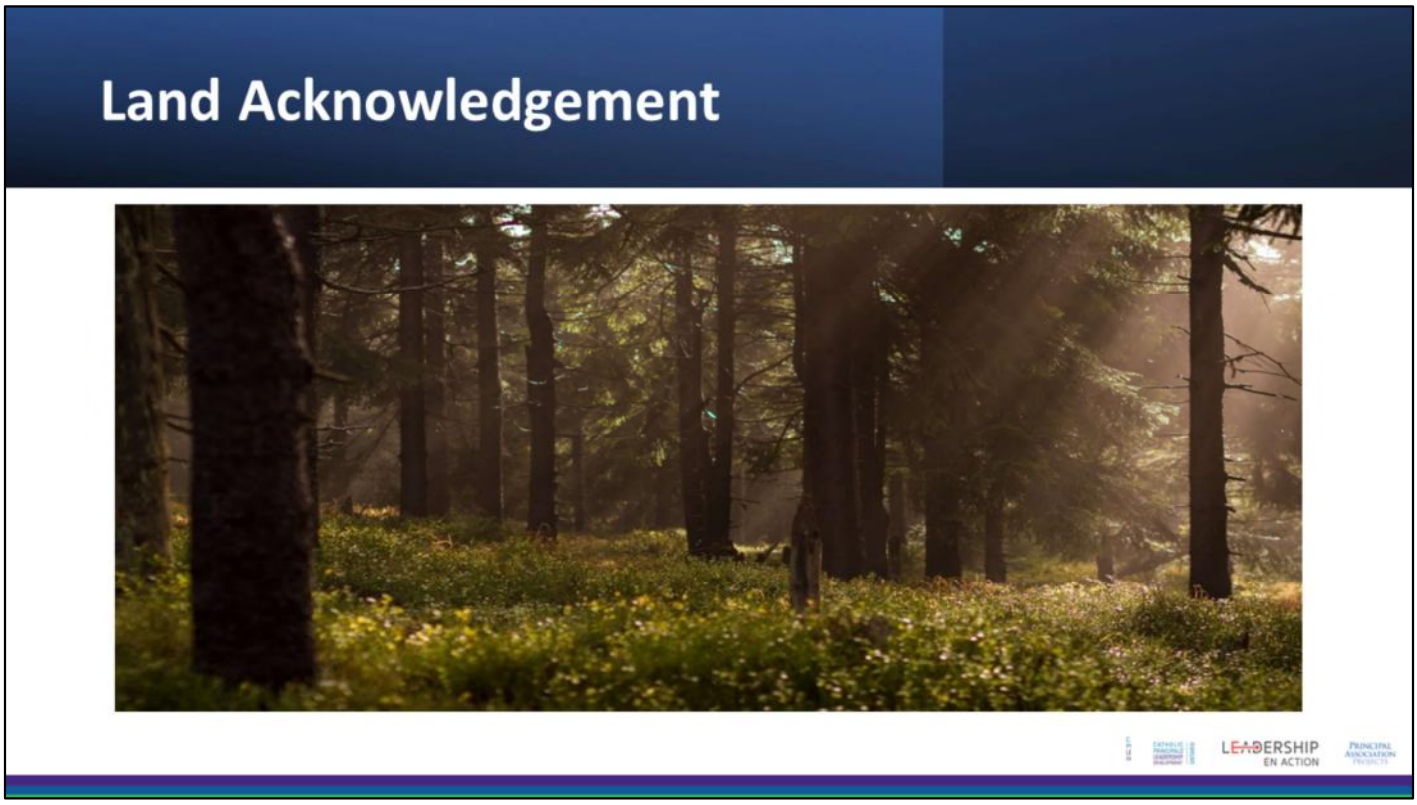
STEM - One Way to Change the World

Webinar: Engaging Students in Social And Environmental Justice

LEADERSHIP EN ACTION



Erica - introduce and share the partnerships …
I would like begin by acknowledging that the land on which I worked for this project is the traditional unceded territory of the Caldwell nations of the Three Fires Confederacy comprised of the Ojibway, the Odawa, and the Potawatomi Peoples, and the Huron/Wyandot nation.

The Caldwell First Nation lived as a distinct First Nation in the Point Pelee area from before 1763. When European settlers arrived in the area, a treaty was negotiated with the Anishinaabe for a large tract of land, including Point Pelee, without the consent of the area's Chiefs or benefit to the

Caldwell First nations people.

Then during the War of 1812, the Point Pelee people fought as British allies, and were promised formal title to their lands - however, that promise was not granted and by the 1800's, colonization displaced the Caldwell people from the area.Point Pelee was designated a National Park in 1918, and when the Caldwell First Nations people attempted to occupy their traditional homeland in 1922, they were forcibly displaced by the RCMP. The Caldwell First Nation was the only federally recognized band in southern Ontario without a reserve land of its own, until November 2020, when they announced that they finally have the first part of their new urban Leamington reserve, as part of a 230 year fight for reconciliation.

I offer this acknowledgment as an act of truth-telling and reconciliation with the Indigenous peoples of Canada.

Agenda

What's New?

Why Change?

What skills might teachers need?

As leaders, how might we engage in this work?

What's New?

The revised elementary science and technology curriculum is part of Ontario's plan to modernize the education curriculum to ensure all students have the foundational and transferable skills they need in a rapidly changing world, with an ongoing focus on science, technology, engineering and mathematics (STEM).

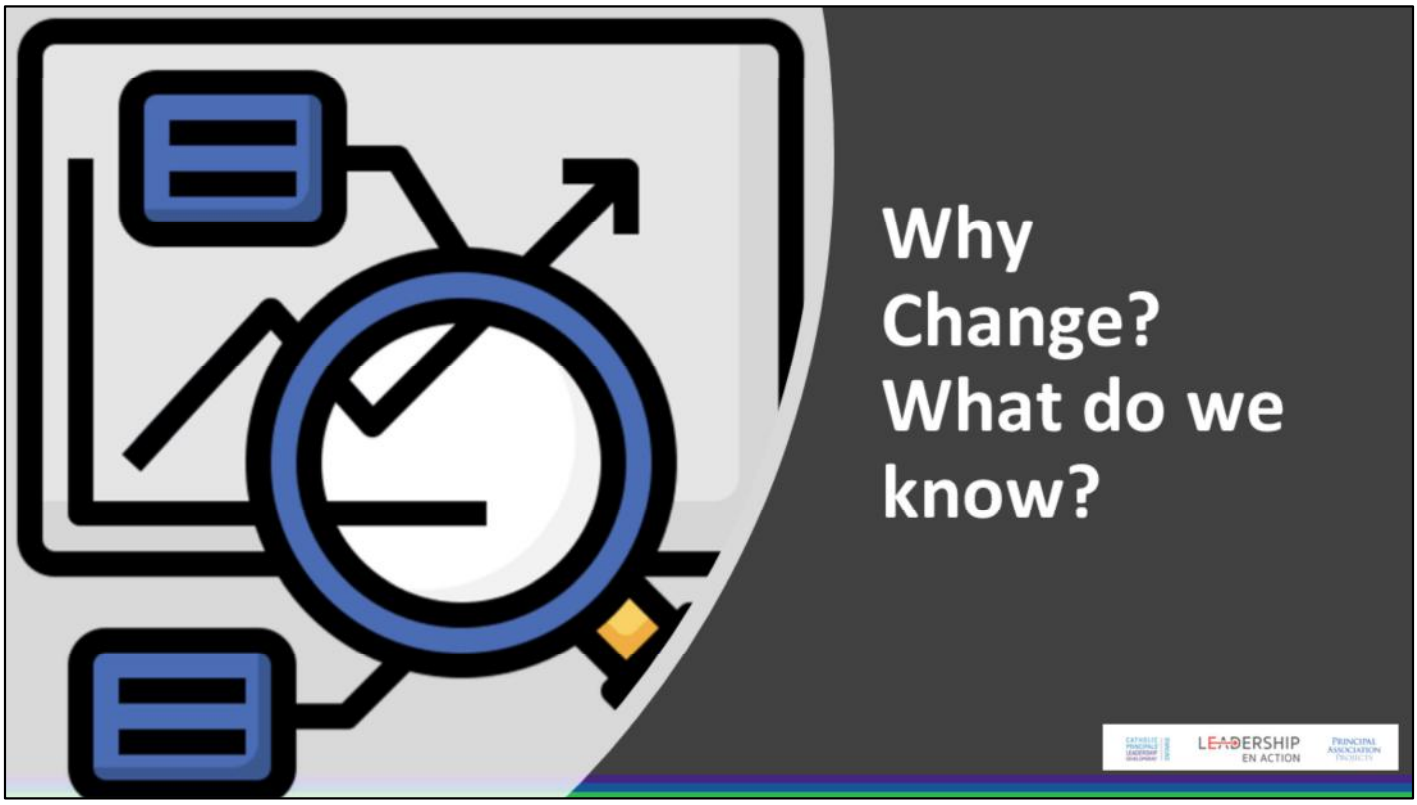
(Ontario Science and Technology Curriculum Grade 1 to 8, 2022)

