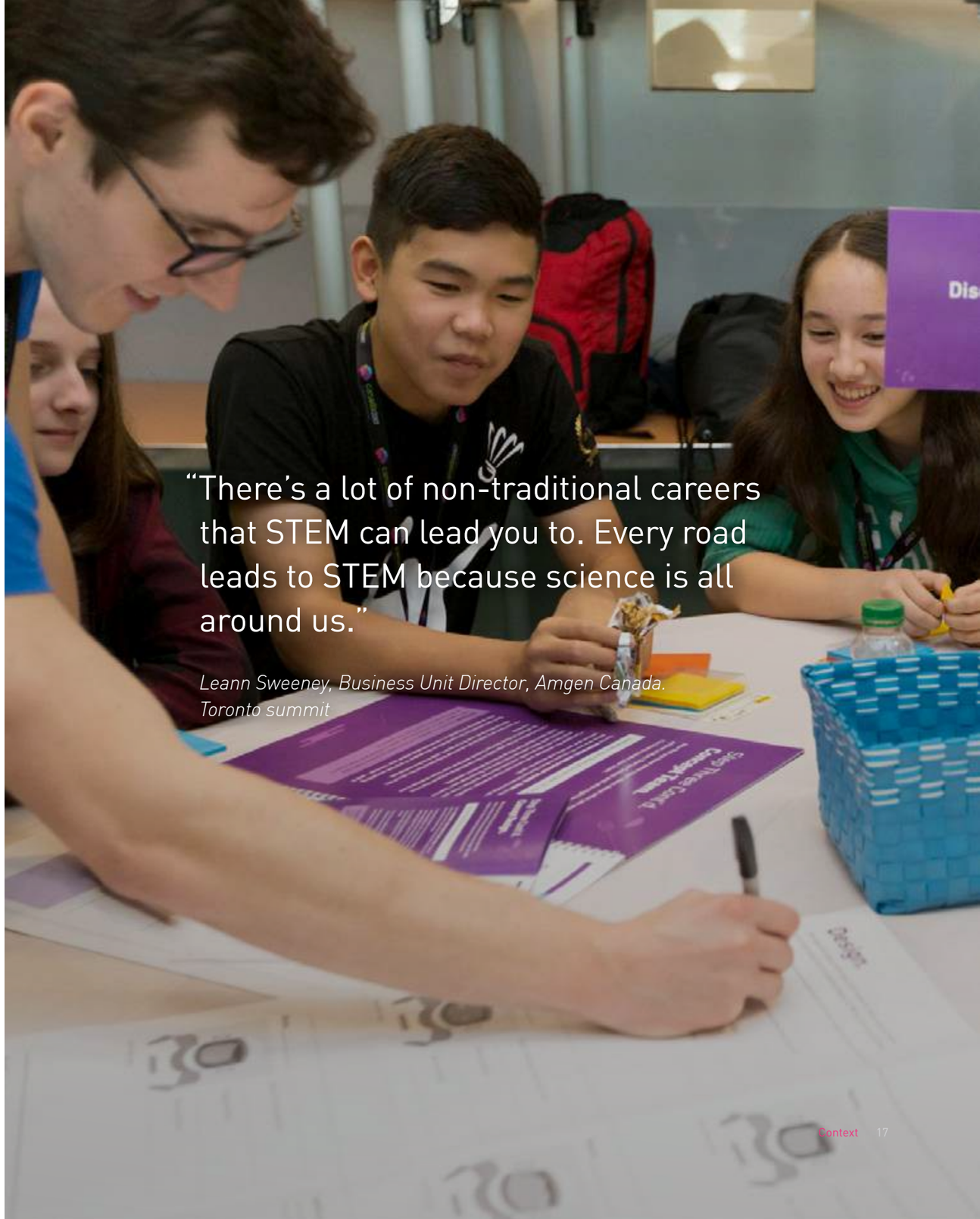
As we work to solve complex global challenges, being at the cutting edge of STEM education and making STEM education relevant and rewarding for all students will be increasingly important.



According to recent studies, anywhere from **25 to 42 percent of Canadian jobs will be heavily disrupted by technology within 20 years[1, 2].** In this context, finding answers to the question of how Canadian youth can thrive in the age of disruption is critical. Investment in education is one way to reduce the percentage of jobs at high risk of automation. But investments in education need to be strategically targeted in order to have their maximum positive impact.

For example, after modelling the UK economy and its likely transformation up to 2030, Deloitte UK found that the importance of mathematics and science knowledge will increase[3]. Other studies make similar arguments, with biology and health related sciences often topping the list of important knowledge areas, while also emphasizing the importance of skills like critical thinking and social and system skills[4].

1. RBC. (2018). Humans Wanted: How Canadian youth can thrive in the age of disruption. Toronto, ON.
2. Brookfield Institute. (2016). The Talented Mr. Robot: The impact of automation on Canada's workforce. Toronto, ON: Lamb, C.
3. Deloitte. (2016). Talent for survival: Essential skills for humans working in the machine age. London, UK.
4. Bakhshi, H., Downing, J., Osborne, M. & Schneider, P. (2017). The Future of Skills: Employment in 2030. London, UK: Pearson and Nesta.



Skills and attributes for the future

The acronym STEM stands for Science, Technology, Engineering, and Mathematics, but it has come to be used as a broader label that includes a diverse set of skills and characteristics — ways of thinking about (and solving) problems that we all face as global citizens. Canada 2067 aims to help Canadians understand how STEM learning can empower future generations.

Students who will thrive in the future require new skills and characteristics. As expressed in Deloitte's 2018 Global Human Capital Trends report, the most valuable roles will be the ones that allow creative, skilled, cross-disciplinary thinkers to work alongside machines in order to innovate, create and deliver services.

The growing importance of competencies such as critical thinking, problem solving, collaboration, creativity, programming and digital literacy have been explored in considerable detail by many agencies, including the World Economic Forum, the Council of Ministers of Education, Canada, and Let's Talk Science.

Students who are grounded in STEM will grow into creative, critical thinkers, discoverers, entrepreneurs and problem solvers. Exploring what this means for Canadian education is at the heart of Canada 2067.

SKILLS

STEM education builds **fundamental skills** that are of value to anyone, in any occupation and in everyday life:

- Logical reasoning
- Critical thinking
- Problem-solving

Practical skills are associated with particular jobs such as specialized careers or highly skilled trades:

- Using specialized equipment
- Doing calculations
- Developing technology

Advanced skills allow for engagement in discovery and innovation and are often developed through advanced post-secondary education:

- Groundbreaking research
- Creation of new technologies

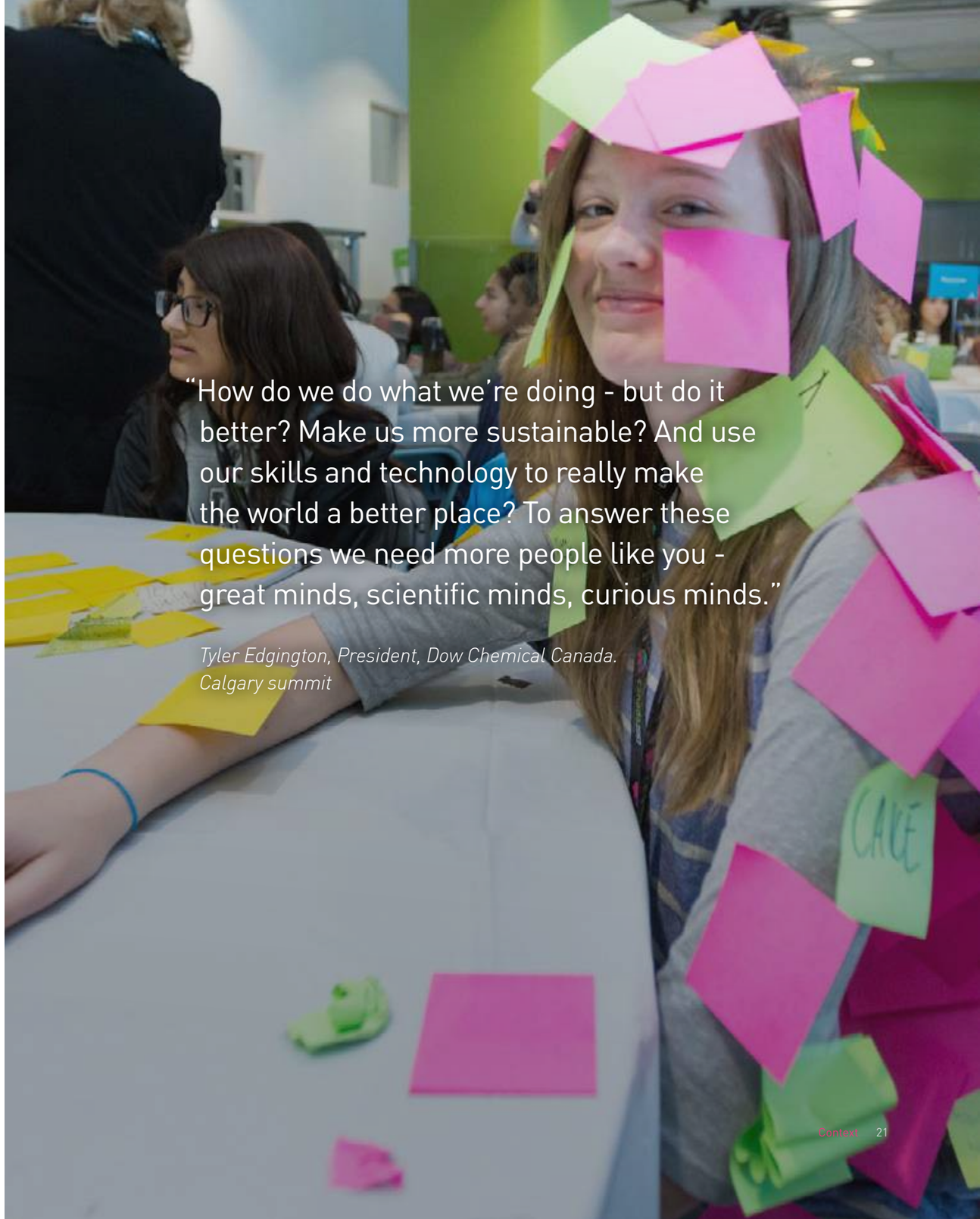
ATTRIBUTES

- Collaboration
- Critical / Logical Thinking
- Creativity
- Problem Solving
- Reflection
- Optimism
- Leadership
- Innovation and Invention
- Digital / Technical Literacy
- Resiliency
- Empathy

Canada 2067 was launched to respond to these urgent challenges and develop a ‘made in Canada’ roadmap. It evolved into an ambitious, multi-pronged national initiative to reimagine the future of STEM learning, focusing on Kindergarten to Grade 12 (K-12).

Through an unprecedented national conversation led by Let’s Talk Science, Canada 2067 provided a platform to engage diverse stakeholders in defining a national vision and goals for STEM education that will ensure young Canadians are prepared to compete, thrive and contribute in a rapidly changing world.

It looked beyond the traditional disciplines to consider broader skills and characteristics required in the future. It also addressed the critical role of students, parents, educators, industry, community organizations and governments in K-12 education.



Canada 2067 components

To develop a national vision and goals for the future of STEM education, Canada 2067 implemented a multi-pronged research and consultation-based initiative. Four components of the Canada 2067 platform are highlighted here, which provide insight to the breadth and importance of this national dialogue.

All of these components contributed to and complemented the youth summits, which were a cornerstone of the Canada 2067 research and engagement platform.

All components are available at canada2067.ca or through Let's Talk Science.

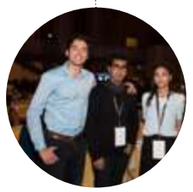
RESEARCH

More than 30 reports published since 2007 were reviewed to document international experiences and best practices related to education policy. The reviewed reports are published in English and focus mainly on STEM education at the primary and secondary levels in developed western countries in Europe, North America and Australia. Alignments found through the research were used to develop the six pillars that underpin the Canada 2067 Learning Roadmap (Appendix 1).

- How we teach
- How we learn
- What we learn
- Who's involved
- Where education leads
- Equity and inclusivity

NATIONAL LEADERSHIP CONFERENCE

The Canada 2067 National Leadership Conference engaged participants in a dynamic conversation about the future of STEM learning. This unique event, held at Toronto's Design Exchange on December 5-6, 2017, brought together policy makers and government officials, youth, educators, industry leaders, community partners and other stakeholders with the shared goal of preparing Canadian youth to thrive in a technology-driven world for generations to come. Conference talks and panel discussions tackled important issues in education defined by the six pillars of the Canada 2067 Learning Roadmap. More than 1,000 people participated in person and through livestream.



GLOBAL SHAPERS MILLENNIAL CONSULTATIONS

Part of the World Economic Forum, the Global Shapers Community is a network of 378 city-based hubs across 160 countries where young people under the age of 30 work together to address local, regional and global challenges. Let's Talk Science invited six Canadian Global Shapers hubs to host a series of dialogue sessions in Vancouver, Edmonton, Calgary, Ottawa, Toronto and Halifax between August and November 2017. More than 200 participants from the millennial demographic (20-30 years old) offered their unique perspectives on K-12 education within the context of creating a new vision for STEM learning (Appendix 2).

YOUTH SUMMITS

A highlight of Canada 2067 was the series of five youth summits held in Vancouver, Calgary, Toronto, Montreal and St. John's. Each event included inspiring speakers followed by a design charrette that challenged students to imagine a new education system. The youth summits brought together hundreds of students, teachers, volunteers, partners, community stakeholders and thought leaders to inspire, engage and empower the next generation of Canadian leaders.

Canada 2067 pillars

The vision statements for each pillar are highlighted below. All Canada 2067 initiatives used this as a guiding framework for consultation and engagement.

HOW WE TEACH

- Education faculties recruit and train sufficient number of student teachers with STEM experience.
- STEM education is delivered by teachers with specialized training and confidence in STEM disciplines and pedagogy in elementary and secondary schools.
- There are increased opportunities for ongoing STEM-based professional learning and development and for the development of collaborative learning communities (in school and online) for teachers.

HOW WE LEARN

- Inquiry-based and experiential learning are comprehensively integrated and supported in STEM education.
- STEM education takes advantage of the teaching and learning possibilities offered by new information and communications technologies (ICTs).
- Interdisciplinary and co-operative approaches are welcomed and used by STEM educators, and STEM learning is woven into other disciplines.
- All students receive an appropriate amount of STEM education.
- Assessment tools are designed to measure the learning outcomes we value most.

WHAT WE LEARN

- The focus of teaching and learning is on cross-cutting competencies as well as bodies of disciplinary knowledge.
- Definition of literacy is expanded to include digital literacy and skills.

WHO'S INVOLVED

- Consideration is given to the responsibilities of learners and the role of the student in bringing about change in education.
- Parents are active partners who are well integrated into their children's STEM learning.
- Post-secondary institutions are active partners of K-12 STEM learning and update their entrance requirements to recognize K-12's growing focus on cross-cutting competencies.
- Businesses maximize opportunities to enhance STEM learning and career awareness in K-12 education by supporting experiential and co-operative learning.
- Effective coordination of education partners inside and outside of schools and across provinces and territories, enhances learning outcomes of students.

WHERE EDUCATION LEADS

- Students in Canada receive good guidance on careers from an early age, including through experiential learning opportunities and community partnerships.
- Guidance for STEM-related education and careers pathways is integrated into the regular STEM curriculum.