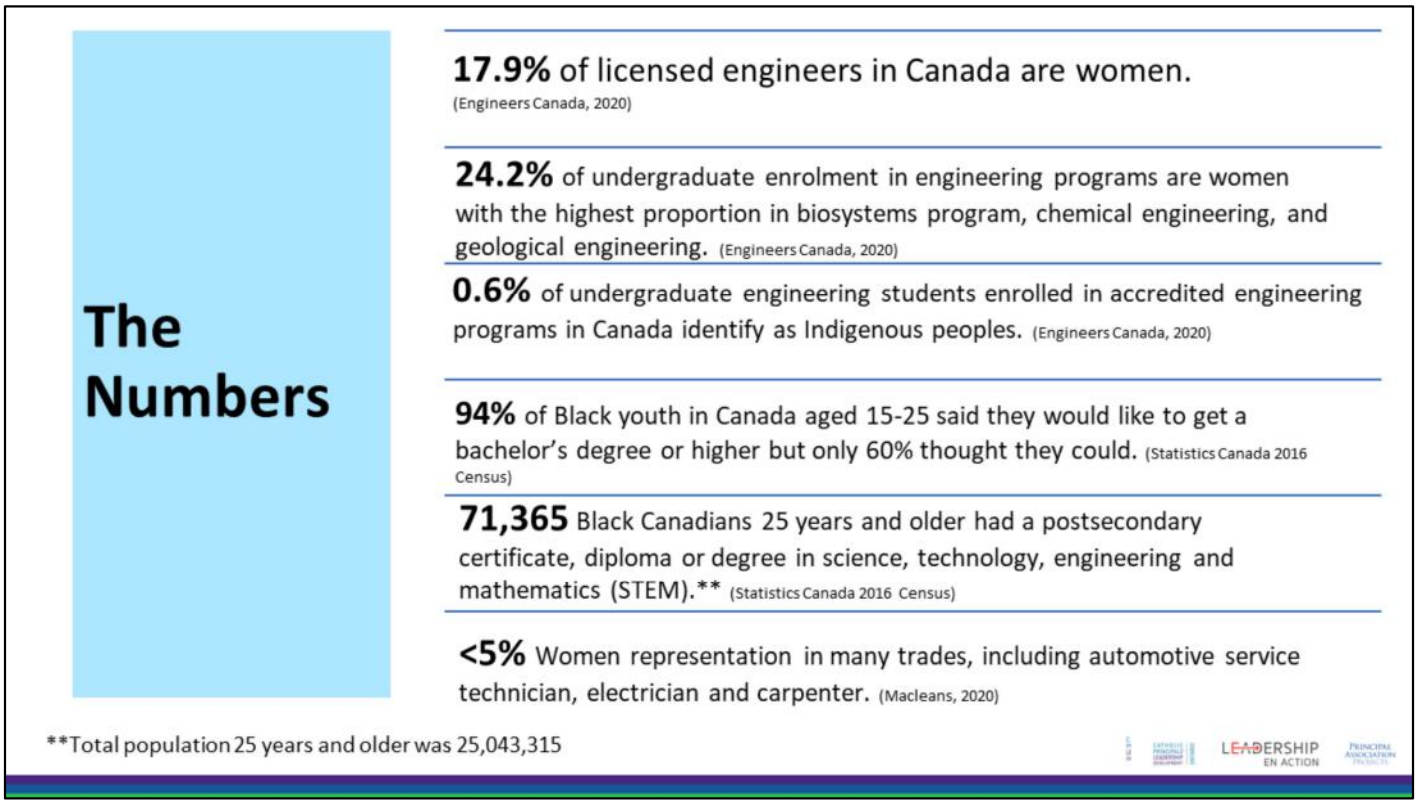
Erica –
https://assets-us-01.kc-usercontent.com/fbd574c4-da36-0066-a0c5-849ffb2de96e/5c32d234-af5a-49a7-9345-417e9267e186/8ci.%20Sci%20Key%20Changes_Mar%2030.pdf

What are the Biggest Changes?

- New Strand - STEM Skills and Connection
- Coding and the engineering design process
- A focus on Curiosity and Wonder
- Impacts of coding and emerging technologies
- Climate change, skilled trades, food literacy
- Equity focus - every student has an access point

1 - STEM in the past was an “add -on” or movement, often provided as a club or specific curricular activity or field trip. This is now a concrete, intentional part of the curriculum, which must be taught as a focus.
2 - coding appears in all grades, as does a focus on engineering design (not just technological problem solving)
3 - HOW are we teaching? Are we encouraging curiosity, critical thinking, discovery learning? Using a cross-curricular approach to solve real world problems?
4 - Relating content to global issues - and how science, technology, coding and engineering can tackle these issues for the betterment of the world. Although STSE’s are not outlined in the same way, the focus of the curriculum throughout is on implementing positive change related to Environmental and social issues.
5 - increasing content related to issues that matter to students, health and wellbeing, and practical applications, including skilled trades
6 - Human Rights and Equity, Indigenous education, ELL and Special Education supports


Why
Change?
What do we
know?
LEADERSHIP
EN ACTION

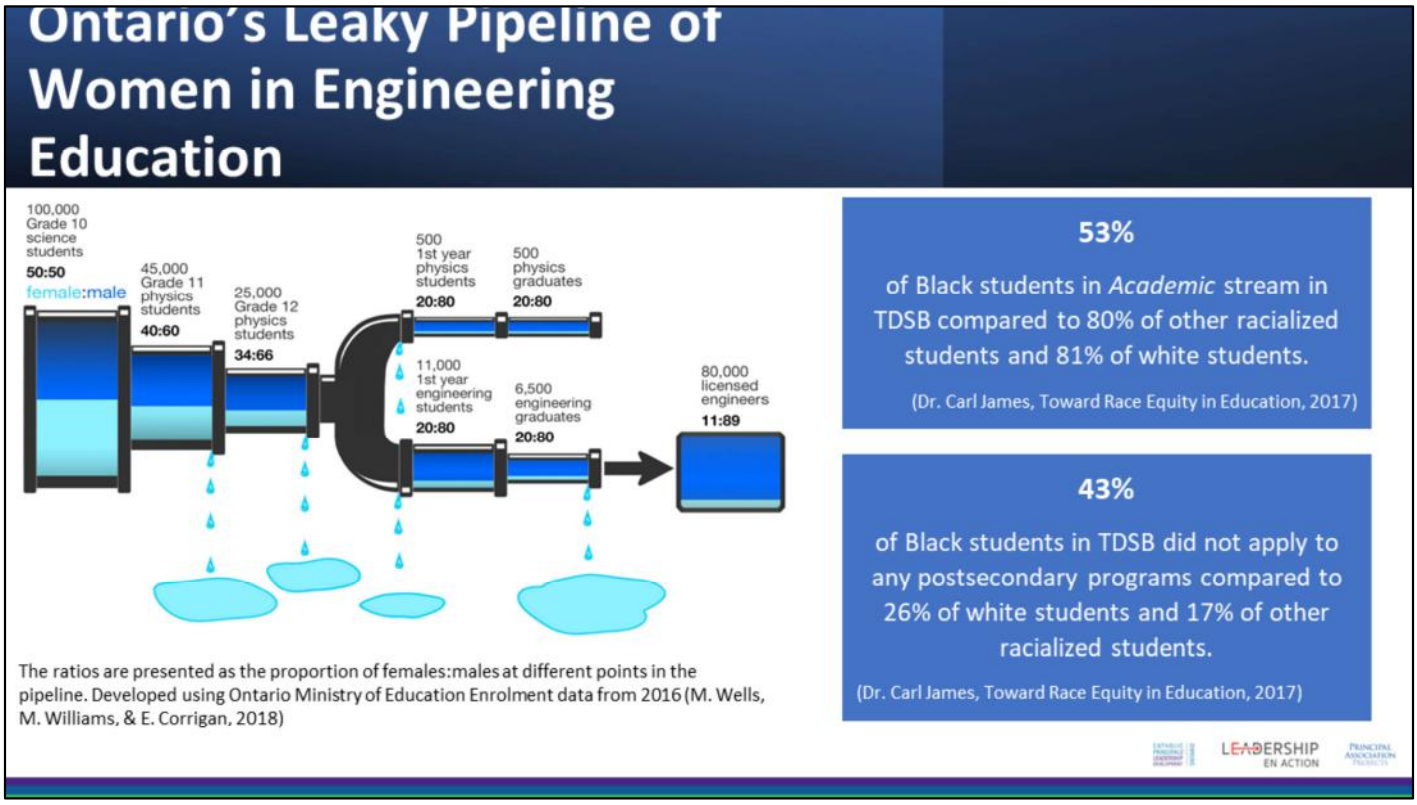


To begin our conversation today, let's explore some numbers.
In Canada, only 17.9% of licensed engineers are women. And there is less than 5% women representation in many trades, including automotive service technician, electrician, and carpentry.

Women only make up 24.2% of enrolments in engineering programs in Canada with the highest proportions in biosystems, chemical engineering and geological engineering.

Only 0.6% of undergraduate students enrolled in engineering programs in Canada identify as Indigenous peoples.

According to the 2016 census, only 71,365 Black Canadians 25 years and older had a postsecondary certificate diploma or degree in STEM. Canada's population of 25+ years is approximately 25 million. In fact, 94% of Black youth in Canada said they would like to get a Bachelor's degree or higher but only 60% thought they could.



Dr. Carl James, at York University found that only 53% of Black students were in academic programs in TDSB compared to 80% of other racialized students and 81% of white students.

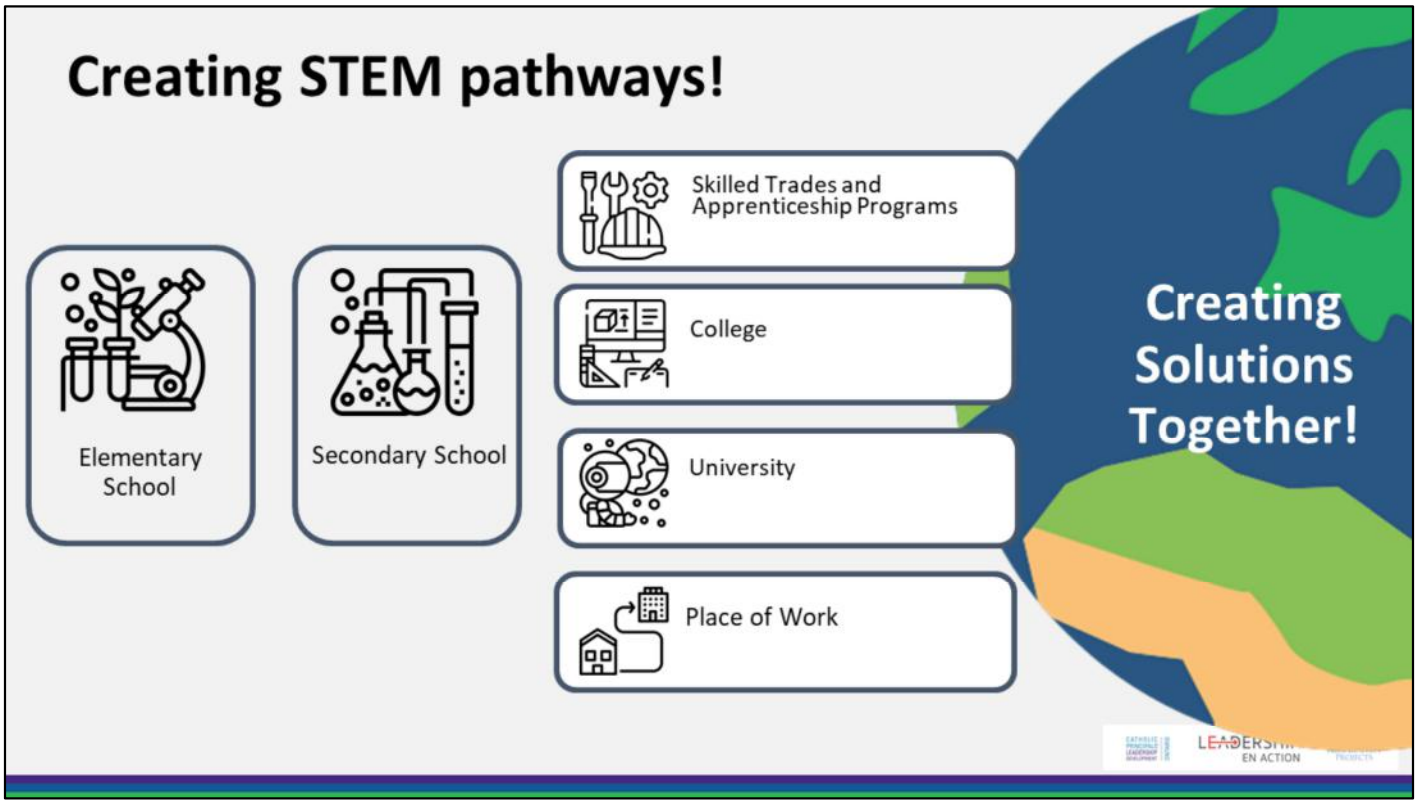
In addition, he found that 43% of Black students in TDSB did not apply to any postsecondary programs compared to 26% of white students and 17% of other racialized students.

De-streaming Grade 9 is the first step towards changing this narrative. It is now time for us to do this work together.