EQUITY AND INCLUSIVITY

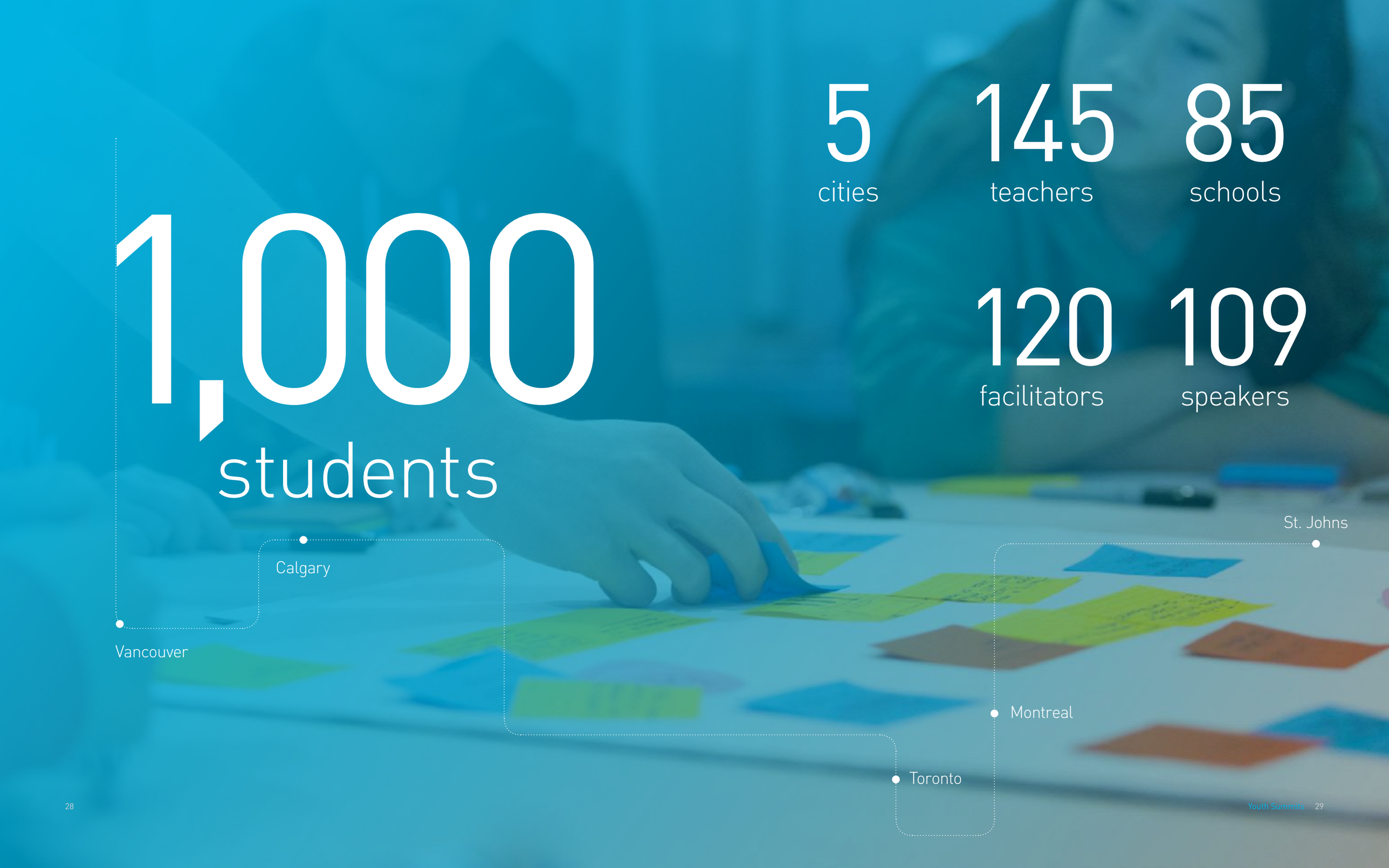
- There is sufficient focus in Canada on STEM education at all levels of education, beginning in the early years of school.
- Educators in Canada identify, understand and address inequities in STEM education including inequalities relating to gender and ethno-cultural background.
- STEM education evolves to address the specific needs of Indigenous students and to incorporate Indigenous perspectives and cultures as well as other non-European world views into STEM teaching and learning.

Section 2

Youth Summits

Inspiring, engaging and empowering more than 1,000 Grade 9 and 10 students across Canada to contribute to a vision for the future of STEM education.

Canadian youth are leaders. Their creativity, curiosity, tenacity and knowledge will help solve many of the complex global challenges we face today and transform the Canadian economy in ways we can't yet imagine. Placing youth at the centre of this engagement process was a mandate of Canada 2067 and it led to a unique experience that enabled their voices to be heard. This section includes an overview of the intent, structure and process of the Canada 2067 Youth Summits.


5
cities
145
teachers
85
schools
120
facilitators
109
speakers
1,000
students
Vancouver
Calgary
Toronto
Montreal
St. Johns

"Some people say that everything has already been done, but that's just not true. If anything, we barely scratched the surface of science and what we can learn from the natural world. So I say that all of us have a unique perspective and all of us can bring something new to the table, and this is why I love STEM research and hope you do too, because it gives us all the opportunity to ask these questions and to fuel our curiosity."

Sophie Hoye Pacholek, Emerald Code: Decoded, Young Scientist and STEM Talk presenter.
Calgary summit

Why youth?

In the quest for 'made in Canada' solutions, it was critical to engage students across the country in an authentic, meaningful and exciting way.

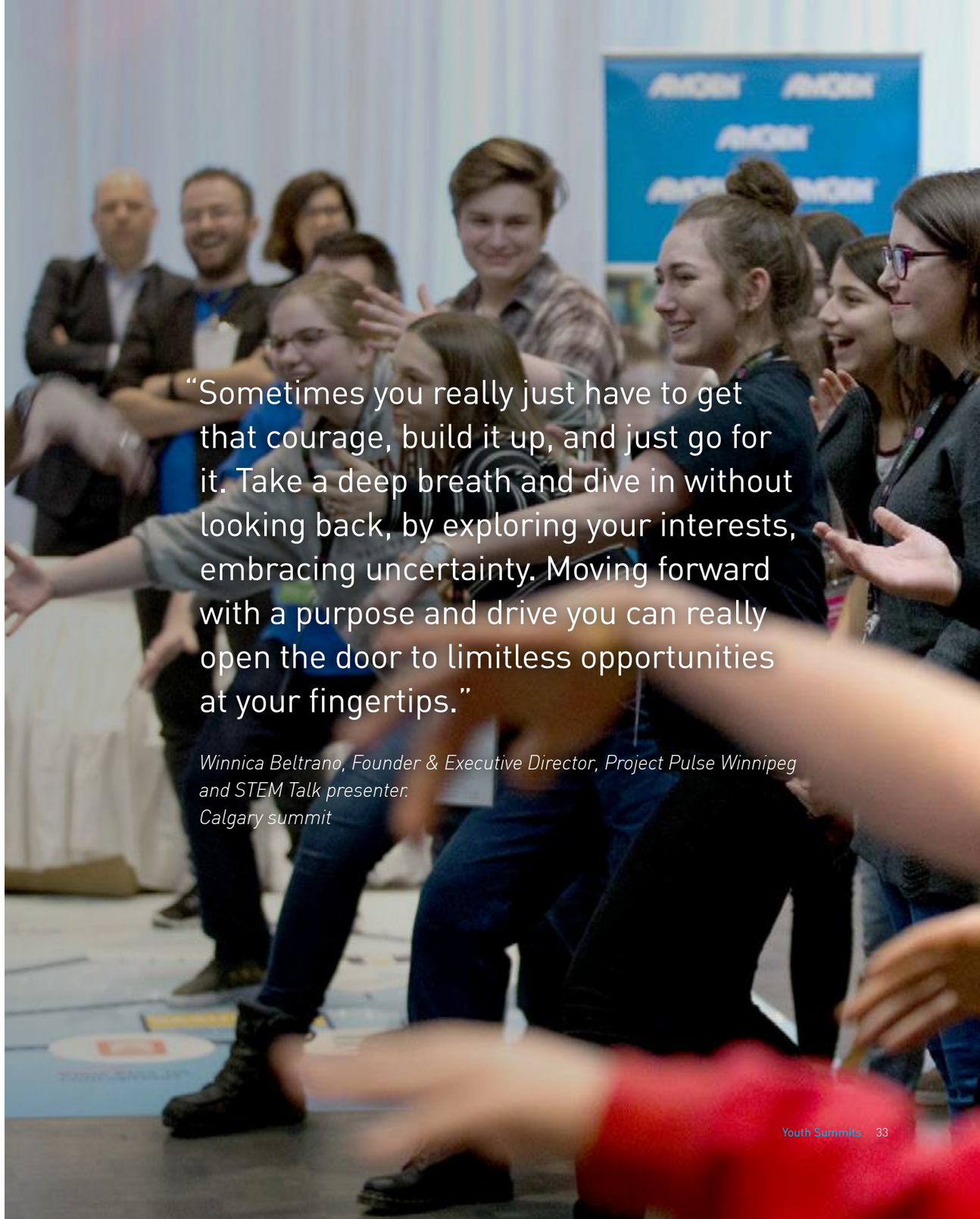
To achieve this, the Canada 2067 Youth Summits employed a user-centred design approach, which placed students at the centre and emphasized the importance of their participation. As primary users of the education system and future leaders of Canada, the Youth Summits aimed to inspire, engage and empower youth, while providing them with a platform to use their collective creativity to contribute to developing a national vision for the future of STEM education.

The Youth Summits also encouraged collaboration between diverse youth – including many who never envisioned themselves as "STEM students" with thought leaders, educators, and other key stakeholders responsible for shaping and implementing education systems.

YOUTH ENGAGEMENT AS A HUMAN RIGHT

UNESCO and its Member States have a strong legacy of youth engagement within the workings of a complex intergovernmental organization. The United Nations Convention on the Rights of the Child (UNCRC) provides a strong foundation for youth engagement.

Article 12 of the UNCRC, Respect for the Views of the Child, states that "when adults are making decisions that affect children, children have the right to say what they think should happen and have their opinions taken into account." Youth participation in initiatives that impact them – like education and STEM reform – is critical to ensuring not only their experiences, vision and insights are understood by change makers, but that their rights are respected and upheld.



Engaging stakeholders across Canada

While the Youth Summits focused on students, they were also an opportunity to engage school boards, teachers, governments, thought leaders, industry and community stakeholders across the country.

Beginning on the West Coast in October 2017 and ending on the East Coast in April 2018, Youth Summits were held in five locations.

- **Vancouver** – October 24, 2017
- **Toronto** – November 15, 2017
- **Montreal** – January 25, 2018
- **Calgary** – March 1, 2018
- **St. John's** – April 26, 2018

This pan-Canadian approach offered a world-class platform within each region to engage students from over 80 schools. Each youth summit was tailored to the unique context of the city but followed a consistent framework.

The framework consisted of STEM Talks, followed by a Design Charrette and a closing discussion where students were able to share their ideas with peers. The following objectives were used to guide the development of the charrette process, curate talks and evaluate the success of the Youth Summits:

AWARENESS

- Understand Canada 2067 goals.
- Learn that they have the knowledge, skills and voice to shape the future of their own education, and the larger education system as a whole.
- Gain an understanding that the subjects they choose in high school can affect their access to STEM-based careers.
- Become aware and feel part of global conversations.
- Acknowledge Canadian cultural heritage and reconciliation efforts.

INTEREST

- Meet STEM professionals and learn about pathways and careers that pique their interest and align with their own curiosities.
- Learn about global innovations and trends.
- Identify their own point of view and collective views on STEM issues that matter to them.
- Learn about the charrette process as a way to collaborate with peers, tackle problems and test solutions to improve human experiences.

ACTION

- Collaborate with peers outside their existing network to imagine how education might change or be redesigned to align with their interests, needs and wants.
- Return home eager to lead discussions around education and STEM at their schools.
- Design and implement solutions to real life problems.
- Remain engaged with and play a central role in STEM solutions at their schools.

STEM Talks

A dynamic group of speakers kicked-off each summit with a series of short, TED-style talks about their journey, highlighting stories about what enabled them to become thought leaders, entrepreneurs and innovators in their respective fields. This was intended to inspire ideas, promote STEM education and act as catalyst for the design charrette. It included speakers of all ages and from diverse fields that captivated and inspired the youth audience to imagine their own future.

These speakers were livestreamed online for students and teachers tuning in across the country.

See page 116 for a complete list of speakers'.

Jennifer Gardy
Assistant Professor, School of Population and Public Health, University of British Columbia

Rohan Nuttall
Global Shapers Vancouver

Katharine Scotton
Environmental Consultant, PGL Environmental Consultants

Margarita Marinova
Senior Mars and Vehicle Systems Development Engineer, SpaceX

Valerie Song
CEO, AVA Smart Garden

Kelly Shkuratoff
Senior Manager, Salesforce

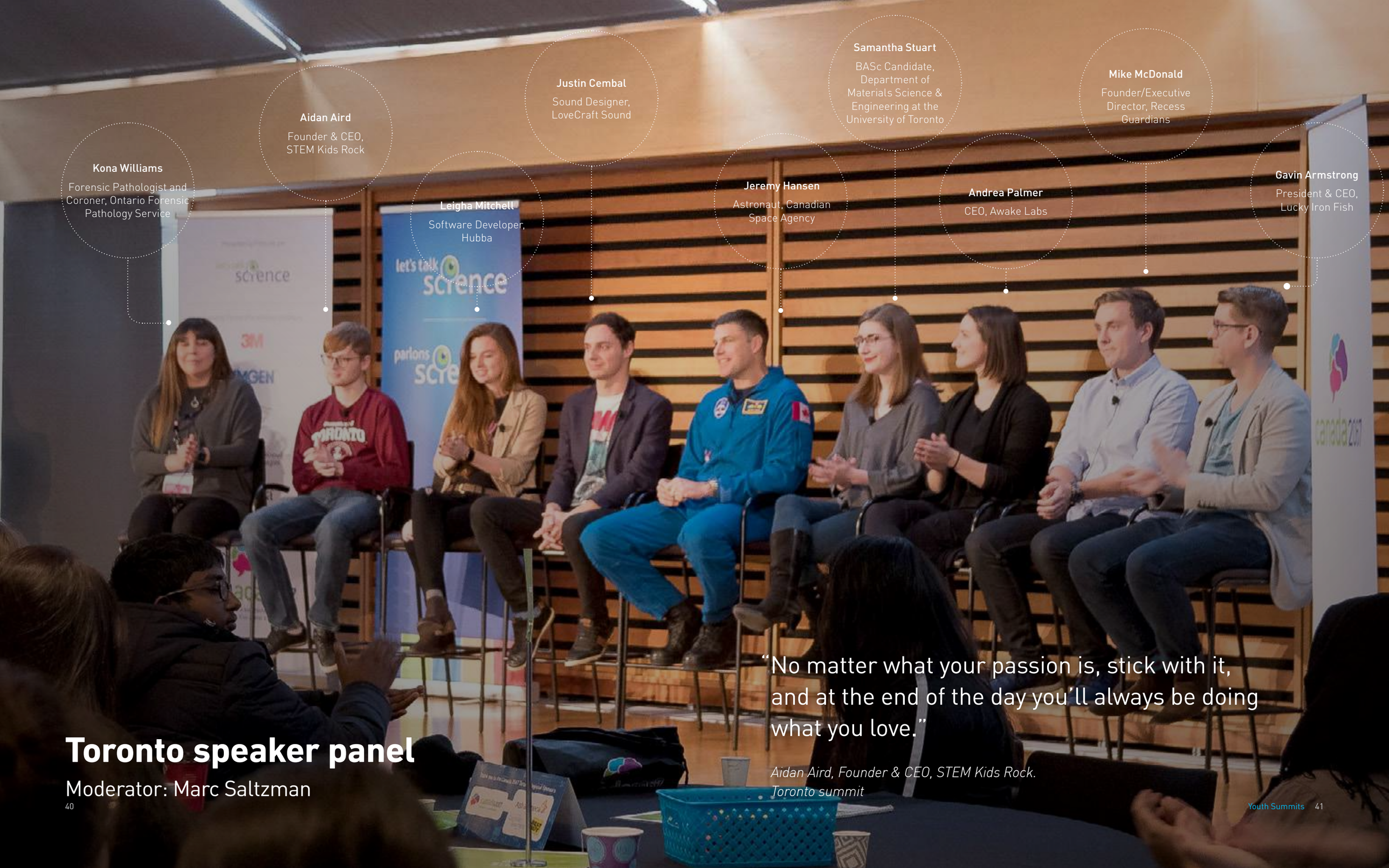
Alex Gillis
Chief Operating Officer, Spot Systems

Vancouver speaker panel

Moderator: Jonathan Woodward

"My passion is exploration, asking the question why and stretching our boundaries of technology. In my world that has meant learning science and engineering, but really the bottom line of this all is following your passions and making a difference in the world."

Margarita Marinova, Senior Mars and Vehicle Systems Development Engineer, Space X. Vancouver summit

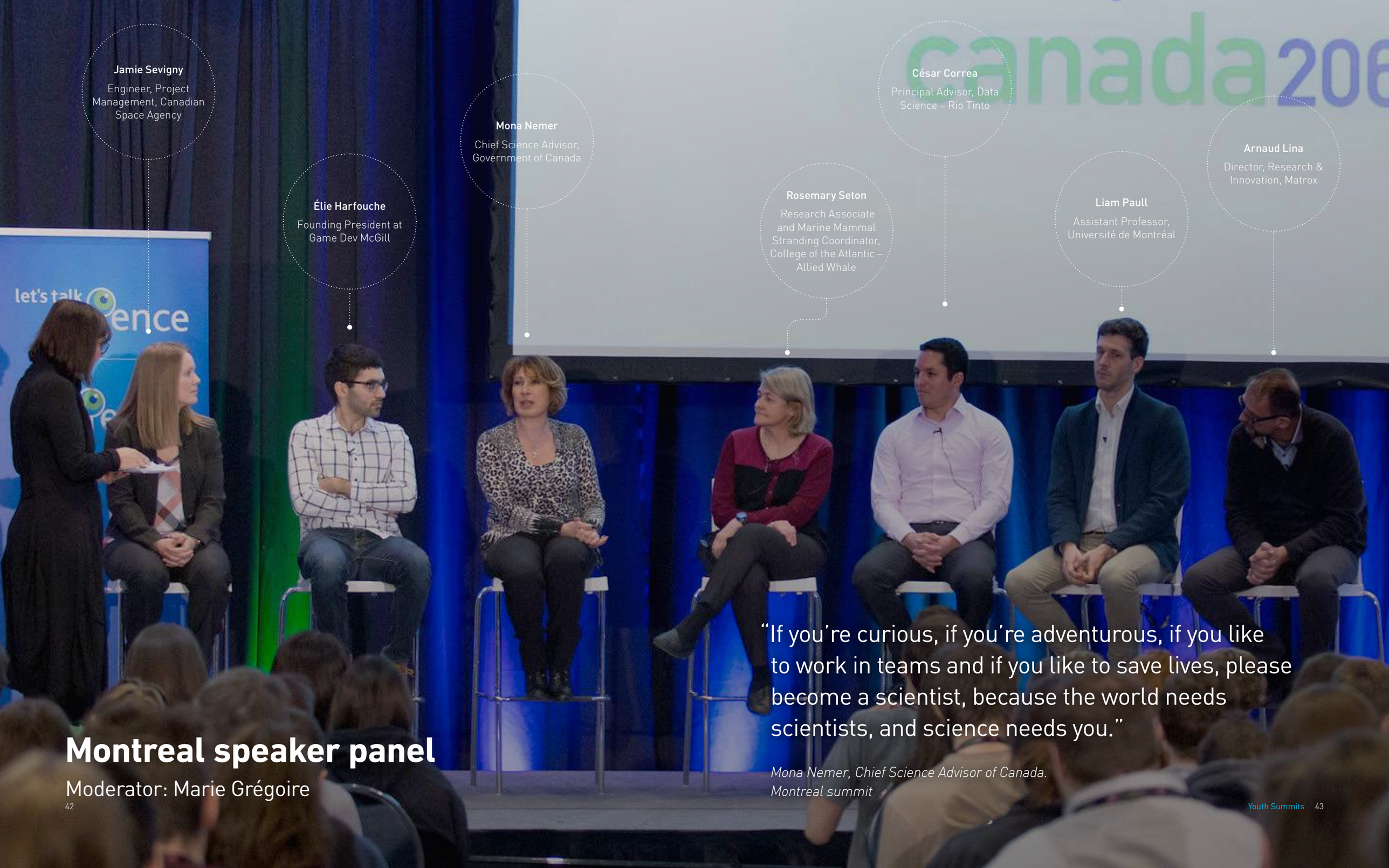


Toronto speaker panel

Moderator: Marc Saltzman

"No matter what your passion is, stick with it, and at the end of the day you'll always be doing what you love."

Aidan Aird, Founder & CEO, STEM Kids Rock. Toronto summit

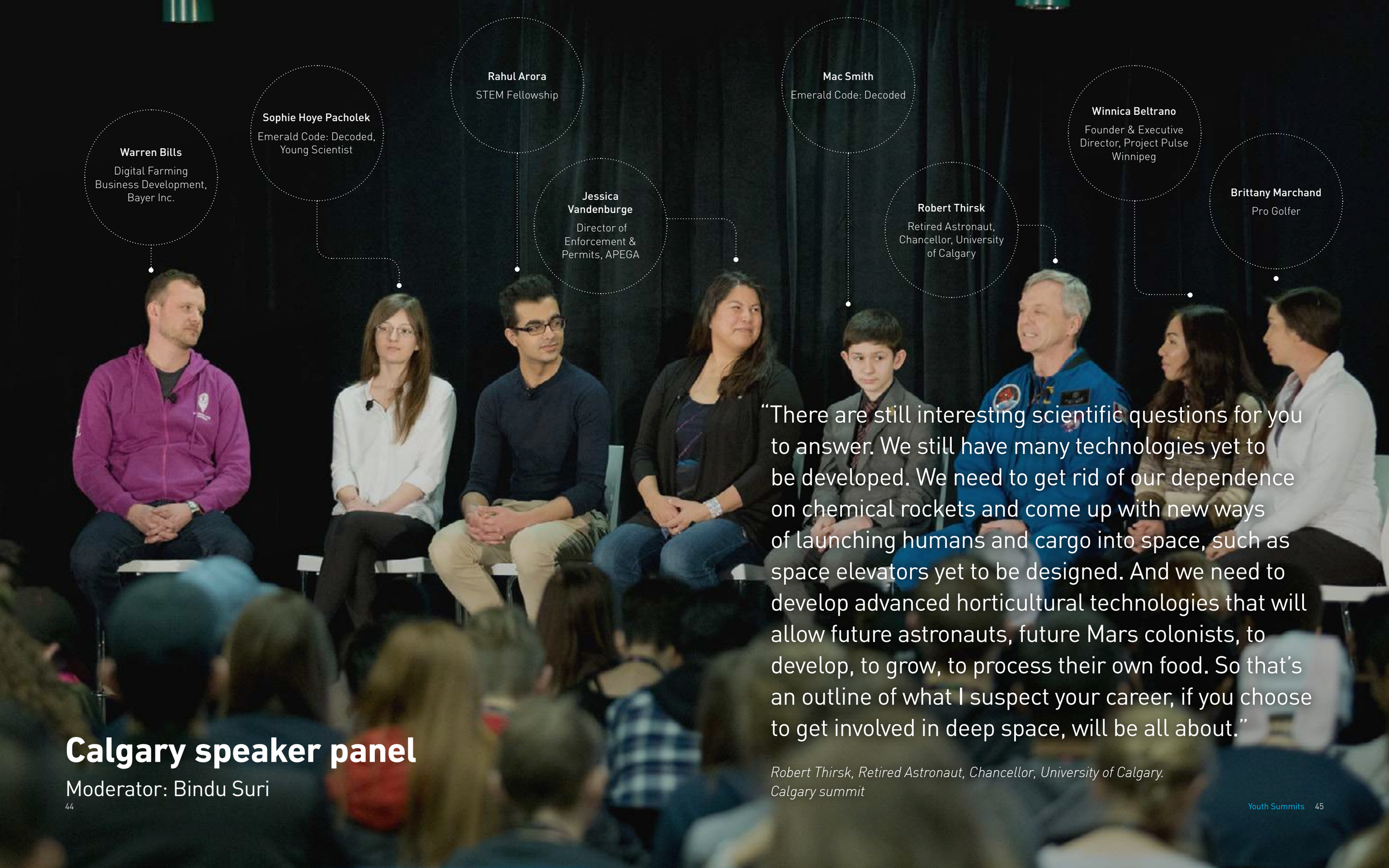


Montreal speaker panel

Moderator: Marie Grégoire

"If you're curious, if you're adventurous, if you like to work in teams and if you like to save lives, please become a scientist, because the world needs scientists, and science needs you."

Mona Nemer, Chief Science Advisor of Canada. Montreal summit

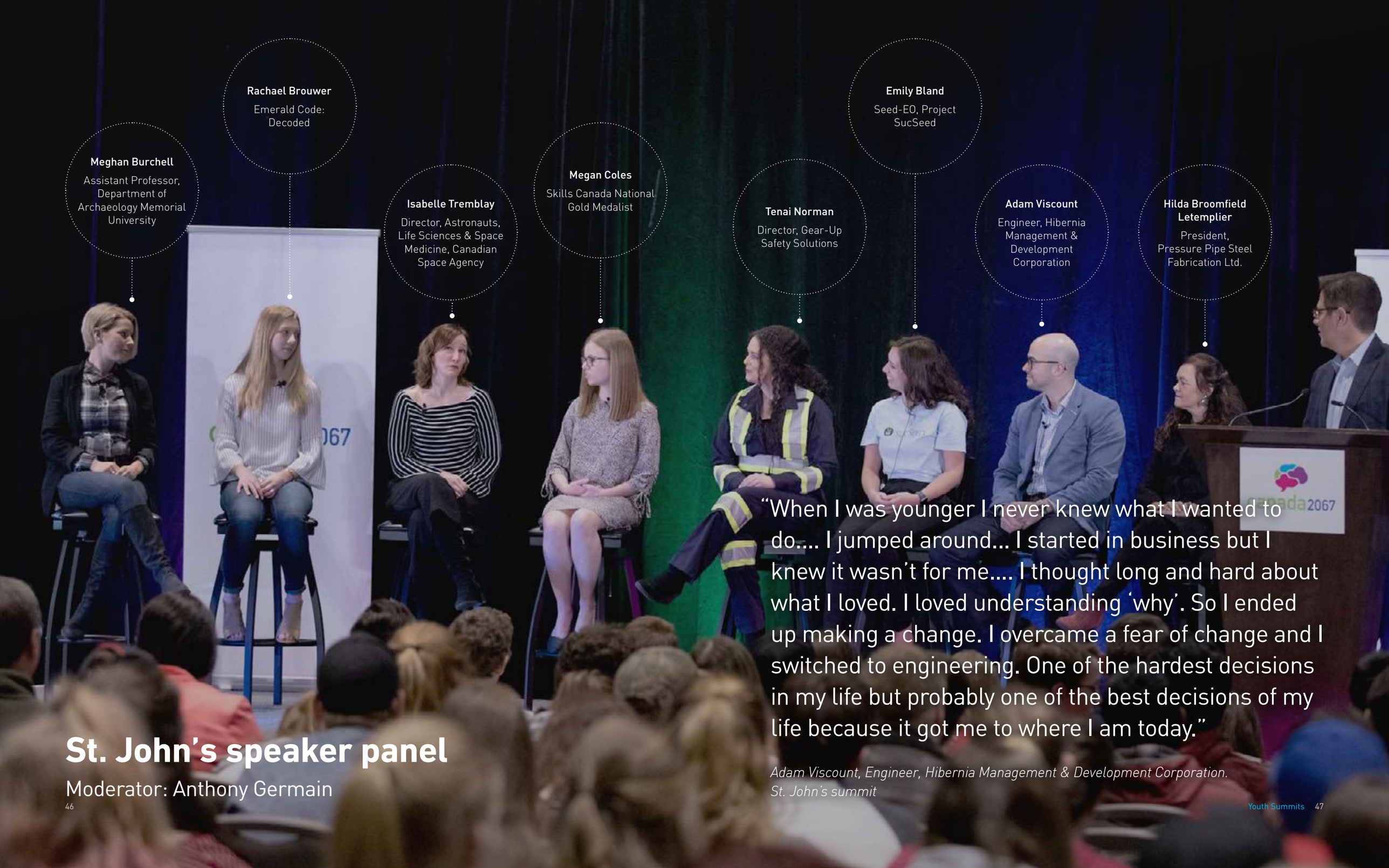


Calgary speaker panel

Moderator: Bindu Suri

"There are still interesting scientific questions for you to answer. We still have many technologies yet to be developed. We need to get rid of our dependence on chemical rockets and come up with new ways of launching humans and cargo into space, such as space elevators yet to be designed. And we need to develop advanced horticultural technologies that will allow future astronauts, future Mars colonists, to develop, to grow, to process their own food. So that's an outline of what I suspect your career, if you choose to get involved in deep space, will be all about."

Robert Thirsk, Retired Astronaut, Chancellor, University of Calgary. Calgary summit



St. John's speaker panel

Moderator: Anthony Germain

"When I was younger I never knew what I wanted to do.... I jumped around... I started in business but I knew it wasn't for me.... I thought long and hard about what I loved. I loved understanding 'why'. So I ended up making a change. I overcame a fear of change and I switched to engineering. One of the hardest decisions in my life but probably one of the best decisions of my life because it got me to where I am today."

Adam Viscount, Engineer, Hibernia Management & Development Corporation. St. John's summit

Design charrette

To meaningfully engage youth across the country in imagining the future of STEM education, Let's Talk Science engaged Groundswell Projects and the Institute without Boundaries to design a charrette experience.

WHAT IS A CHARRETTE?

A charrette is an intense, collaborative, creative process that encourages participants to tackle complex challenges over a condensed period of time using creative thinking and inquiry-based problem solving. Charrettes offer a framework for problem solving that encourages participants to step outside their comfort zone, gain new perspectives and imagine possibilities for the future.

This leveraged a design thinking methodology and user-centred design approach to develop a unique experience for students that would challenge them to think creatively, critically and collaboratively. The charrette was developed to help students break free from the confines of traditional thinking and draw on their imagination and expertise as students to imagine the components of a new education system.

To achieve this, a unique narrative was developed for the students that challenged them to imagine a new school on Mars: Mars Startup School. Following the STEM Talks, the charrette was launched at each event with a Mission Statement:

Mission statement

You have a unique opportunity to design the education system from the ground up as a new society on Mars is being established. While your school on Earth may be characterized by desks and blackboards and an 8:45 am start-time, the Startup School on Mars can be anything you want it to be! It should reflect your wants and needs as students, tapping into your personal experiences to inform how the Startup School will improve the educational experience for everyone.

However, it's not just about making school enjoyable. The world is changing and you have a responsibility to create a school that prepares students to join the workforce now and in the future. Research shows that 70% of jobs by 2020 will require a foundation in STEM (science, technology, engineering and math) and currently fewer than half of all students are pursuing senior credits in STEM .

As students, you have the creativity and knowledge that can help create a better education system. We're looking to you to design the pieces that fit together to make up the transformational "Mars Startup School".

This mission requires courage, curiosity and creative thinking.

Design challenges

Designing the Mars Startup School included five challenge areas. These challenges were developed in alignment with the Canada 2067 pillars and encouraged students to reimagine components of the school system, including:

EVALUATION

(How we Learn)

Report cards are the current standard to document and demonstrate academic achievement. However, this is just one approach. To imagine new approaches for evaluation students were challenged to design a new report card, including how students' skills and growth will be evaluated and communicated.

TOOLS & SPACES

(How we Teach)

Classrooms are characterized by four walls, desks, blackboards and notebooks. These are the tools and spaces that make up much of the learning experience, but they have not adapted to technological or societal changes. Students were challenged to design new learning tools and spaces that enhance the STEM learning experience and prepare them for the future.

THE PROGRAM

(What we Learn)

The current educational experience is organized by subject areas and specializations, and student abilities are often measured through testing and memorization rather than process, integration and application. This challenge encouraged students to imagine new STEM programming that aligns with their interests, responds to global challenges and promotes 21st Century competencies such as problem solving, collaboration and critical thinking. This included a vision for the content and structure of the program to better align with student needs and wants.

MENTORSHIP

(Who's Involved)

Students look to their friends, teachers, family, members of the community and aspirational figures for support and inspiration. These mentors help students navigate the school experience, stay healthy, happy, motivated and prepare them for life, but the mechanisms that allow students to connect to mentors, and the types of support that students need vary. This challenge encouraged students to identify a team of people that will help achieve personal and academic goals and design a mentorship program that helps students connect with important support mechanisms.

PATHWAYS & BRIDGES

(Where Education Leads)

In schools today, teachers, guidance counsellors, careers class, digital tools, friends and family help students make decisions about their future. Yet, figuring out what comes after high school can be extremely challenging. This challenge encouraged students to imagine a new bridging experience that would help them transition from high school into higher education, entrepreneurship or work.

Although the Mars Startup School asked students to envision a school system of the future, these challenges were specifically designed to draw on students' lived experiences, providing insight to their current wants and needs, as well as the opportunities they see for creating a more engaging education system that aligns with their values, motivations and aspirations.

Together, these challenges provided a framework to create a holistic vision for a new school system.

CHARRETTE PROCESS

To work on the five unique challenges, students were divided into teams of 8-10. Each regional summit consisted of 20-25 student teams, which were led by facilitators. Facilitators included speakers from the STEM Talks, Let's Talk Science volunteers and local stakeholders who helped the students work through the charrette process and document their ideas.