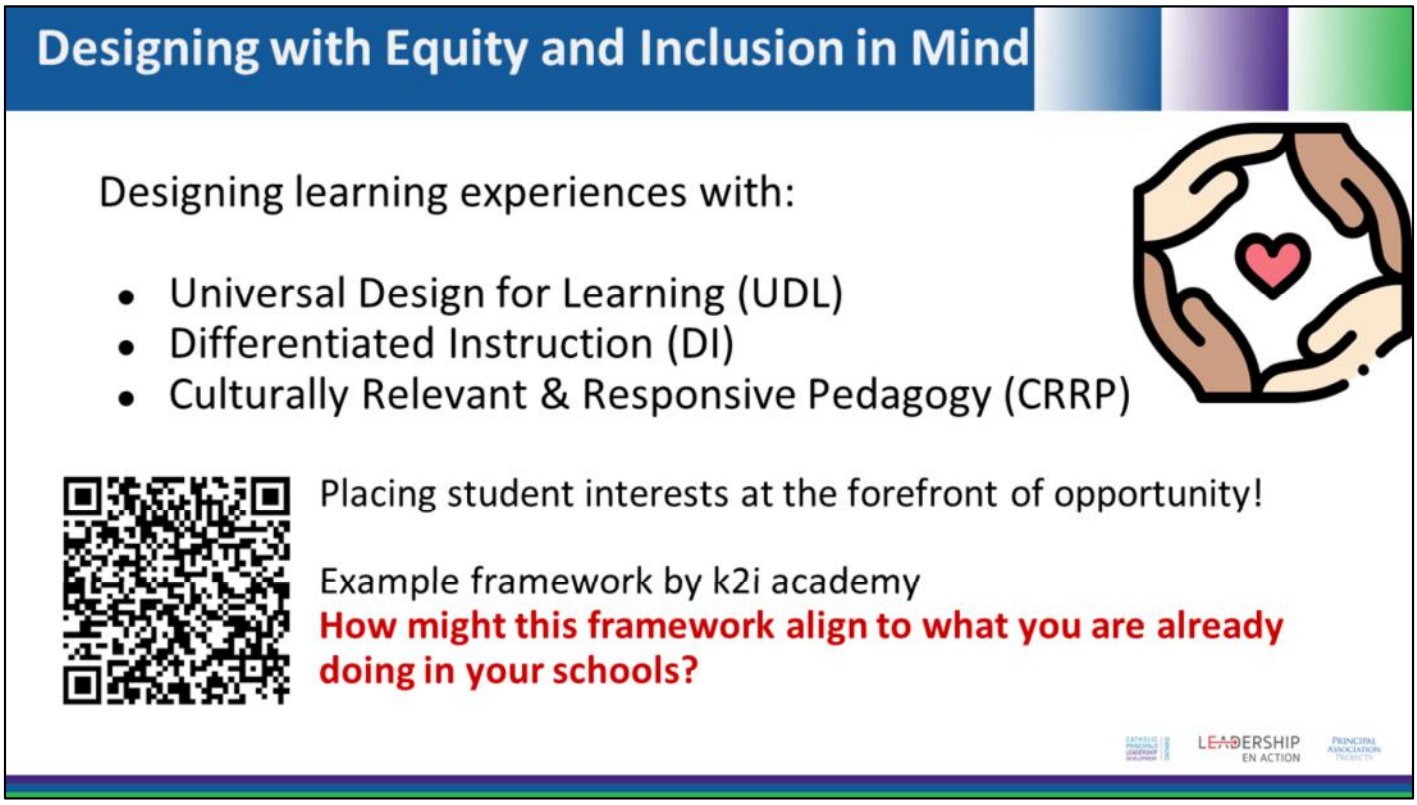
Often times, the loss of students along the educational journey is referred to as the "leaky pipeline". This illustration focuses on women in engineering and references physics as a key prerequisite course for university pathways into engineering. This metaphor is problematic, as our students are not "passively" leaking out of our system. We have created a system that pumps and filters out certain students with very little possibility of reconnecting back into pathways. Let's reframe this model. We may talk about pathways. However, at times, I wonder… who are constructing these pathways… and for whom? We must believe that a better model is possible … an ecosystem - where students can learn and discover interests in pursuit of their goals - where all students discover their role and purpose and feel connected with a sense of belonging… in this ecosystem. This new curriculum is in response to this reframing

that is needed in our schools.

Racism and bias has been a historical part of science and today, it still continues to create challenges.
Black in Science
Bias and Self-Driving Cars
AI and Health Care
Historical Racism in Science/Engineering
Forced Sterilisation of Indigenous Women
Henrietta Lacks
Tuskegee Experiment
AI and Racial Bias
Hand soap/water dispenser



Our current pathway includes elementary to secondary to skilled trades and apprenticeship programs, college, university, and the place of work. Students also navigate programs between as they start in one place and move across to other opportunities. The k-12 education sector has a critical role to play. Let's create STEM pathways and ensure that all students have access and opportunity for STEM learning. Let's support students to discover their interests, pursue questions that interests them, and consider STEM pathways if they choose.



Is your existing stem program aligning with the DEI approach?

I share with you a framework which we at k2i academy uses as a way to think about programming design and implementation. It is also used to assess the current state of a program and find ways to make enhancements to ensure that the programming is accessible and available for students who are most impacted by the inequities of our system.

You will see that the framework is grounded in Critical Theory, Anti-Oppression Theory, and Anti-Racism Education. It pushes us to think about the individual, instructional and institutional responsibilities that each of us have to co-develop and co-implement inclusive experiences for students. The document includes some questions for your to consider as you think about designing and implementing programs through the Operational Framework including three levels, Organizational, Program, and Sessional.

This framework is the first version we have put out there for people to consider. We are always interested in your thoughts and welcome you to

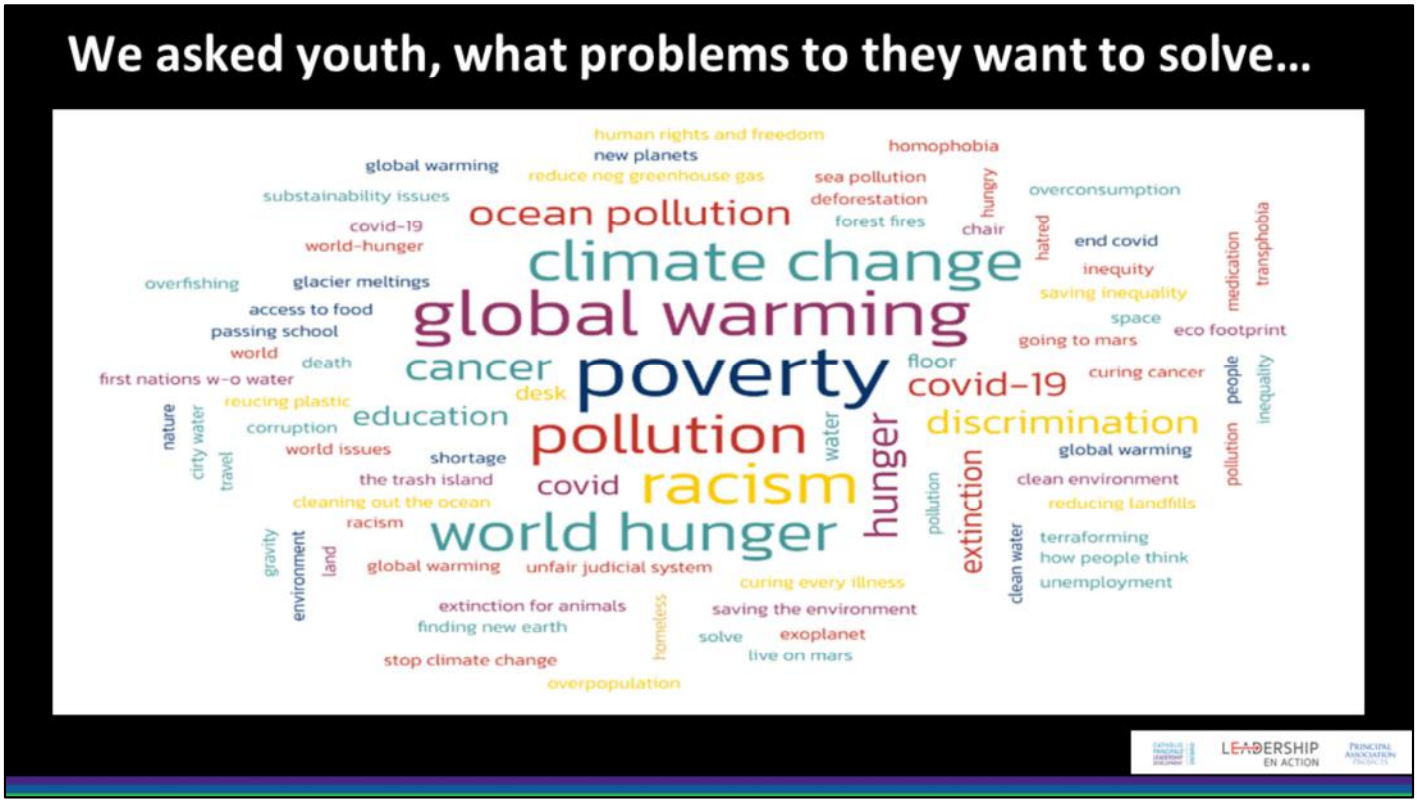
share back your insights. I would also like to say, this framework was inspired by the work of jeewan chanicka and Camille Logan on Inclusive Design.