A number of materials were also provided to the charrette teams to help them tackle their challenges and guide their process to develop ideas. The charrette process consisted of the following steps:

1

MEET YOUR TEAM & DEVELOP A VISION FOR THE MARS STARTUP SCHOOL.

The first step of the charrette process encouraged students and facilitators to get to know each other. Teams were strategically created to be diverse — bringing together students from different schools, balancing gender and ethnicity to encourage broad perspectives and foster new connections.

Students were asked to share their skills and kick-start their creativity by developing an overarching vision for the Mars Startup School. This encouraged them to think freely and imaginatively prior to tackling their specific challenges.

2

INTRODUCTION TO THE DESIGN CHALLENGE & DEVELOPMENT OF DESIGN CRITERIA.

Teams were then introduced to their specific challenges and provided with worksheets that included a series of prompts to facilitate brainstorming. These prompts were unique to each challenge and provided a framework for developing design criteria that highlighted student wants, needs and opportunities in developing a new education system.

3

CONCEPT DESIGN: DESIGNING THE COMPONENTS OF THE MARS STARTUP SCHOOL.

Building upon the design criteria, teams developed concepts for the particular challenge they had been assigned. These concepts uncovered student-led visions for a new education system and included a combination of written descriptions, diagrams and sketches that demonstrated their ideas. Additional worksheets were provided to help them through this process and capture their insights in a consistent format.

4

SHARE: PRESENTING IDEAS TO SHAPE THE FUTURE OF EDUCATION.

Through creative writing, sketches, timelines and diagrams, each team summarized the challenge that they worked on and the key ideas they developed throughout the process. This was captured on a consolidation poster and each team presented their final ideas to their peers. Presentations were organized in Mars Startup School zones that included challenges one through five. This enabled students to gain insight to the other challenges and imagine how they might fit together to create a holistic vision for a Startup School.

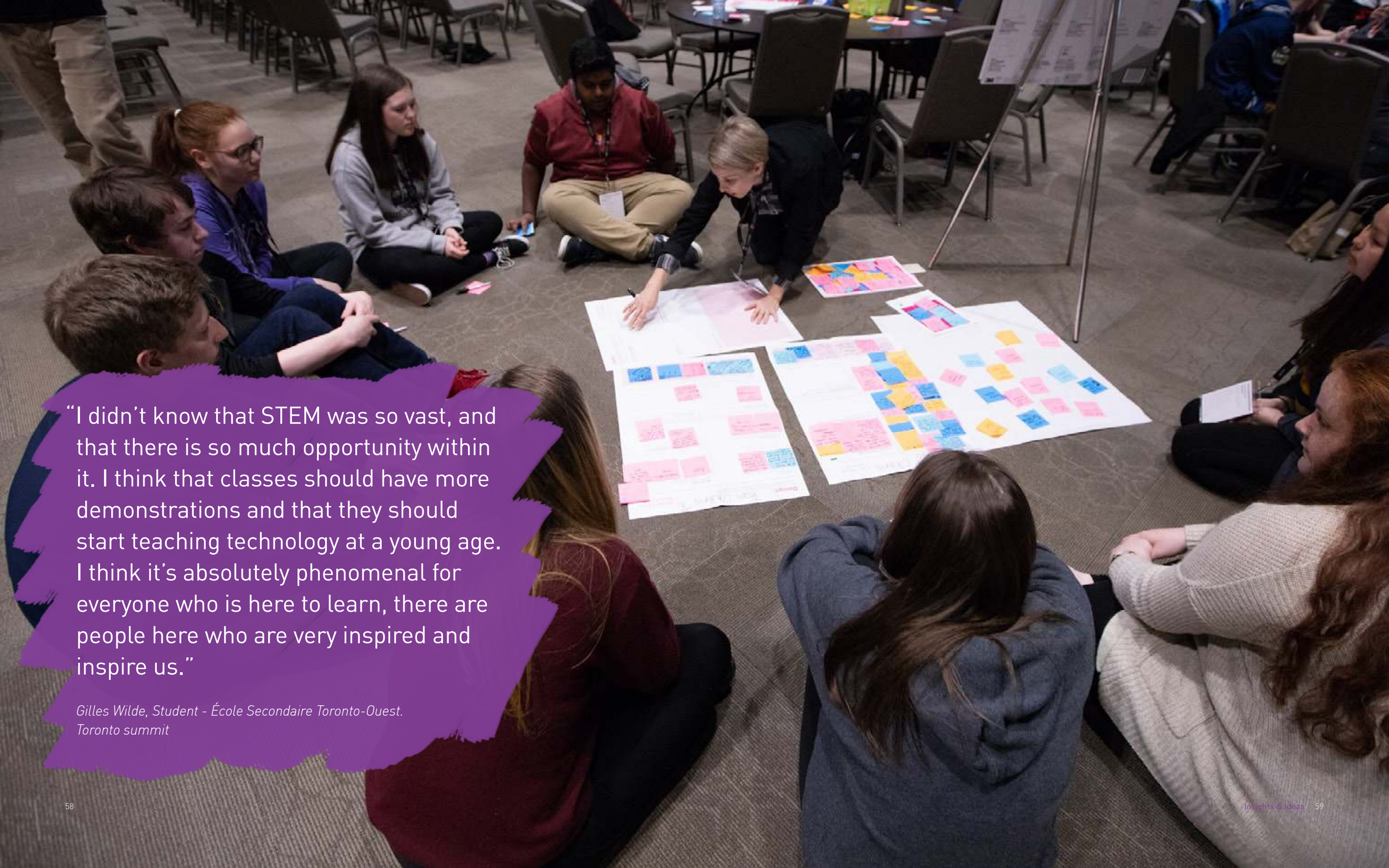
- The content that emerged from these challenges was consistently captured and documented in each of the five cities visited. It was used to develop the insights and project showcases that highlight the participants' visions for the future of education.

Section 3

Insights & Ideas

Thousands of ideas and hundreds of unique concepts from 125 student teams across Canada synthesized into 10 common insights that present a youth-centred vision for the future of education.

After extensive consultation with students across the country we reflected, analyzed and synthesized what we heard. In doing so, we observed ten unique themes that were consistent across Canada. This section provides a summary of the methodology we used to analyze the ideas, the ten themes that emerged and a series of student projects from each city that responded to the charrette challenges.



"I didn't know that STEM was so vast, and that there is so much opportunity within it. I think that classes should have more demonstrations and that they should start teaching technology at a young age. I think it's absolutely phenomenal for everyone who is here to learn, there are people here who are very inspired and inspire us."

Gilles Wilde, Student - École Secondaire Toronto-Ouest. Toronto summit

Insights

In reviewing thousands of ideas generated by students with such diverse experiences, we were astonished by the alignment and repetition of ideas across the country.

Equally astonishing is the alignment of these findings with global trends in youth leadership and STEM education. This summary of insights reflects the voice of Grade 9/10 Canadian students and their vision for change in the education system.

The findings describe STEM perceptions and proposed pilot projects that are tailored to students' needs. Teachers, parents, administrators, policy makers, government officials, community partners, and students themselves can use this qualitative research to shape new approaches to STEM education in their own communities.

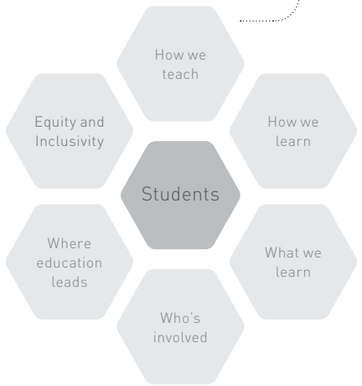
METHODOLOGY

A design research methodology was used to approach the Canada 2067 engagement process. This qualitative research methodology involves research participants in the study of their own experiences and uses creative frameworks that foster collaboration, imagination and systems thinking to create solutions to complex problems.

Rather than ask students to "fix STEM education", we asked them to design a Startup School on Mars, a place where there are no boundaries and where they are free to imagine new possibilities that aligned with their interests, wants and needs. This is an important distinction from quantitative research or traditional consultation. The results included thousands of data points collected by the research team.

Thousands of Post-it notes and hundreds of posters were catalogued and transcribed to record ideas, designs and drawings from the students. Researchers tagged the data, counted the frequency of repeated ideas and summarized the ideas that emerged in response to the charrette challenges.

This information was analyzed and insights developed about the student ideas and projects. Ultimately, summaries from all youth summits were further distilled to create a national picture, describing the patterns that emerged across the country. The key insights are clustered under the **Canada2067 pillars**.



NOTE FROM THE RESEARCH TEAM:

Although we were struck by the similarities and uniformity of the wants, needs and ideas of the students from across the country, we did note a few distinct regional perspectives that are worth mentioning.

Vancouver – Students often included the environment as a key criteria when designing their solutions across all challenge areas.

Toronto – Diversity and equity as well as financial literacy (and a heightened awareness of education spending) stood out as unique values and important considerations for these students.

Montreal – The role of the education system in fostering and protecting culture was key in Quebec.

Calgary – Personalization and customization were very important. Students asked for individualized teaching in response to their unique needs.

St. John's – Local community and challenges related to the physical geography of the province (including remoteness, access and affordability) underlined many of these students' ideas and design concepts.

How we Teach

1. Personalization & customization

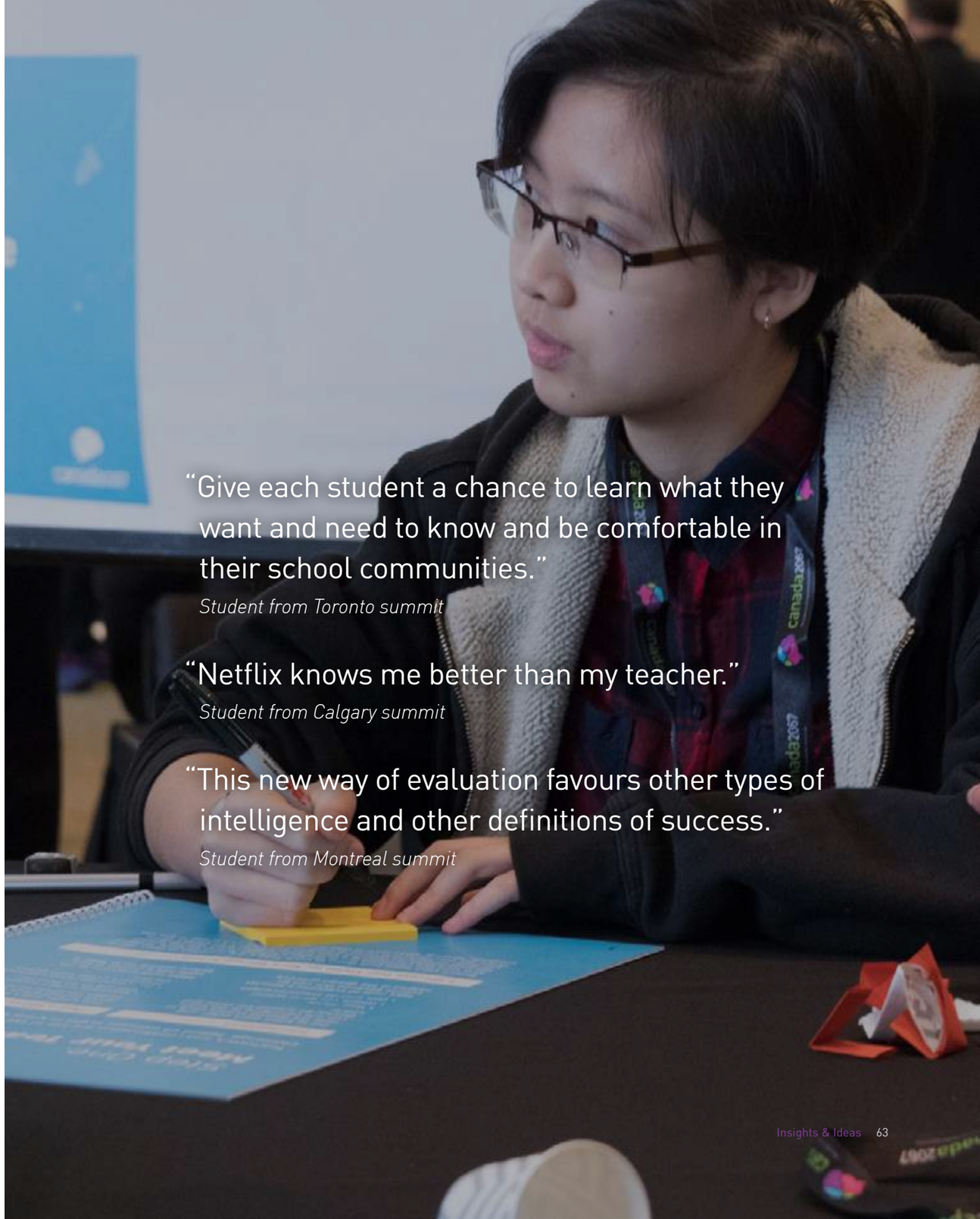
The future of STEM education doesn't look the same for every student.

Across the country, students want help from their teachers to understand their unique learning processes and create custom learning experiences. They want space and time to explore their passions at school. Right now they are having trouble feeling motivated by the curriculum and wish their interests could be used more often to drive their learning journeys.

They are also seeking more frequent and richer interactions with their teachers. Their preference is for one-on-one time to really get to know each other. They believe that if teachers got to know them better, they could adapt both curriculum content and their teaching styles to suit students' learning styles. This approach would be complemented with a variety of ways to share information including audio, visual, video, interactive, participatory, and through the latest technologies.

Students are seeking learning opportunities that accommodate the different pace and needs of individual learners.

Personal and custom evaluation would start by capturing the goals of individual students, their effort and progress, as well as their mastery of curriculum expectations. This customized profile would be used as valuable data, compiled over their entire school career, to help students understand how their aptitudes and interests connect with different education possibilities and ultimately to post-secondary pathways and the labour market.



How we Learn

2. Collaborative participation

Students want to be active agents in their own education.

Students understand the world is changing at an unprecedented rate and they know adults don't have all the answers. But they aren't scared! They are enthusiastic about the opportunity for school to be a learning environment for everyone, including teachers, administrators and students.

This learning environment would be one where students actively participate in developing education strategy, choosing what courses are offered, how the curriculum is explored, building their timetables and contributing to the design of their personalized course of study.

In this collaborative environment, students would participate in setting their own learning goals and tracking their progress in deep and meaningful ways. This could be achieved through self-evaluation, peer-to-peer evaluation, and through connection with their teachers.

In addition to traditional evaluation, they would collaborate with other students and teachers in their course exploration and during extracurricular activities – and their effort would also be included in their evaluation. Students also value individual work and want time to work independently.

3. Technology everywhere

The future of STEM education embraces technology.

When it comes to technology, students feel schools are being left behind. Many aren't allowed to use their smartphones or access the Internet in class; often they are using the same technologies their parents had in school - chalkboards, textbooks and calculators. For example, though a student today may have learned an alternative method for trigonometry online, they may not be allowed to use that method in class, and that makes them frustrated and discouraged.

Their dream is for the latest technologies to be accessible by all students and used to enhance their ability to learn. There are several ways they envision this happening:

- Students are looking for technology to improve the process through which they learn.
- They believe technology can help them understand themselves and improve their relationships with others. Many students in every city talked about struggling with this.
- Students cite that technology can open up their schools to the world and to unlimited opportunities to access experts and experience possible pathways globally.
- In terms of evaluation, new technology could post their progress online - accessible 24 hours a day, 7 days a week.
- Students want digital evaluation tools that capture their learning journey from the start, and organized in such a way that it's easy to understand, presented visually and uses percentages rather than letter grades.

"We learn best when we are involved in designing our own learning."

Student from Vancouver summit

"Involved in every step of the way."

"Co-developers, co-constructors of program."

Students from Calgary summit

"Choose our own standard and then be held accountable for reaching it."

Student from Toronto summit

"It's weird to use paper to learn advanced robotics."

Student from Toronto summit

"Tech makes learning: quicker, interesting, faster... Using tech will help advance your learning ability."

Students from St. John's summit

"Improve student life by focusing on traditional aspects & making them more advanced."

Student from Montreal summit

What we Learn

4. Changing the arc of education

STEM learning could change the entire approach to schooling, starting in the early years.

Across the country, students talked about how in the primary grades, everyone should develop foundational STEM skills. In middle school the focus should be on self-discovery and building social and emotional skills. By high school, students should explore and apply STEM on specialized projects.