As leaders, we know that one initiative isn't going to be the solution to all things. However, we can start to build a culture and a suite of initiatives that gets us moving forward, each addressing different aspects of the larger problem. I am often reminded of my time in the classroom when I say this - as a physics teacher, I always had a set of screwdrivers and duct tape to fix things. I wonder about the tools we use to fix the leaks, to design new pipeline and pathways for now… while we also dream about the new, inclusive, ecosystem we will start to create together.

Copy this into chat:
k2i academy Inclusive Design Framework 1.0:
https://drive.google.com/file/d/16QSzls_VXbV2e_Bc7zfbbHkvHVyHISby/view?usp=sharing
Canadian Engineering Education Association (CEEA) Conference Paper:
https://oxford-abstracts.s3.amazonaws.com/cbea220a-f69a-44ab-99ab-9d5f7e6fe451.pdf

Inspired by:
chanicka, j., and Logan, C. Example of best practice: inclusive design. Intercultural Education (London, England), 32(3), 335–347, 2021.
https://doi.org/10.1080/14675986.2021.1886430

Share thoughts about the framework to: lisa.cole@lassonde.yorku.ca



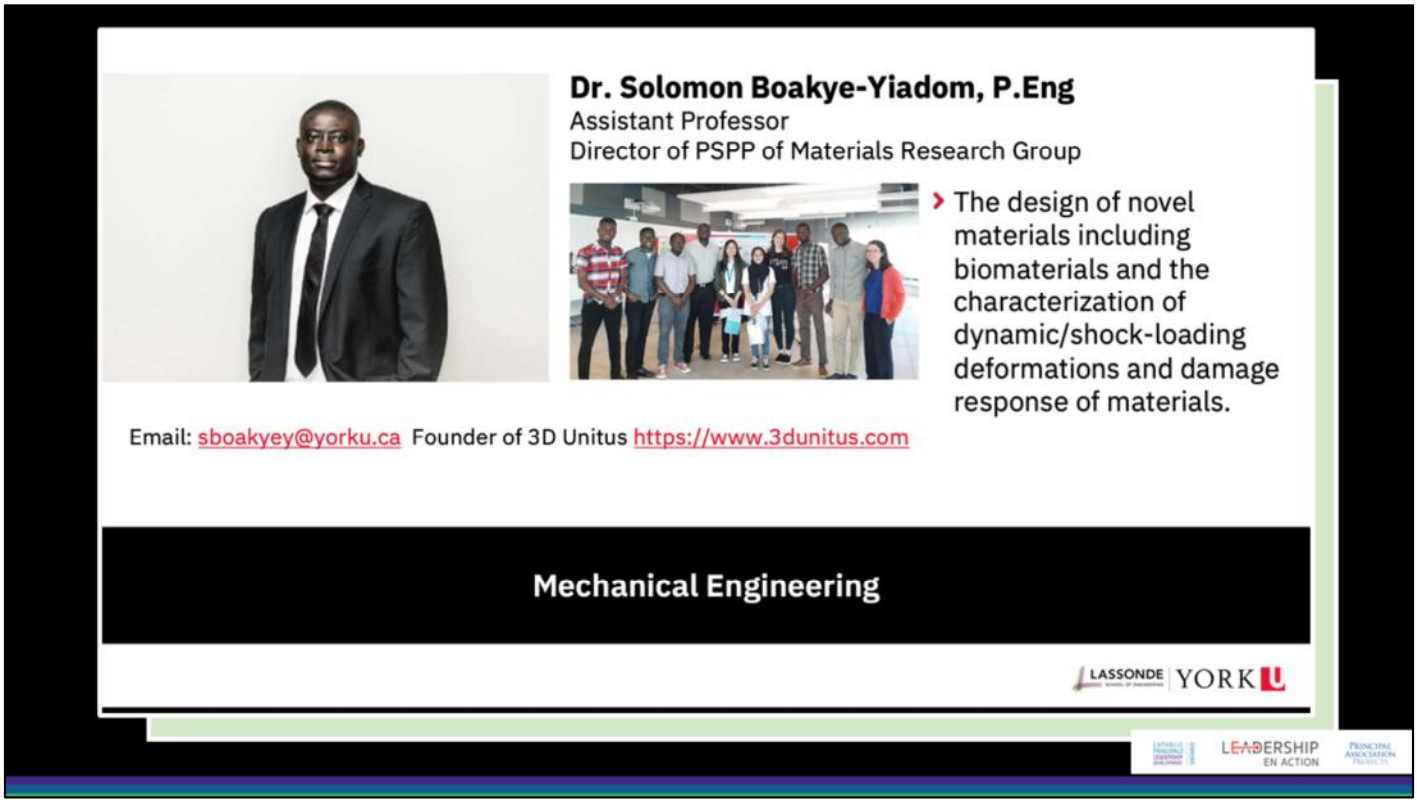
To design for students, we need to ask students what interests them… So we did…

How do we, as educators, make connections?