Currently, they are not motivated by the focus on theoretical learning in high school and suggested re-examining the journey from the start. Independently, students in five provinces proposed similar structures: develop an early STEM foundation in primary grades giving students the language with which to explore; in Grades 6-7 the focus would switch to self-development including discovery, social and emotional skills (life skills) and ultimately, actualization.

By Grade 8, students would have the foundational skills and passions to guide them in practicing specialized, applied STEM learning.

In high school, this new approach would include:

- Regular exposure to experts in the community for learning and networking opportunities.
- Regular exposure to possible pathways through presentations, immersive workshops and field trips.
- Full integration of job experience programs like co-ops and apprenticeships.

5. Experiential learning

Students would be motivated to learn and develop competencies by connecting STEM concepts to real life problems in a hands-on way.

Students are urging us to imagine the future of STEM as integrally connected to the arts and humanities. In fact, they want to collapse disciplines and teach subjects in an interdisciplinary way - much like inquiry or studio based methods.

Using real problems to teach concepts would allow students to deepen their understanding of foundational theories through application. In this approach, there are no fixed solutions and learning relies on hands-on methods to discover new and innovative outcomes, much like the contemporary workplace situations into which students will graduate.

Students who have consistent opportunities for learning outside the classroom will be exposed to real world problems and to real world practitioners working on solutions. Students believe this exposure will help them develop self-confidence. Evaluation of this type of learning would include student effort, behaviour and improvement. In turn, marks would lose their current stronghold in defining one's identity.

"We want to ensure our students get the best open education they can possibly get with an open curriculum."

Student from St. John's summit

"It would be super helpful to always understand how the courses connect with one another."

Student from Vancouver summit

"A variety of different options in STEM based fields. To learn new experiences in specific topics and areas of interest."

Student from Calgary summit

"Labs help get a real understanding and apply your knowledge to real life situations."

Student from Calgary summit

"Applying learnings and sciences in life."

Student from Montreal summit

"Teach students how to apply their knowledge and let them practice solving problems."

Student from Vancouver summit

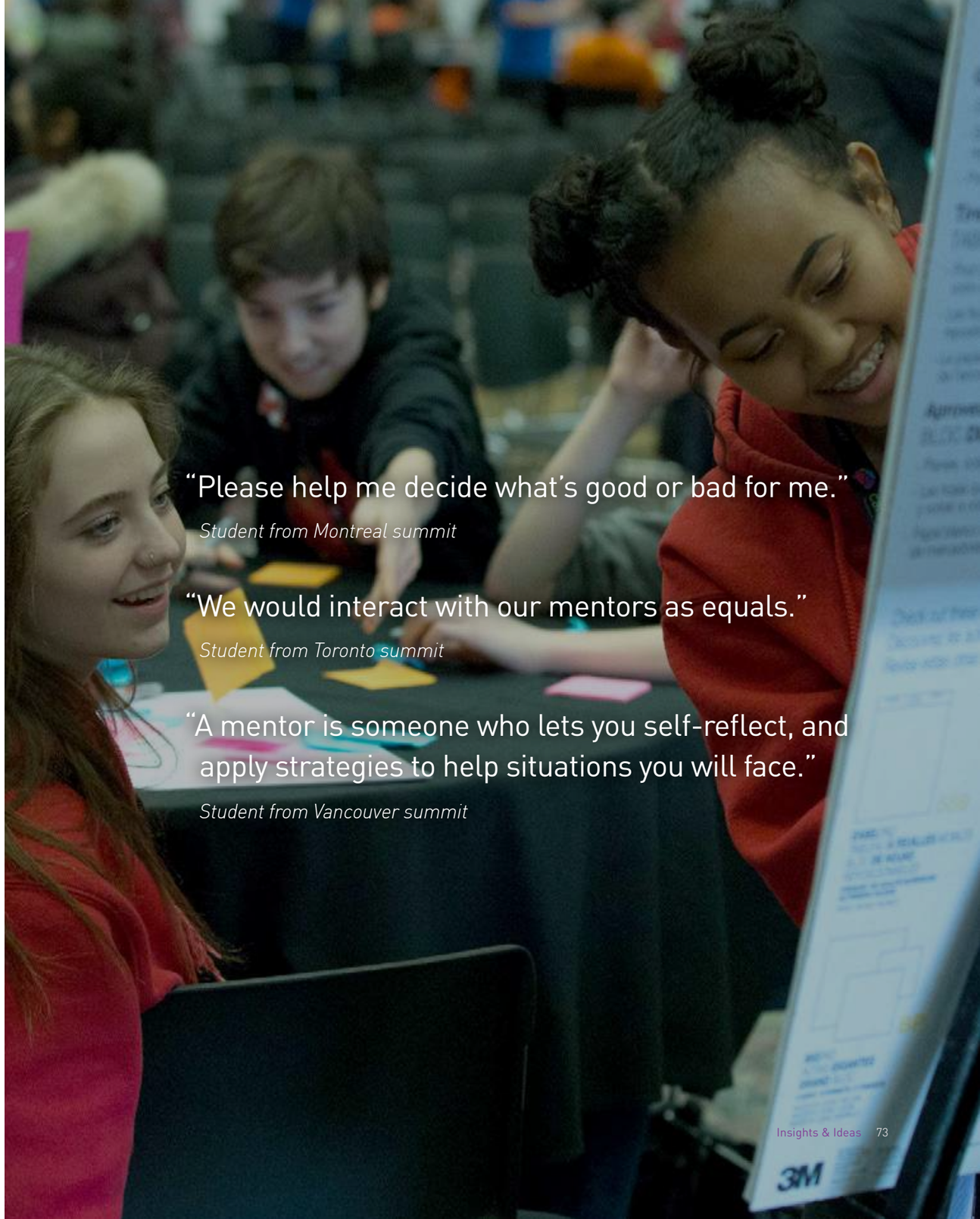
Who's Involved

6. Mentorship

Students crave relationships with caring and trustworthy adults and consistent exposure to experts outside of school.

There is a great need for mentorship programs. When asked to imagine a team of mentors, students across the country talked about non-judgmental, understanding and kind adults or peers who have time to help them figure things out and practice building a healthy life. They want relationships with people who have ample time for them online or in person. They see mentors helping them with various issues, including:

- Navigating the school system and understanding the fundamental act of learning how to learn and interact with teachers.
- Working on social skills and learning to cope with stress and bullies.
- Maintaining their motivation and staying on track.
- Talking about what comes next, including exposure to different pathways and different ways to get there.
- Building healthy mental, physical and emotional lives.



Where Education Leads

7. Critical thinking & problem solving

To be resilient and flexible, students need to develop critical thinking and problem solving skills.

Students want opportunities to practice and improve their critical thinking skills. They are craving exposure to diverse perspectives and the skills to make sense of the ensuing complexity. Students are aware they need to become experts at deconstructing ideas and creating informed points of view that are uniquely their own and at the same time respectful of a larger context. Coupled with this, they are interested in learning and practicing a range of problem solving processes to help them make sense of the world, gain independence and come up with novel and practical solutions.

Because they are so focused on the application of new learning, students believe that critical thinking and problem solving should be linked to activities they will face once they are on their own, like taxes, deciphering the news, negotiating rent, professional networking and preparing meals. They stressed the need to formalize post-project reflection about new learning and new processes they encounter. Students are looking for opportunities to practice sharing their ideas and reflecting on their learning across many media.

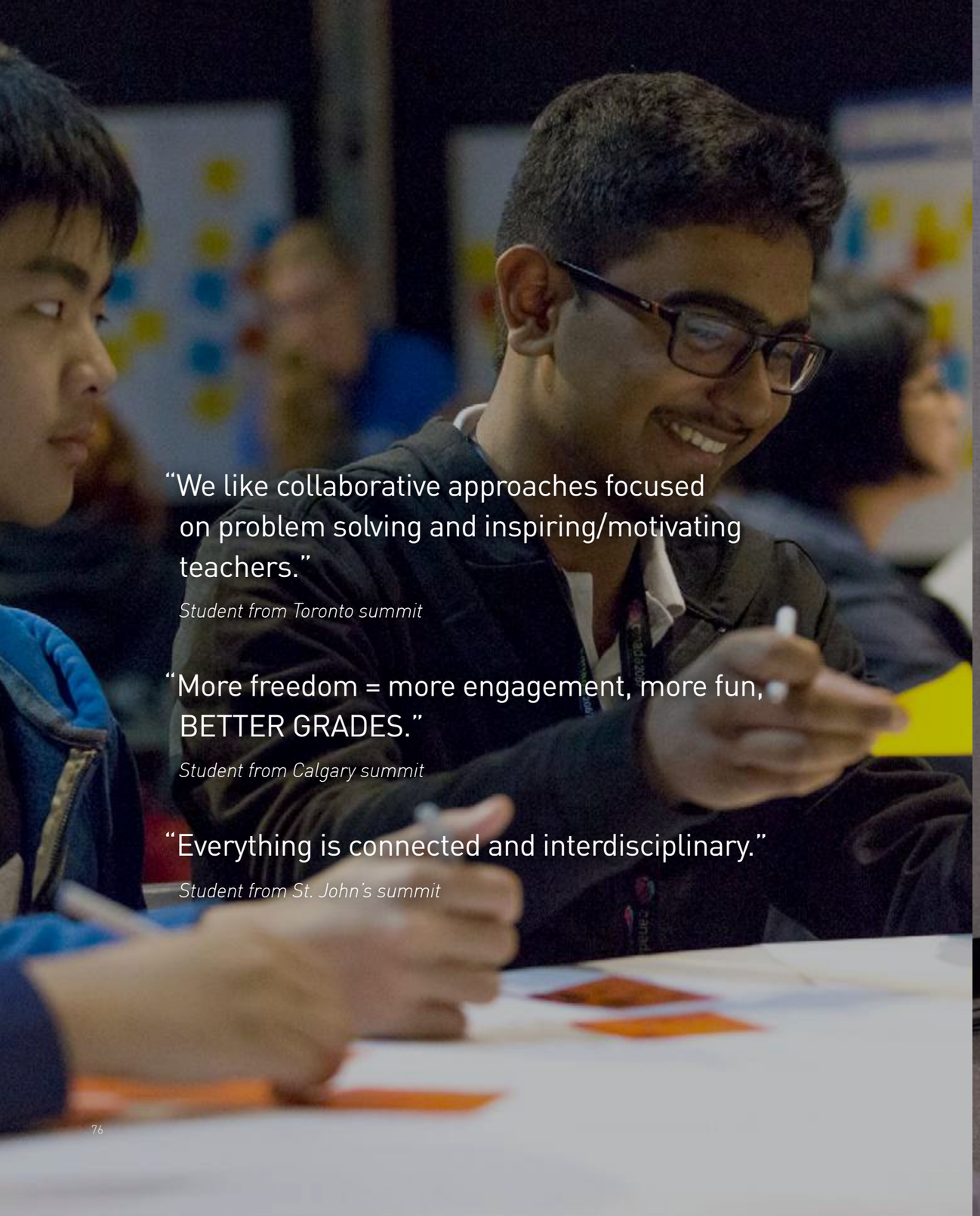
They want to make verbal presentations and written compositions. They also want opportunities to practice making, prototyping or building their concepts. This focus on critical thinking, problem solving and reflection will help students comprehend complex ideas, refine their own place in the world and share their thoughts, using basic and digital literacy skills.

8. Self-awareness & direction

STEM education will help students develop self-awareness in order to manage their own improvement and move toward new directions.

High school is a time for self-discovery. Students are deeply focused on figuring out who they are, what the world is like and how they fit in to it; they are seeking help on all three fronts. Across Canada, students emphasized the need to learn to recognize their own personal strengths and weaknesses so that they can create a plan to develop their strengths and improve their limitations. Ultimately, they want to connect their academic skills, character traits, passions, behaviours, values and aptitudes to the job market.

They see this happening through frequent feedback and self-led evaluation that promotes peer-to-peer interaction and is managed in collaboration with their teachers. The feedback would give specific direction for growth and help drive a personal improvement plan. It would give ample opportunity to practice making small and big choices about their lives and time and space to evaluate their choices. Coupled with relevant and clear information about the labour market through connections to experts, government data made digestible for teens, and programs that give on-the-job experiences, students would be in a position to be confident about making informed decisions about their future.



"We like collaborative approaches focused on problem solving and inspiring/motivating teachers."

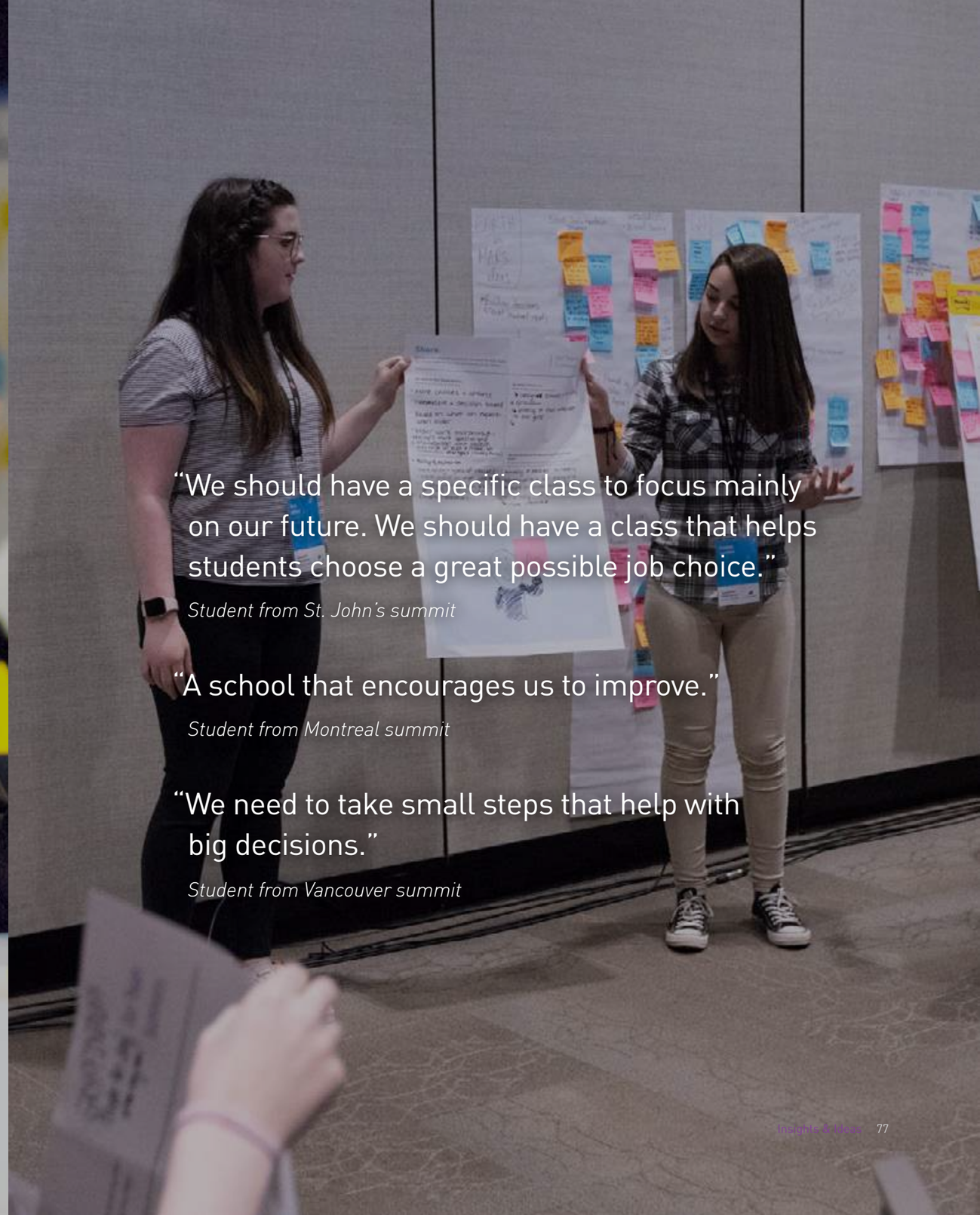
Student from Toronto summit

"More freedom = more engagement, more fun, BETTER GRADES."

Student from Calgary summit

"Everything is connected and interdisciplinary."

Student from St. John's summit



"We should have a specific class to focus mainly on our future. We should have a class that helps students choose a great possible job choice."

Student from St. John's summit

"A school that encourages us to improve."

Student from Montreal summit

"We need to take small steps that help with big decisions."

Student from Vancouver summit

Equity and Inclusivity

9. Well-being

A culture that supports feeling good in your own skin and developing the skills to help others feel good in theirs.

Being a teenager is one of the hardest times in life and students across the country are feeling the weight of stress. They are calling for something healthier. They want a school system where the happiness of students, teachers and administrators is paramount. They want school culture that is supportive, encouraging and inspiring; they want to be in a place where diversity and inclusion are practiced and cultivated.

Students want schools to be the places where they learn how to become contributing citizens in a just and equitable society. Looking inwards, individual students need help learning how to cope with stress in a destigmatized environment where mental health is integral to overall health.

Looking outward, they hope to build communities where they can share their journey and help one another. They are looking for schools to be safe places that support everyone to learn social and emotional skills.

This holistic vision for healthier schools includes access to healthy and affordable food, frequent breaks for movement and rest, and flexible schedules with later start times in harmony with the circadian rhythms of teens.

10. Space & comfort

Students wish for safe, clean, bright and inspiring spaces.

Students are requesting safe schools. They want schools to be places of respect where they can feel free to be themselves, where they're free from bullying, free from judgement and free from environmental hazards. Across the country, students are requesting more natural light, access to nature and cleaner schools. They want large, flexible spaces that support many uses as well as many different types of space including labs, maker-spaces, kitchens and libraries.

There would be spaces designed to connect socially and facilitate 'hangout and chill-time', places to work in solitude and in collaboration. Buildings would provide more space per student and smaller class sizes. In addition to their desire for cutting edge technology, students want environmentally responsive and sustainable buildings.

"We need time and space in the day to be a human."

Student from Vancouver summit

"We want a comprehensive education that makes us mentally/emotionally strong and academically prepared."

Student from Toronto summit

"Better education around mental health and illness as a way to combat the stigma around the subject"

Student from St. John's summit

"Learning at your own pace helps comfort and understanding."

Student from Montreal summit

"A relaxing environment can make students more motivated to learn... Focus will improve when students are more comfortable."

Student from St. John's summit

"Make organizing and learning more comfortable and efficient."

Student from Calgary summit

Teacher project showcase

At one summit, teachers participated (separately) in the same charrette process as their students. Interestingly, their insights aligned with the youth perspectives, reflecting many of the same priorities as students. This section provides a brief summary of what emerged from the consultation conducted with teachers.

DEVELOPING ALL SKILLS

Just like the students, teachers found that too much emphasis is put on grades, and not enough on skill development. They pointed out that often they do not even have the time to ask students to demonstrate a skill and evaluate it. Furthermore, they felt that the system does not reflect the skills that are needed. These teachers envisioned a digital portfolio that would collect evidence provided by students through projects that allowed them to be creative and apply their problem solving skills. The portfolio would be a flexible tool, always accessible and continually updated, that would feature descriptive feedback, concept mapping and a mentoring component to better represent students' abilities and passions, and help them achieve their goals.

SOLUTION-BASED CLASSROOMS

As the students overwhelmingly demonstrated an interest in experiential learning and collaboration, the teachers imagined "solving real world problems with resources at hand." They designed "solution-based classrooms," - a series of adaptable "centres" that would allow students to explore, experiment and apply their problem solving skills while working together to create and synthesize in an interdisciplinary environment. These classrooms would also be flexible in meeting the needs of different learning styles. The centres would surround a common area, a "forest," that would incorporate nature and light to enhance student comfort and well-being.

TEACHERS AS FACILITATORS

The teachers seem aware that students are stressed by their fears of failing at school and want to be more engaged in curriculum development. They suggested student-centred learning that is collaborative and allows students to face challenges as a group, while teachers act as facilitators. The program they envisioned would help students develop transferable skills such as problem solving first, then process skills - with an emphasis on embracing failure - and finally hard skills that are relevant and applicable in real world scenarios. This system would be self-directed and flexible, offering a wider variety of delivery methods, a focus on achieving success rather than simply passing or failing a class, and less physical structure and time constraints.

LEARNING FROM EACH OTHER

Student-centred design was at the core of the teachers' vision of mentorship. While seeing themselves as facilitators, they imagined mentors to be experienced multi-taskers, able to support the students, communicating clearly with them, and showing empathy and understanding. More importantly, they saw them as "co-learners". In the system the teachers envisioned, mentors and students would learn from each other, going at the same pace (the students would have the option to customize the delivery of programs), while relying on inquiry-based learning to integrate science, technology, engineering, math and arts into the curriculum.

ENCOUNTERING POSSIBILITIES

In the student-driven school envisioned by the teachers, what comes after high school is an exploration focused on student interests and passions rather than connected to curriculum. This environment values and promotes self-awareness and direction, and pushes students to take responsibility for their own futures. Mentors in and outside of the school, as well as better access to career resources, would support student choices.

Student project showcase

The following projects showcase some of the most innovative and unique ideas that emerged in response to the design challenges that were described on page 50.

These student-designed projects are organized by the cities in which they emerged and provide insight to the creativity, thoughtfulness and level of engagement at the Canada 2067 Youth Summits. Each project is unique and highlights the diversity of ideas generated across the country.

We hope these ideas inspire action!

VANCOUVER PROJECTS

SUBJECT FEST 2067

Hands-on experiences and teamwork to foster innovation

Canada 2067 Pillar: What We Learn

This project focused on students' health, innovation and diversity, proposing a learning environment that encourages interaction and pushes "students to become thriving members of society." This new learning environment included tools and spaces that are flexible, engaging, and can accommodate experiential learning.

There was specific emphasis on problem solving and teamwork, which could be achieved through a series of "practical" activities and "challenges" that pique their interest—allowing students to be creative and apply their learned skills. More specifically, collaboration was seen as a way to foster critical thinking and to feel less stressed and more welcomed.

The final design solution proposed a "Festival of all subjects" every two months, where they take experiential learning outside of the classroom and interact with the world beyond school.

#STEMFORLIFE

Embracing STEM innovation through mentorship

Canada 2067 Pillar: Who's Involved

A mix of independence and collaboration are at the core of the mentorship program proposed by this team. As they stated: "along with the independent pursuit of mentors and the incorporation of STEM and verbal communication in school, there will be many collaborative connections that will be made to create a relatable educational environment."

They envisioned a school where STEAM (the combination of STEM and Arts) has an "innovative and personal value" and is embraced "almost as a way of life". In this school, mentors provide a network of relationships that help bring students' skills out of the classroom. Friends, family and counsellors would offer emotional and psychological support, but mentors would also offer connections and real life expertise.

Additionally, senior students are involved in the mentorship program, tasked with giving younger students advice on education and career paths.

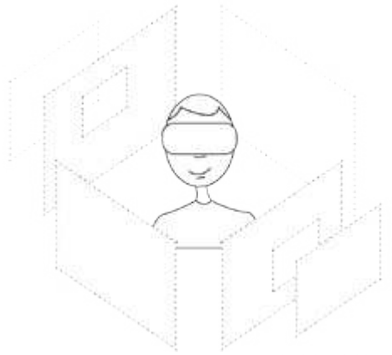
GET OUT

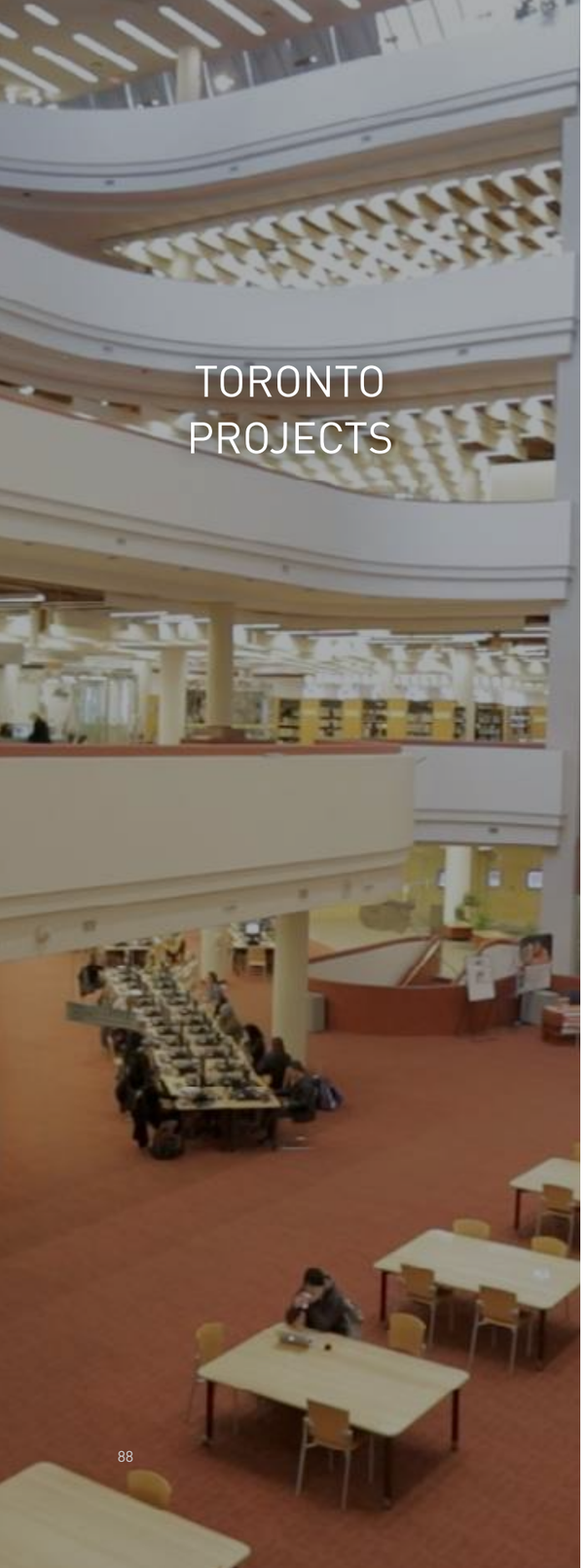
Immersive environments that foster creativity and fun

Canada 2067 Pillar: Equity & Inclusivity

This team had two simple requests: for students to be treated as adults, and for school not to feel like jail. To address this, they imagined an open, comfortable, collaborative school tailored to the individual, a space meant to interest students in an immersive environment that can adapt to different learning approaches and needs.

The students envisioned classrooms designed to foster collaboration and spark discussion, equipped with powerful, up-to-date technology that supports learning and enables STEM related activities. The school itself would be engaging, incorporating areas where students can play and apply skills learned in class. Theirs is a school that students would not want to leave, not because they can't, but because they feel welcome, respected as individuals, and are eager to experience different and fun teaching methods.





TORONTO PROJECTS

AI + EI = :)

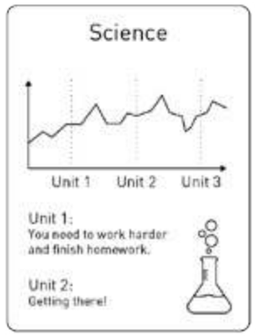
Balancing artificial intelligence and emotional intelligence in the evaluation process

Canada 2067 Pillar: How We Learn

This team imagined a highly technological evaluation process, suggesting a balance between AI and teachers. In order to make evaluation more immediate but also more reliable, the students envisioned a system in which AI is responsible for grading, freeing up teachers' time so they can give more personalized and detailed feedback.

As the team put it, "teachers analyze behaviour" and a "computer analyzes grades". The latter would generate marks instantly, tracking the students' progress represented by a line graph, while teachers would evaluate them based on their work ethic, effort, and problem solving skills.

The integration of technology in the evaluation process as imagined by this team combines an online platform and app powered by sophisticated AI with teachers understanding and communicating with students as individuals.



MAGIC SCHOOL BUS 2.0

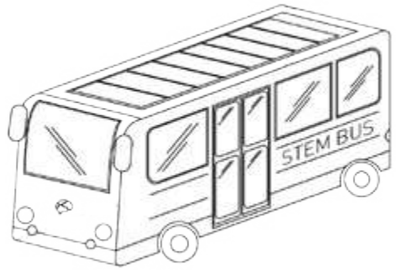
Exploring the world while improving students' well-being

Canada 2067 Pillar: Equity & Inclusivity

The focus of this team's design is: "students should be taught more about mental health and how to deal with it". Taking comfort and well-being into account, these students imagined spaces that are welcoming and inspiring, and tools that are tailored to each individual and can provide support and assistance.

Specifically, they envisioned a personal AI assistant and a combination of apps and devices to help them with their schoolwork. Their proposal includes a mobile school powered by renewable energy where mentors, social workers and guidance counsellors are available to "help students with emotional and mental issues".

The idea of an environmentally friendly, technologically advanced mobile school represents the need for facilities to be more accessible and flexible, and the desire to explore and be open to "more out of school opportunities."



BUILDING BLOCKS

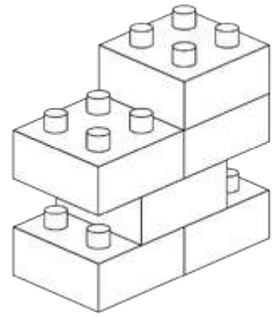
Creating a foundation for lifelong learning in STEM education

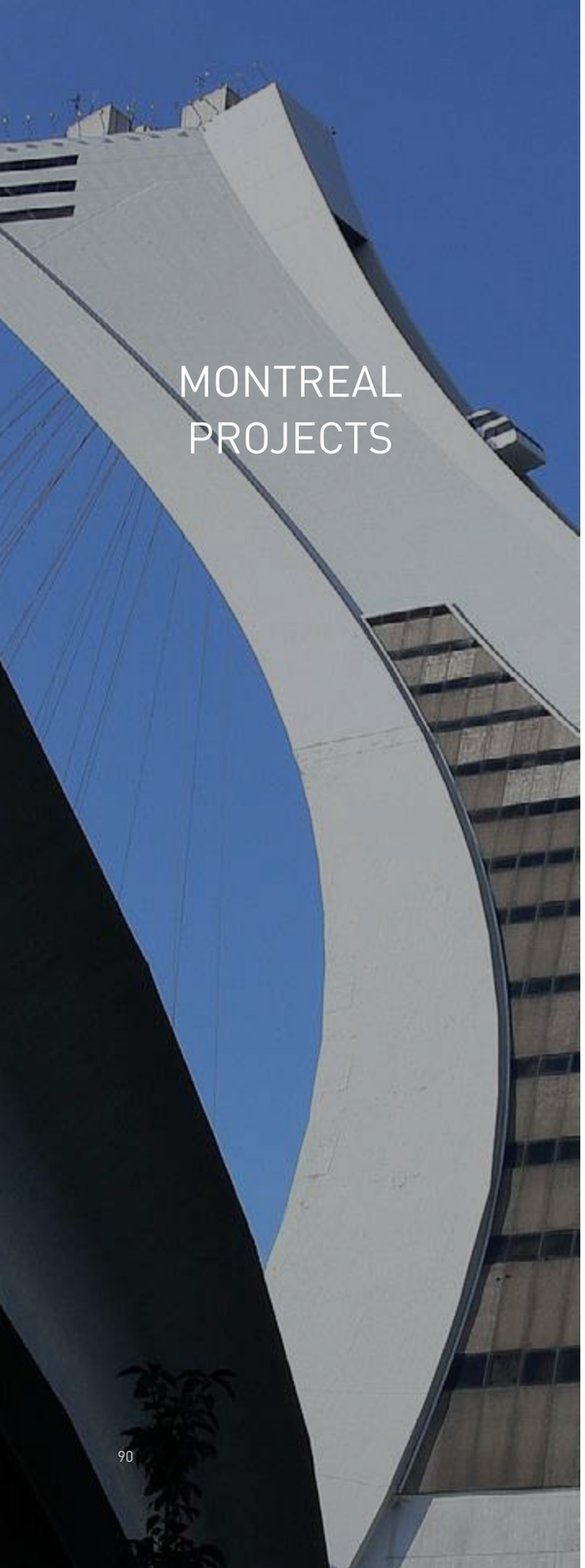
Canada 2067 Pillar: What We Learn

Key ideas for this program include enthusiastic and engaged teachers, more out-of-class work, hands-on experience, and student exploration through internships and field work.

This team envisioned a dynamic and flexible school, with later start times and more spaces to engage in experiential learning such as labs and specialized facilities. Their school is open to experiences outside the classroom and encourages students to pursue their interests at post-secondary institutions and places of employment, and by having experts and professionals give lectures and run workshops.

Additionally, they suggested students start engaging in STEM learning at an early age and progressively deepen their knowledge and specialize in fields of their choice.