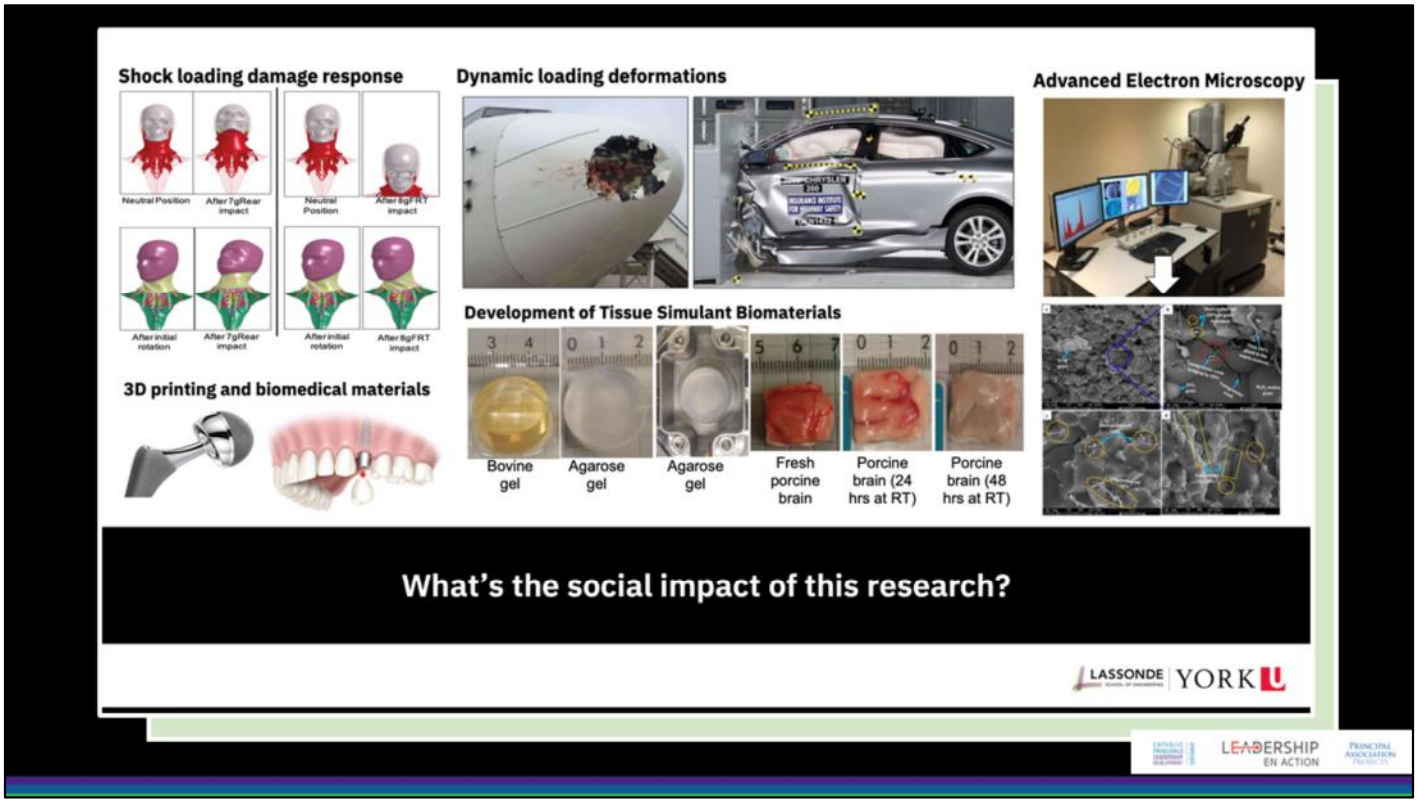
How might these problems use science and technology to develop solutions? Share your thoughts in the chat

Students are most excited about real-world problems, connected to social and environmental justice.
It seems it is an opportunity to engage with learning that can explore the UN Sustainable Development Goals as one example.

Share link in chat: https://sdgs.un.org/goals



Let's not forget that Ontario has exciting researchers and professionals! Though it is important to go back and profile the stories of role models who were never spoken about in our science textbooks, it is important to also speak about the people who continue to contribute today. Meet Dr. Solomon Boakey-Yiadom. He is in an Assistant Professor in our Mechanical Engineering. Many of you probably immediate thought of cars, airplanes, and machinery. Dr. Boakye-Yiadom designs new materials and then studies how they behave when you smash it up.



His area of research expands materials for transportation including airplanes and cars but also looks at biomaterials using 3D printing technology. His work has applications to new emerging medical technologies and materials including better understanding of concussions, and medical implant technologies.

Interesting Fact: Solomon was on National Geographic, Colossal Machines!

I share Solomon's profile here with you to illustrate that STEM is happening here, in Ontario. If you ask your students to name or draw a scientist, engineer, computer scientist, electrician… who would they identify? Would they imagine themselves in those roles as possibilities? Why or why not?

Creating opportunity for students to see that science, technology, engineering design, coding and mathematics are skills and tools that can be used to tackle the problems that means the most to them will engage diverse learners to imagine a place for them in STEM. It is not the things we design and build that is STEM alone. It is a process that builds a toolkit for all learners to become problem solvers, innovators, critical thinkers in today's technological, scientific world.

For example, a 3D printer is not STEM in itself - I imagine that there are some 3D printers in schools. I wonder, how many of them are currently being used? How many might be sitting idle because the teacher who once used it is no longer there? How many are being used for printing random objects with no purpose other than to just print something from the thingiverse? https://www.thingiverse.com/ Instead of passive users of the thingiverse, how might we become creators of solutions?

Maybe the STEM we need is not about 3D printing more stuff but maybe a discussion about plastic waste? Or maybe, they are working on a problem and realize that the component they need does not exist and a custom design is necessary? Why is a 3D printer needed? What is its purpose in the process of problem solving?

Once might say, "I can't do STEM because I don't have a 3D printer"... I might suggest here, that buying the 3D printer is often the easy part… it is defining its purpose, intentional instructional design of its use and learning outcomes, that is often the hardest part. Imagine, we released the STEM curriculum, every school goes out

and buys a 3D printer, and every student from Grades 1-9 now print things each year… that's a lot of plastic and additional electrical energy consumption… with what learning outcome? What purpose?

I don't' mean to suggest that we don't get the tools we need such as 3D printers, I am only suggesting here that getting the equipment without a plan is not moving us forward in STEM teaching and learning.

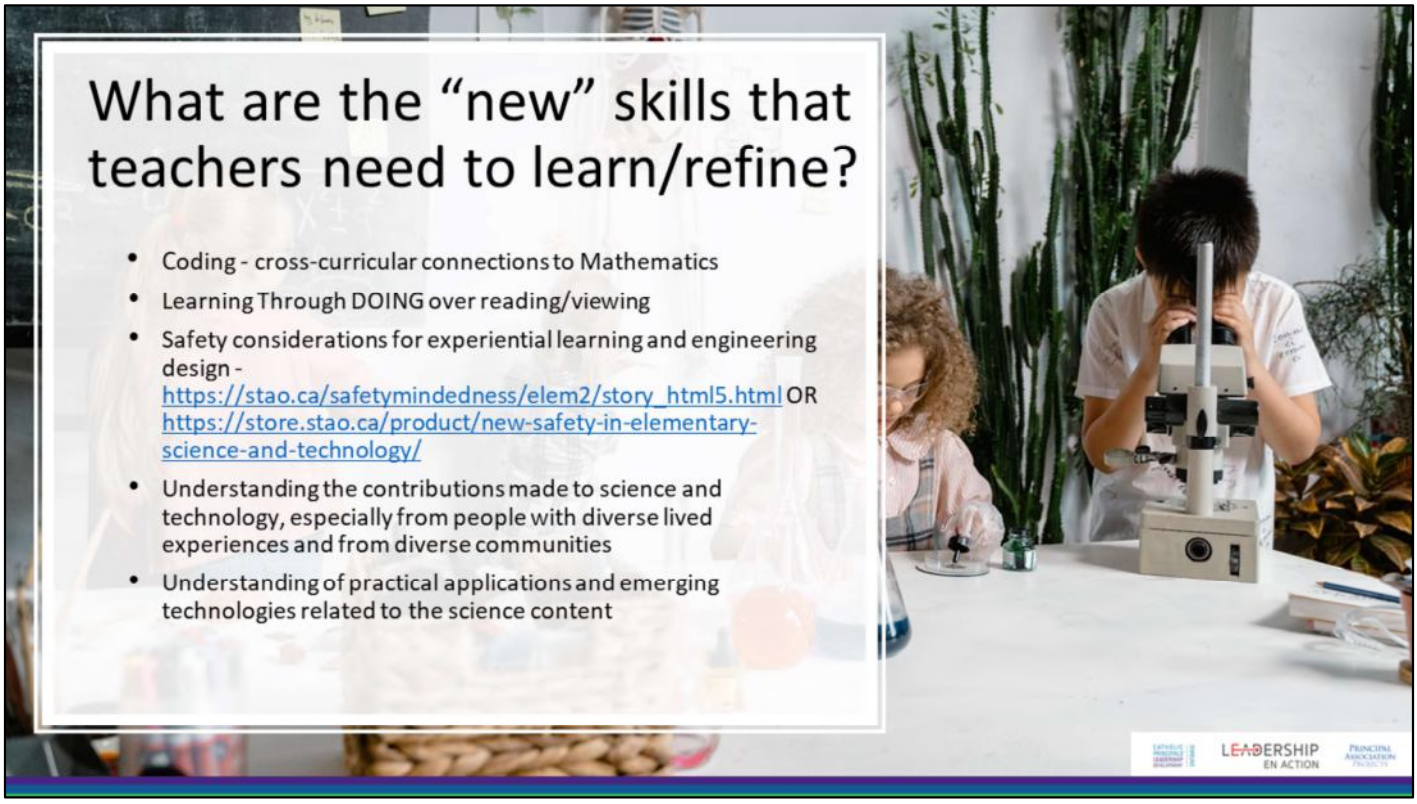
(Maybe in the future PLN - let's address inquiry - 4 types of inquiry in science)

Post-secondary needs to innovate too! The Lassonde School of Engineering will be launching the first university integrated program. Students entering this degree program will earn their 4 year undergraduate degree in Digital Technologies, working in a paid job in industry 80% of their time and 20% in courses. How might we ensure that students have the skills and knowledge they need to pursue degree programs that integrate work and study?

Put in chat:

Article in the Toronto Star by Dr. Jane Goodyer, Dean, Lassonde School of Engineering, York University:
https://www.thestar.com/business/opinion/2022/08/07/digital-apprenticeships-could-solve-canadas-tech-talent-shortage.html?utm_source=share-bar&utm_medium=user&utm_campaign=user-share

https://lassonde.yorku.ca/about/our-people/leadership



1 - coding might be a newer skill, but there are many great Math resources already out there - use what we have to connect!
2 - a great connection of our junior/intermediate teachers to our Kinder/primary teams - learning from each other
3 - safety will be a hurdle people may express - these resources are some of the great things out there that can support teachers in feeling comfortable and reducing liability
4 - teachers should be helped to learn about diversity in contributions made to S&T, and be cognizant of including these - not everything was because of Einstein! Being thoughtful - you might need to counter narratives like “work harder”
5 - opportunities for community speakers, virtual events etc. related to current events and technologies is a good place to start - think about how these “BIG” solutions connect to practical solutions to small problems that have meaning to students?

New Resources Available

What is matter and how is it changed?

Focus strands:

- **STEM Skills and Connections:** A1.2, A1.4, A1.5, A2.2, A3.1, A3.2
- **Matter and Energy:** C1.1, C1.2, C2.1, C2.2, C2.3, C2.4, C2.5, C2.6, C2.7

Examples of cross-curricular connections

- **The Arts:** Visual Arts
- **Language:** Oral Communication, Writing

Skills and connections	Expectations and related curriculum
Students complete a range of introductory activities to learn about the properties of matter, changes of state, and chemical and physical change	C2.1, C2.2, C2.3, C2.4, C2.5, C2.6
Students apply a scientific experimentation process to investigate and describe characteristics and properties of solids, liquids, and gases. They connect their findings to the real world as they explain why specific physical properties of solids, liquids and gases make them useful for particular applications, and they can consider The Arts concepts as they consider the properties of solids and liquids used in paintings and sculptures in two-and three-dimensional art works.	A1.2, A1.4, A1.5, A3.1, A3.2, C2.2, C2.7 **The Arts:** Visual Arts **Language:** Oral Communication, Writing

Long Range Plans - Science and Technology Curriculum Site

STAO Resources - LR Plans and Lesson Plans

- Highlight the key areas in the revised Elementary Science and Technology Curriculum 2022.
- content-specific lessons and activities that cover approximately 1-3 class periods
- All activities include curriculum expectations, learning goals, success criteria, teaching and learning activities, resources and materials, assessment opportunities, and important equity, diversity, and inclusivity considerations to support all learners
- Each of the learning experiences is tied to one of the two models in the long range plans found on this website
- strong focus on Strand A as the overarching strand that focuses on the foundational STEM skills and connections
- enable students to investigate concepts and integrate knowledge from each of the other strands and make practical connections between science and technology and other subject areas
- develop their understanding of strand-specific concepts, investigate phenomena, and make meaningful connections to the real world.

https://scitechontario.ca/

Webinars

As support for these long-range plans and curriculum resources, a series of professional development webinars were presented in November. These webinars were recorded and are now available. The goal of these webinars is to increase teachers' understanding and confidence in teaching the revised Science and Technology curriculum, including cross-curricular instruction and culturally responsive and relevant pedagogy.

Please note that the presentation files will be available for download in January 2023.

Primary

View the replay of the Ontario Elementary Science and Technology Curriculum Primary Webinar 2022.

Watch Here

Junior

View the replay of the Ontario Elementary Science and Technology Curriculum Junior Webinar 2022.

Watch Here

Intermediate

View the replay of the Ontario Elementary Science and Technology Curriculum Intermediate Webinar 2022.

Watch Here

https://scitechontario.ca/

Guiding Question: **How can Principals facilitate professional learning for teachers? How do we know where to start? Some ideas to consider/think about**

1) Before we begin, take a **temperature check**
    - Start from where they are; get to know where teachers are through dialogue, reflection, survey etc.
    - What are the strengths and learning needs of my teachers? (Important that this work is relevant to teachers, asset based learning will reach more people)
    - What is our baseline? What does science look like in the classroom right now? (Important to keep this work close to the classroom)
    - What are the conditions for learning? E.g. No PD last 2 years? Slowly emerging from conditions of pandemic? Ready, engaged, clear, learning stance? Unsure, new school this year?
2) **What learning structures already exist in my school to facilitate the work?**
    - Examples include PLC, divisional meetings, staff meetings, inquiry groups, think tanks
3) **What connections to existing work can we make?**
    - Examples include mathematics, science of reading, assessment etc.
    - Equity, Diversity and Inclusion (EDI) woven throughout - Importance of building the conditions to engage in deep dialogue; focus on the why; importance for our future; ongoing learning to reshape pedagogy and