MONTREAL PROJECTS

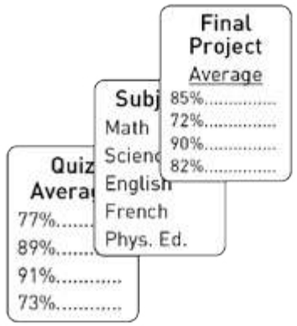
SHOWTIME!

Building stronger relationships through collaboration

Canada 2067 Pillar: How We Learn

One of this team's main criteria when designing a better evaluation process was to minimize student stress. Their focus on building better relationships with teachers included a "student-teacher night" to replace parent-teacher night, as parents are seen as an additional source of stress. The report card is more personalized and in the format of audio recordings where teachers talk about students' strengths and weaknesses.

This team sees engagement and interaction as keys to success. In addition to communicating with teachers, the students designed time and space to collaborate with each other on year-end shows such as science fairs, art exhibitions and concerts – a series of final projects that would encourage them to apply their skills and be evaluated on their ability to work together.



FULL STEAM AHEAD

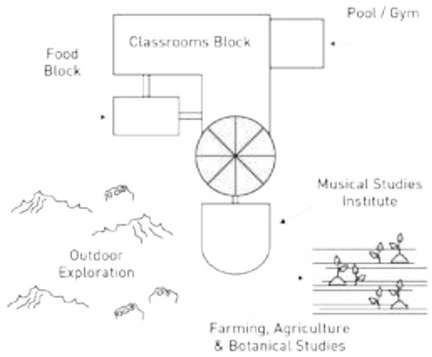
Integrating arts and creativity into STEM education

Canada 2067 Pillar: Where Education Leads

This team expressed an interest in experiential learning and technology and stressed the importance of diversity and inclusivity in the academic programming and in the classroom. Their program criteria listed the combination of arts and creativity with STEM, and the need to adapt to different learning styles

The team also pointed to critical thinking and problem solving as essential skills to be developed and applied through hands-on activities from an early age – activities that span everything from cooking to ethics, from "global scientific communication" to financial literacy.

While not necessarily rejecting current structures, this team also noted that more flexible schedules and an engaging environment (similar to a college campus) would allow for a wider variety of offerings while increasing productivity and student satisfaction.



IT'S ABOUT THE JOURNEY

Exploring global opportunities through experiential learning

Canada 2067 Pillar: Where Education Leads

This team noted that self-awareness is essential in choosing the right career path. Experiential learning, teamwork and group discussions and guidance from mentors and teachers were all listed as key in preparing students for life after high school. However self-awareness and having opportunities to "try things out" were identified as main criteria when designing the bridging experience.

The team pushed the concept of hands-on experiences even further, envisioning a system where students learn about a career they are interested in, pick a foreign country where they can "experience that career", and immerse themselves in that country's work environment, while experiencing its life and culture. Once back home, they can talk to professionals and visit post-secondary institutions to find out how to pursue their chosen path.

CALGARY PROJECTS

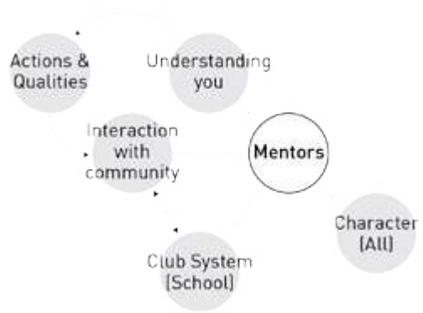
IT TAKES A VILLAGE

Cross-collaboration between the school and the community

Canada 2067 Pillar: Who's Involved

This team envisioned a mentorship program that includes guidance counsellors, health experts and science teachers as well as special education teachers and the students themselves, with seniors mentoring younger ones for a course credit. Each mentor would lead a different club on a topic related to their specific knowledge, from STEM to music, from cooking to coding, ensuring cultural diversity and inclusivity.

Feeling welcomed and engaged was at the core of this team's design. They want to experiment in and outside of school, and to interact with the community by involving experts and professionals in the delivery of the mentorship program. In their vision, students find a place in the community by participating in it, thanks to experiential learning and the understanding and support of teacher and community mentors.



ALT OPTION + STEM

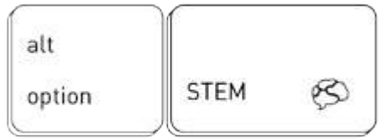
Providing a variety of options to meet students' interests

Canada 2067 Pillar: How We Teach

The idea at the core of this team's vision is simple and to the point: to offer students a wider variety of opportunities that enable them to find the one that best meets their interests.

Specifically, students who are interested in a "STEM- based field" should have the option to choose classes that would be increasingly more specific throughout their academic career, and would feature experts and professionals as guest lecturers.

The team stressed the importance of tailoring education to personal interests and potential careers by gaining hands-on experience. They suggested that the school offer workshops on a diverse range of topics, from medicine to welding, where students would also have the chance to connect with people from outside the school as well as with like-minded peers.



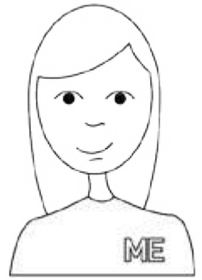
ME. MARS EVALUATIONS

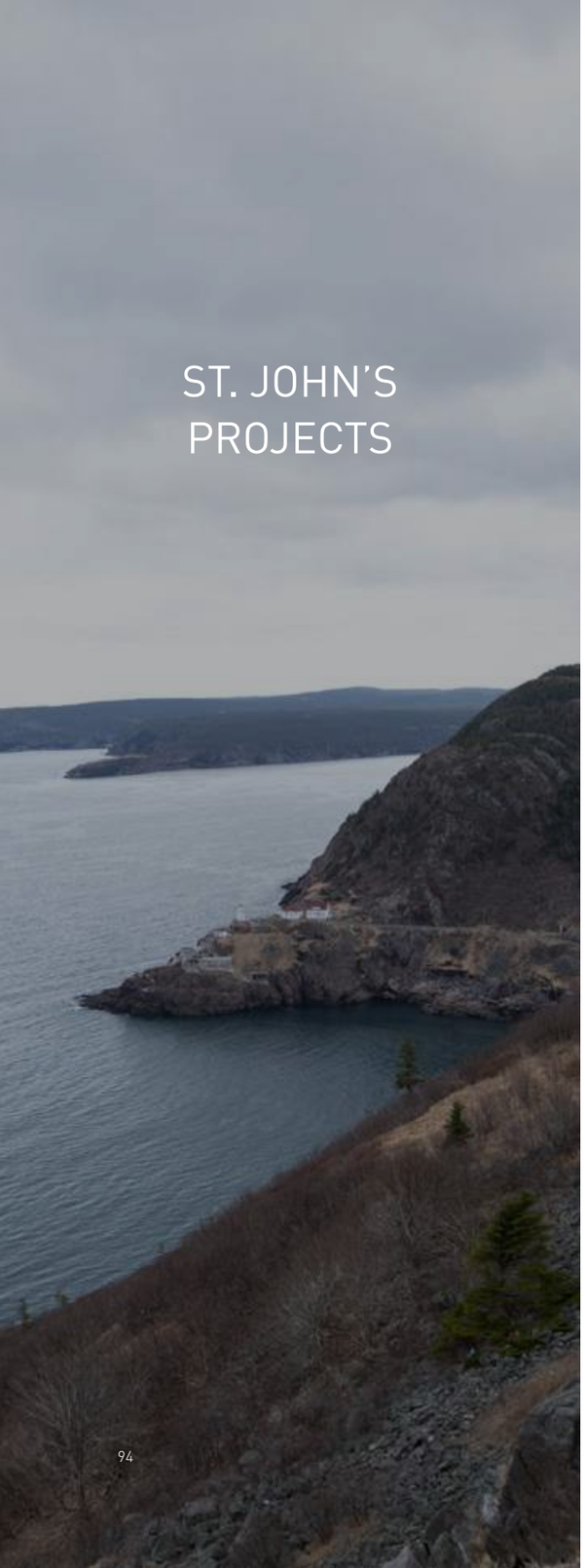
Reflecting students' individuality and motivation

Canada 2067 Pillar: How We Teach

Aside from an overall lack of feedback, this team reported that the current evaluation process is missing "hype" – in other words, it doesn't motivate students to work harder, nor does it encourage them to improve. The students want more one-on-one interactions centred around their strengths and the skills they need to master in order to achieve their goals.

They want to focus on the positive to overcome the negative. They envisioned a system called ME, or Mars Evaluations, where the "M" also stands for motivation, and teachers are joined by mentors who would follow each student throughout their academic career, providing personalized and detailed feedback on their school work as well as on the "social aspects" of everyday life (including life outside school). Such a process would free up teachers' time and allow for smaller class sizes, while evaluating students as individuals, offering them a bonding experience with a personal approach, and boosting their self-esteem.





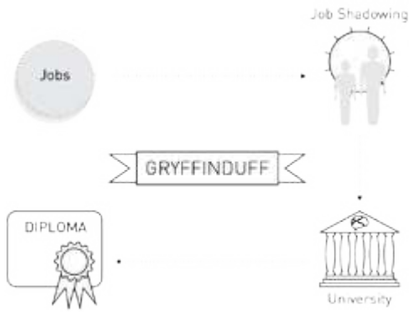
ST. JOHN'S PROJECTS

GRYFFINDUFF

An online platform to match students' interests to future career paths

Canada 2067 Pillar: Where Education Leads

Technology as a facilitator of connections now plays a big role in the life of high school students. In fact, when reimagining the transition from the classroom to the job market, this team suggested creating something close to a dating app that would "match" them to careers. They envisioned Gryffinduff, an online tool that would store and analyze information on their academic achievements (it would include the report card) as well as on their personality and interests, and, based on these outcomes, would recommend a number of jobs that they could select and experience through job shadowing. The first selection would occur in Grade 9, and be reiterated in Grades 10 and 11 in order to narrow down first the field, then the job within that field. In addition to job shadowing and internship opportunities, the school would also offer courses related to the field and job of choice, and guidance on post-secondary education.



BEST VRIEND

A virtual support system with a real impact on students' well-being

Canada 2067 Pillar: Who's Involved

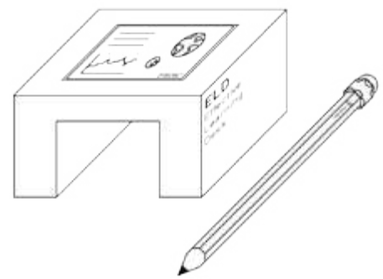
This team noted that initiatives such as the Centre for Distance Learning and Innovation, while providing access to education for learners in rural and remote areas, cannot guarantee the level of support and guidance that they need. They would like the school to be a welcoming, comfortable and inclusive environment, where teachers and mentors are always available, approachable and lead by example. They want teachers and mentors with different skills, who come from different backgrounds and who reflect the multicultural community experienced outside school. This team envisioned a mentorship program that would use virtual reality to give students the freedom to interact with counsellors, emotional support animals and "VRiends" (VR friends) whenever they need to be heard or to relieve stress. They also acknowledged the importance of a (Martian) Indigenous guide to foster community engagement and offer "traditional knowledge."

ELDs AND SCI-FI PENS

Digital tools and flexible spaces to adapt to students' needs

Canada 2067 Pillar: How We Learn

This team pointed out that access to resources would "help students to learn more effectively", "automatically" making them feel more comfortable and organized within their work space, thus also enhancing STEM learning. They designed a "sci-fi pen" and an ELD, "Effective Learning Desk", that would replace all the devices they normally turn to and respond to all their needs. Pen and desk would help students understand and organize concepts, facilitate communications and let them explore new ideas. Additionally, the desks would "take up less space", allowing for a more comfortable, open and dynamic learning environment. Class sizes would be smaller, and complemented by a series of specific spaces for various hands-on activities. Labs, as well as quiet and loud rooms, outdoor and indoor areas, would be both functional and adaptable, responding to different learning styles and students' needs.



Canada 2067 youth outcomes

The insights and unique projects that emerged from the youth engagement represent the vision of Grade 9/10 students for the future of STEM education, and offer creative solutions that could change the school system today.

The Canada 2067 Youth Summits were designed to help them imagine the skills, metrics, tools, spaces and relationships that would prepare them to succeed. This was achieved by raising student awareness about STEM studies and opportunities through the STEM Talks, and, with the design charrette, by enabling students to work together and apply critical thinking and problem solving skills to envision the educational system of the future.

The Canada 2067 landmark consultation enabled participants to achieve the following outcomes.

INSPIRE & INFORM

- Increase their awareness about STEM education, future jobs and skills needed for success in a rapidly changing world.
- Understand the building blocks of the education system and how they can be influencers for change.
- Hear from thought leaders about their journeys and diverse career paths.
- Increase their interest and excitement about STEM studies.

COLLABORATE

- Develop peer networks.
- Collaborate with post-secondary/industry mentors and hear from young entrepreneurs.
- Build their professional networks with leaders/ speakers from the field.
- Build their civic participation so they can actively contribute to designing the Canada 2067 goals.
- Create a shared vision for the future of STEM education in Canada.

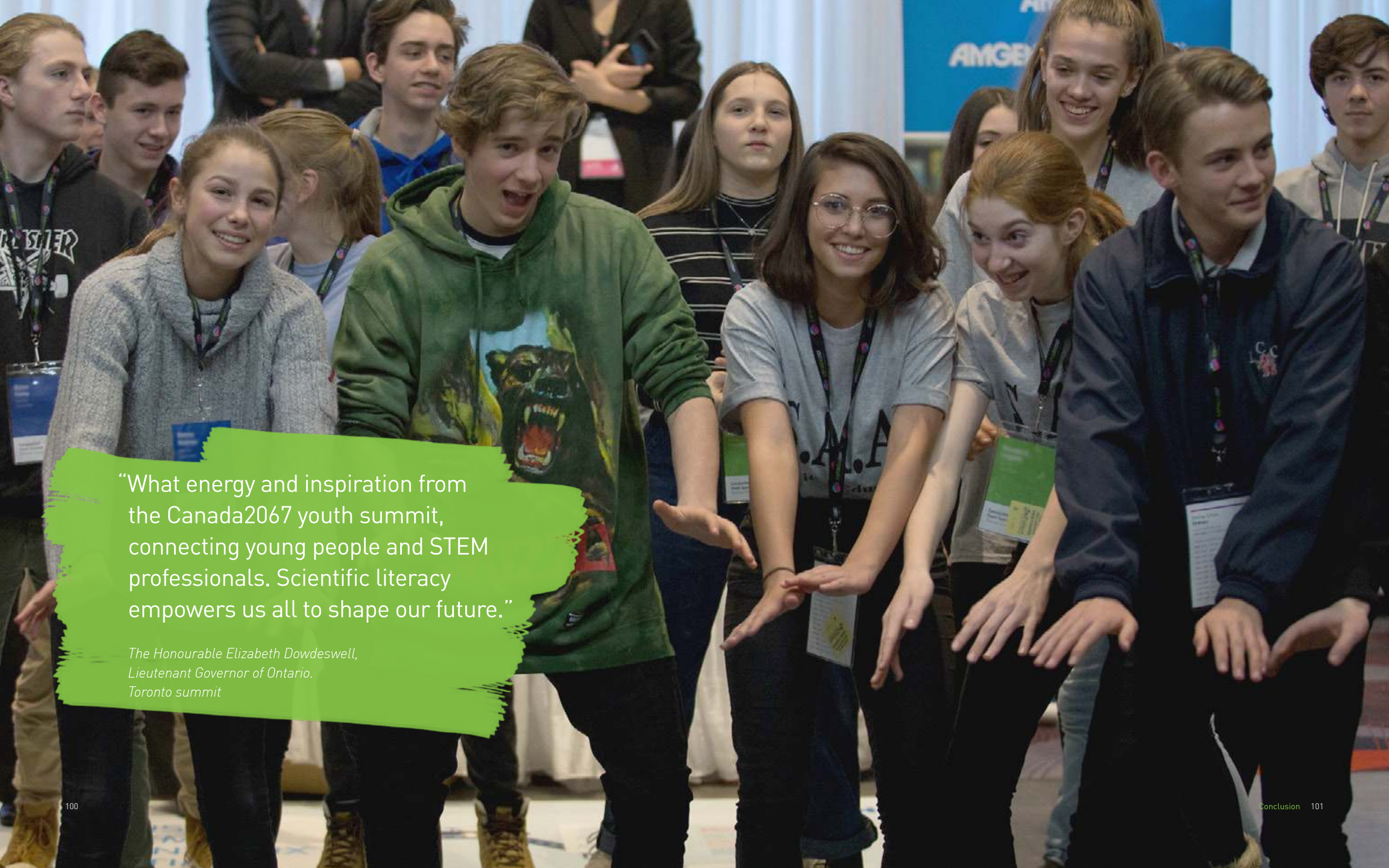
EMPOWER: SKILL BUILDING

- Learn creative problem solving and leadership skills.
- Be exposed to and learn about design tools, methods and processes that facilitate collaboration, promote systems thinking and creative thinking to solve complex problems.
- Develop recommendations about STEM learning that will be presented to education ministers and deputy ministers, school board leaders and other thought leaders and decision makers.
- Energize students about the future of learning, innovation and discovery, and the opportunities that they can create themselves.
- Encourage long-term engagement in STEM studies.