our way of thinking about teaching and learning

Temperature Check Breakout Groups

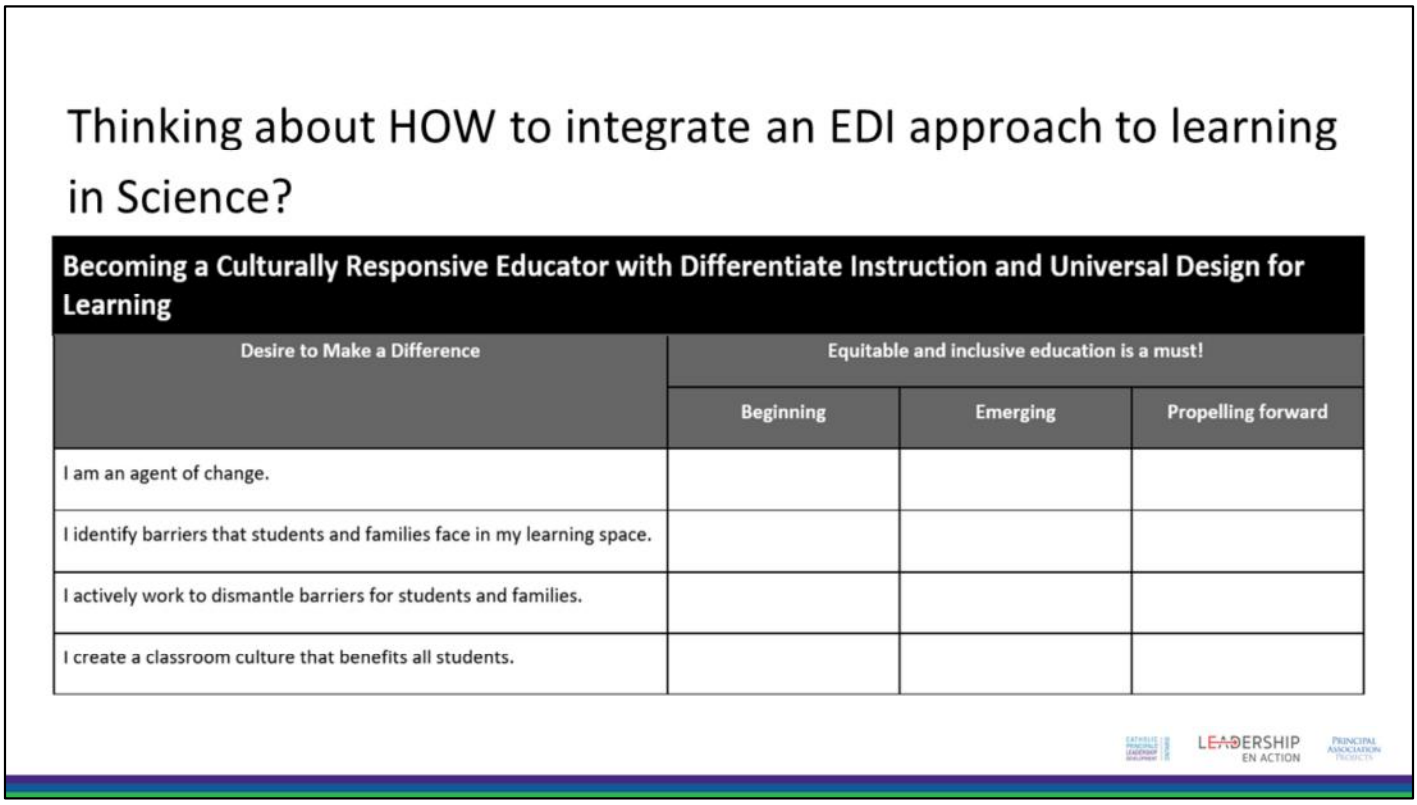
Choose 1 of the following:

Group 1 - Beginning to walk
Group 2- On the journey
Group 3 - Well on our way

Jennifer

3) How can principals engage in meaningful dialogue with staff around EDI?

- Advancing EDI is a commitment and a journey; must be prioritized, takes time, involves taking action, principal is important facilitator of this
- Create norms, values for engaging in learning conversations (Brave spaces vs Safe Spaces); becomes the model for classroom conversations
- Woven through all professional learning; isn't subject specific - new science curriculum allows for relevant context
- Focus on questions and critical thinking; take the opportunity to point out/break stereotypes, broaden our thinking, question status quo
- Use/promote activities that relate to a variety of backgrounds with strong EDI focus - model, model, model!
- Ongoing learning takes time- deepening your pedagogical approach to teaching and learning



Jennifer

Guiding Question: How can principals integrate an EDI approach to learning?

- Existing frameworks can be used as thinking tool
- Tools can help facilitate reflection and conversations about teaching practice
- Supports systems view

Supporting Document “Creating Student Centered Learning Cultures” (refer to document)- insert reference:

- Sample of a questioning tool,- “Becoming a Culturally Responsive Educator with Differentiated Instruction and Universal Design for Learning” (sample section in image above)
    - Pick 1 section as example to walk through with teachers and encourage reflection (e.g. ‘Desire to make a Difference’ section - is about becoming change agents working towards more equity)
        - Share prompts from sample section above to help teachers think about how they can create conditions in their classroom/set up the environment for science.
        - Use think, pair, share (think/reflect individually, share with a partner, consider small groups/staff as appropriate). Highlight importance of creating the conditions for these conversations to take placemeaninfully (Brave spaces vs Safe spaces)

- Think about moving from broad to specific conversations (e.g. getting closer to the classroom)

Example: 1) “I am an agent of change”- How am I thinking about the role I play in making change happen in my science classroom?
2) “I identify barriers that students and families face in my learning space” - How am I actively identifying barriers my students and families safe? Eg. Am I looking at the limits of my task in terms of accessibility by all? Have I looked at the IEPs to ensure roadblocks (such as visual impairment) are addressed ?
3) “ I actively work to dismantle barriers for students and families” - Am I proactively seeking out how I am going to dismantle barriers? Eg. Can I open up the task to reach all learners? If I’m using a specific software for an engineering task, do all of my students have access to this software at home? To a computer?
4) “I create a classroom culture that benefits all students” - How am I building a collaborative culture? What needs to happen before students are put into teams to engage in a task or experient?

**Link to share: https://lassonde.yorku.ca/about/our-values/kindergarten-to-industry-k2i-academy/bringing-stem-to-life#teacher-resources

Jennifer

Guiding Question: How will we know we are successful?

- About monitoring our work
- How do we co-construct the look fors (success criteria) with teachers?
- Co-constructing with teachers is a model for co-constructing with students
- Important because it aligns with where teachers are at
- Use prompts: “What does it look like? Sound like? Feel like?” - explain each
- Eg chart (Looks like: hands on, collaborating, re-doing/re-trying)
- Eg chart (Sounds like: dialogue, questioning, pauses for thinking)
- Eg chart (Feels like: belonging, respected, I can contribute)
- Can continue to build on throughout the year (build on knowledge, experiences, reflection)
- Go beyond looking for anchor charts
- Look beyond the classroom, e.g. doing a great job in stem with class, will see more interest in extracurricular stem clubs such as coding or robotics

Resources that are available include:
Ontario Science Centre
Resources are available online in both English and French.

Science North
Resources are available online in both English and French. New updates are coming in the fall.

STAO
Resources are being being developed in partnership with other organizations and will be coming in the fall in both English and French. For seamless access to the resources, there is a school membership for elementary schools which costs $50, providing access to resources for all your staff.

Let's Talk Science
Beginning this fall, Let's Talk Science will offer multiple professional learning opportunities for educators that support the renewed Ontario curriculum. Key areas being covered are scientific and engineering design processes; STEM skills and connections; and diverse backgrounds and perspectives. More events will be added over the summer so check back in a few weeks to see a full fall schedule. By December let's talk science will add a landing page for Ontario educators that highlights learning resources aligned to the new curriculum launching this fall. Initially

this page will feature 25 English and 25 French resources correlated to the new Ontario curriculum with tags developed in collaboration with the Ministry.

Canada Learning Code
Has some coding activities connected to science content areas that may be of interest for classroom implementation.

Collect Feedback from participants to inform next webinar


CATHOLIC PRINCIPALS' LEADERSHIP DEVELOPMENT ONTARIO
LEADERSHIP EN ACTION
PRINCIPAL ASSOCIATION PROJECTS
CONTACT US
• ADFO www.adfo.org
• CPCO www.cpco.on.ca
• OPC www.principals.ca
@adfo
@CPCOofficial
@OPCouncil

Thank you!