Conclusion

The Canada 2067 Youth Summits were a bold and crucial national initiative that provided a meaningful platform for students to share their vision for education reform with a focus on STEM learning.

More than 1,000 Grade 9/10 students from coast to coast gathered at five regional events to be surprised and inspired by over 100 unique speakers and 120 facilitators who represented diverse STEM fields – from foundational researchers to power engineers, inventors and social entrepreneurs. The Canada 2067 Youth Summits asked the students to do more: they were challenged to create and collaborate in designing five key components of the first school on Mars.



"What energy and inspiration from the Canada2067 youth summit, connecting young people and STEM professionals. Scientific literacy empowers us all to shape our future."

The Honourable Elizabeth Dowdeswell,
Lieutenant Governor of Ontario.
Toronto summit

The students' personal, thoughtful and impactful solutions have been summarized in this publication. The powerful results demonstrate the value of their ideas as well as the surprising uniformity of their wants and needs for education transformation in Canada.

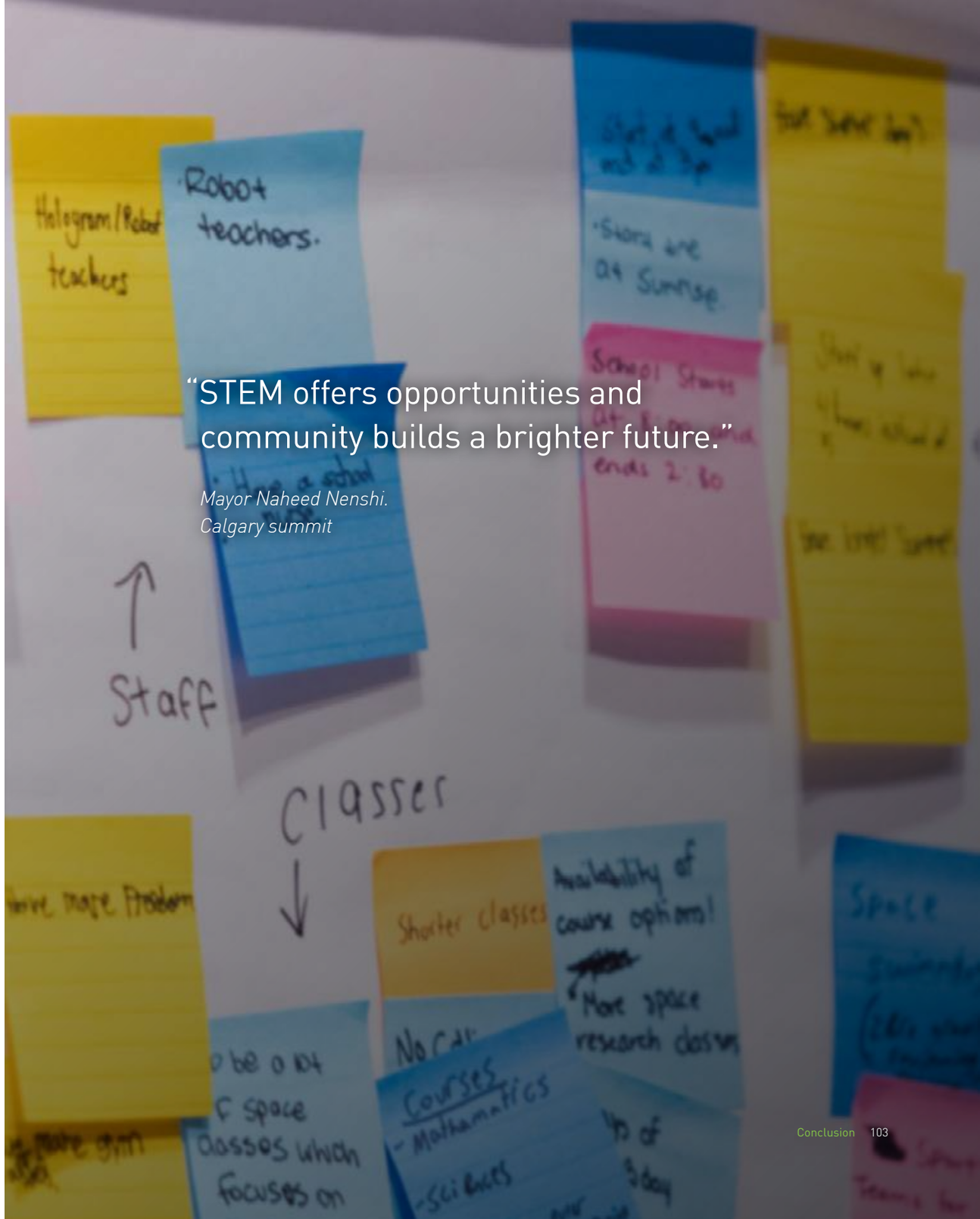
The authentic and genuine engagement of students through this user-centred design process meant that participants could see themselves in their solutions: they saw their needs addressed in the programs, plans, blueprints and prototypes they designed over the course of the day. Their excitement and engagement throughout this process was undeniable and this energy and enthusiasm should be leveraged to make real change that aligns with their needs.

The connection of their needs to the solutions they proposed is what makes the summits and this publication critical components of a national discussion about education. The unified national youth voice captured here is evidence of the ongoing challenges faced by Canadian youth. Their thoughtful solutions demonstrate creative and hopeful thinking with intended impact and results that should inform our nation's decision makers' next steps.

Canada 2067 rallied the nation to develop a shared vision and goals for education, starting with STEM learning. This publication is a key tool for sharing the philosophy and intention of the broader initiative with a focus on students' perspectives.

If you wish to retrace the same steps and process as the students, we invite you to visit the Canada 2067 website: *www.canada2067.ca* or contact Let's Talk Science to access speaker videos, Canada 2067 tools and resources, and all final publications and recommendations.

Together, we can keep the momentum going and ensure the future is bright and prosperous for Canadian youth.



"STEM offers opportunities and community builds a brighter future."

Mayor Naheed Nenshi.
Calgary summit

Section 5

Acknowledgements

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"Be the type of person that looks to your left and your right to lift people up and to join together to accomplish significant challenges. STEM is going to provide and open some amazing opportunities for you."

Jeremy Hansen, Astronaut, Canadian Space Agency. Toronto summit

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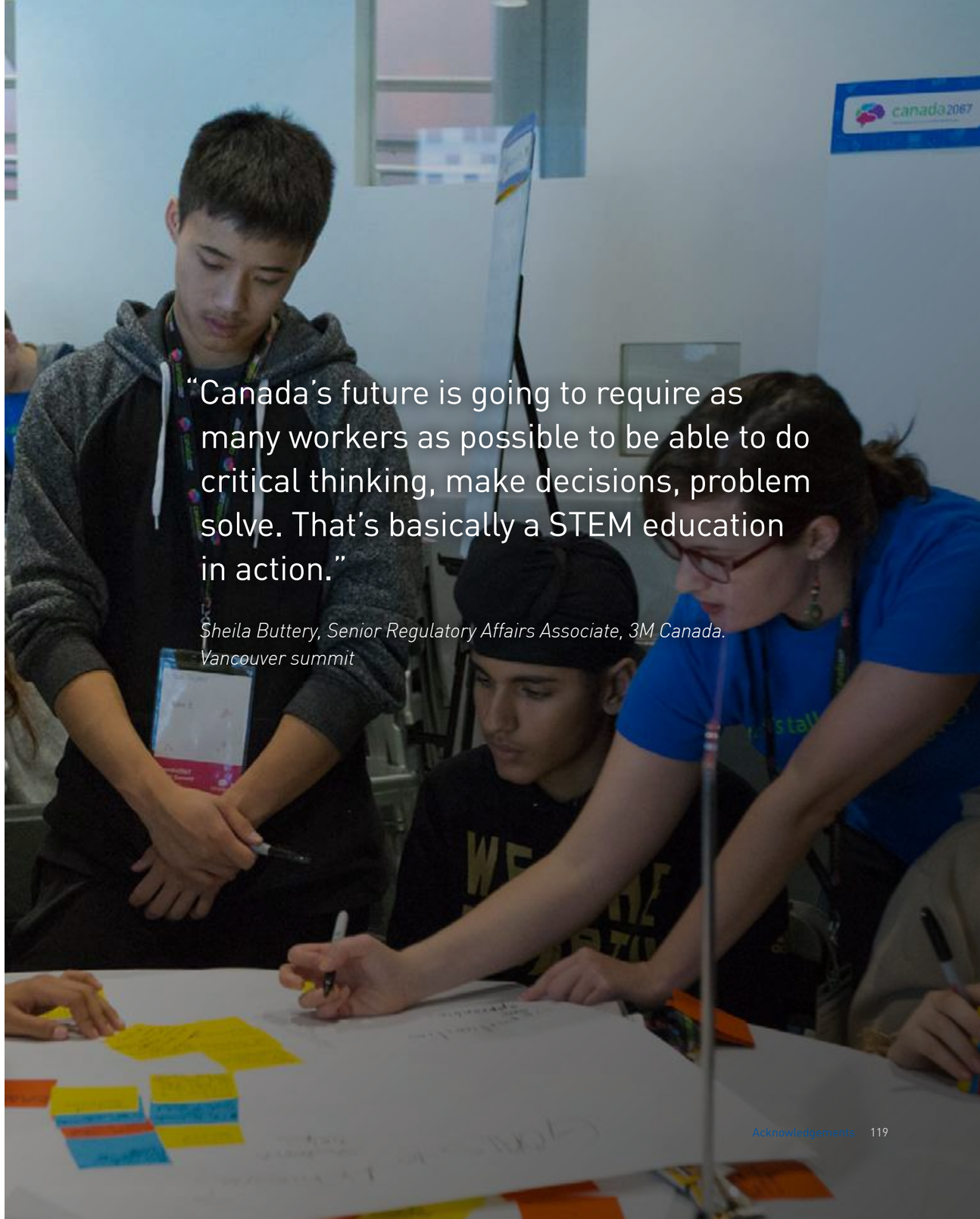

"Canada's future is going to require as many workers as possible to be able to do critical thinking, make decisions, problem solve. That's basically a STEM education in action."

Sheila Buttery, Senior Regulatory Affairs Associate, 3M Canada. Vancouver summit

APPENDIX 1

CANADA 2067 LEARNING ROADMAP OVERVIEW

Canada 2067 catalyzed a landmark national discussion about the future of STEM education. Extensive research with a global lens contributed to the development of draft Canada 2067 goals and targets, which then became the focus of the broad and diverse consultation process.
Visit www.Canada2067.ca for the complete roadmap.

The Canada 2067 Learning Roadmap is organized by six pillars, all of which are critical to education. They address areas of consensus, common themes and shared calls to action for the future of STEM learning. Overall, it emphasizes the need to reach students at all stages of learning, from the earliest years onwards, and to engage and inspire students from all cultures and backgrounds. And it focuses on the roles all parts of the education system, as well as partners such as parents, community groups and employers, can play in enhancing STEM learning opportunities.

Goals such as increasing post-secondary education enrolments in STEM fields can be achieved by making student participation in STEM more equitable in terms of gender, culture and region, and ensuring all students graduate high school with at least one senior level multi-disciplinary STEM course.

Simultaneously, to encourage higher enrolment in STEM-related fields of study, post-secondary entry requirements need to evolve to align with the innovations in the K-12 sector that promote multi-disciplinary and experiential learning and cross-cutting competencies such as critical thinking.

Feedback collected through diverse consultations points to the importance of providing parents and students with access to information and support about STEM education and how it relates to young people's future. At least four in five of the many parents and educators consulted agreed that it is important to help show students how STEM subjects are relevant to students' everyday lives, and to help connect students with employers to see what kinds of jobs need STEM.

At the provincial and territorial level, changes in the curricula should move towards multidisciplinary, competency-based approaches and digital skills, without losing sight of basics relating to literacy and numeracy. Teachers should have access to more regular STEM professional learning and development opportunities and steps should be made to better connect teachers with one another across schools and systems in professional learning communities.

Industry and community organizations should expand their partnerships with schools. Every student should be engaged in at least one STEM community- or employer-supported experiential learning opportunity every year of their K-12 education.

Investments both from governments through STEM research budgets and from industry through community investments should be made to support these education targets. And it is essential that the conversation across all stakeholders continue. Effective coordination and networking among everyone who has a stake in the outcomes of our education systems enhances the learning experience for students and teachers, improving overall outcomes.

These common goals form the building blocks or key elements of a forward-looking system. While the focus is on STEM, the framework is relevant to all subjects and all levels of education.

APPENDIX 2

GLOBAL SHAPERS FINDINGS

Six Canadian Global Shaper hubs hosted a series of dialogue sessions in Vancouver, Edmonton, Calgary, Ottawa, Toronto and Halifax between August and November 2017. More than 200 participants from the millennial demographic (20-30 years old) offered their unique perspectives on K-12 education. Interestingly, all dialogues converged on similar reflections.

Recurring themes were: allowing freedom to self-direct learning, the desire for applicable and practical content, and an appreciation for constructive failure. Enthusiastic and thoughtful, participants demonstrated their collective commitment to support learning opportunities for younger generations and provided strong reasons to continue similar conversations in the future.

Key findings from the Global Shapers dialogue sessions include:

- **'Self-awareness' should be a core competency**
  Encouraging personal reflection and the development of self-awareness, especially as it relates to preferred learning styles and attitudes, can be transformative. These capacities enhance the ability of learners to make effective judgements and weigh influences within and outside the education system.

- **Encouraging constructive failure over blind success**
  It is important for students to learn that failure is a key aspect of the (scientific) learning process and that a consequence of failure can often be a process that leads to innovation.

- **Content should be application-based, personalized and collaborative**
  Transforming the classroom into a hub of learning that is closely linked to "real world" topics has the potential to increase engagement levels and creativity. Part of learning should also include learning to work together as well as moving from standardized to personalized content.

- **Learning should be practical, inspire curiosity and foster independence**
  Through crowdsourcing questions in class, encouraging students to be critical, and allowing freedom to explore an interest within a subject, K-12 education should cultivate a culture of asking questions and exploring diverse ways of answering them.

- **Further enable the role of the teacher**
  Teachers should consistently strive to help students understand the relevance of the material learned. Teachers also play a critical role in encouraging the development of risk tolerance, persistence, grit, resilience and motivation.

- **Enhance mentorship as a supportive tool for learning**
  Connecting students to individuals beyond their peers exposes them to different ways of thinking. Mentorship does not have to take shape in a one-on-one or group basis, but can also take place by connecting different sectoral organizations to classrooms.

- **Categorical over granular testing**
  Eliminating a fear of failure from the education system requires reducing the emphasis on numerical assessments. Moving to a categorical testing structure (i.e. "honours", "pass" and "fail") provides better mechanisms to assess exploratory, problem-solving, collaboration and communication skills.

- **Large, modular projects promote deep thinking**
  Project-based learning provides excellent opportunities to assess skills such as collaboration, communication, creativity and critical thinking.

- **Opportunity for debate and discussion should be increased**
  Making room in the curriculum for formal academic debates (oral examinations) tests students' grasp of concepts, their ability to compose, articulate and defend ideas, as well as to evaluate the quality of those put forward by others.

- **Language matters**
  Students should realize early on that there are many forms of intellect and that the classroom is an opportunity to discover and build upon one's own unique strengths.

- **Using technology as a tool for cross-assessment**
  The move towards digitized assignments and online quizzes provides an opportunity for the cultivation of online "learning profiles" that can provide broader, deeper representations of student growth.

- **Teachers need resources, support and fair compensation**
  The compensation, support and resources teachers receive needs to be reflective of the central role they play in influencing the quality of K-12 education.

- **More support needs to be given to other support mechanisms**
  With stronger and more integrated support for these impactful learning opportunities, more students could be exposed to transformational learning experiences.

- **Acknowledging parents as critical stakeholders**
  Parents can often be the biggest barriers to, or influencers of, change.


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