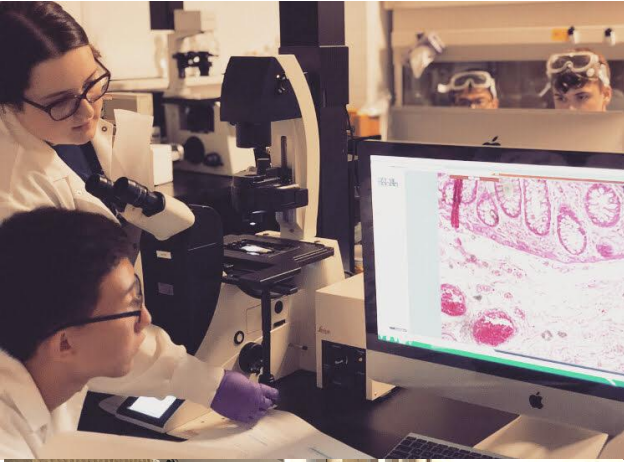




Equity, Diversity and Inclusion in STEM with a Focus on Engineering

Vanessa Ironside
Program Officer
k2i (Kindergarten to Industry) academy





Vanessa Ironside

Program Officer
k2i academy

Education

Honours Bachelor of Science

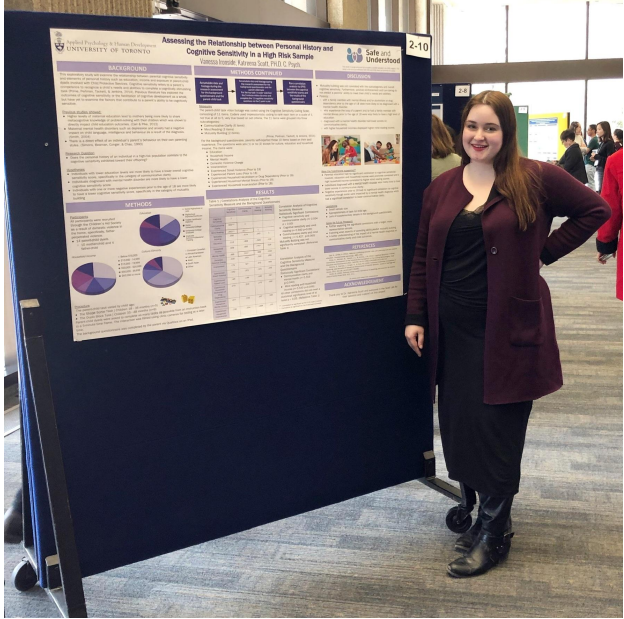
Human Biology & History and
Philosophy of Science and Technology

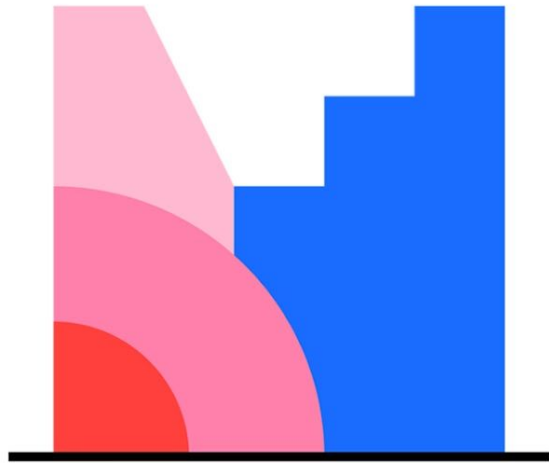
Master of Education

Developmental Psychology

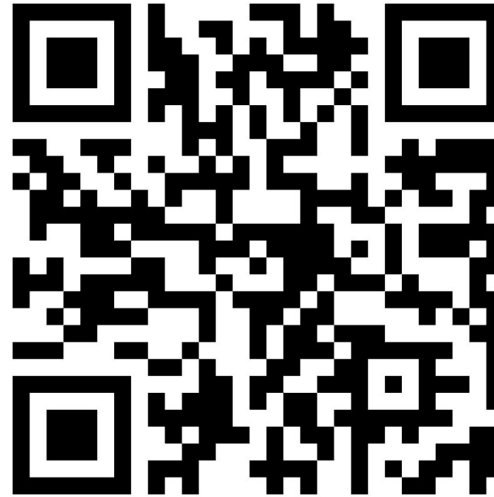
***In Progress* PhD**

Mechanical Engineering with a focus on
STEM Education





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www.menti.com

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Land Acknowledgement

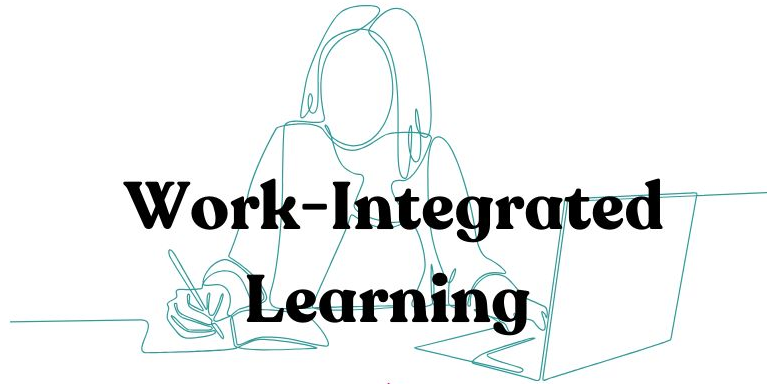
Indigenous peoples have always known and done STEM, the land has been their classroom to learn traditional ways of knowing.



Bringing STEM to Life



Community



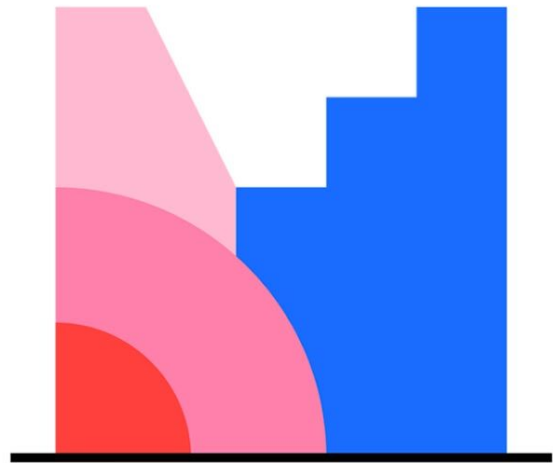
**Work-Integrated
Learning**



In School



**Leadership Development
Research**



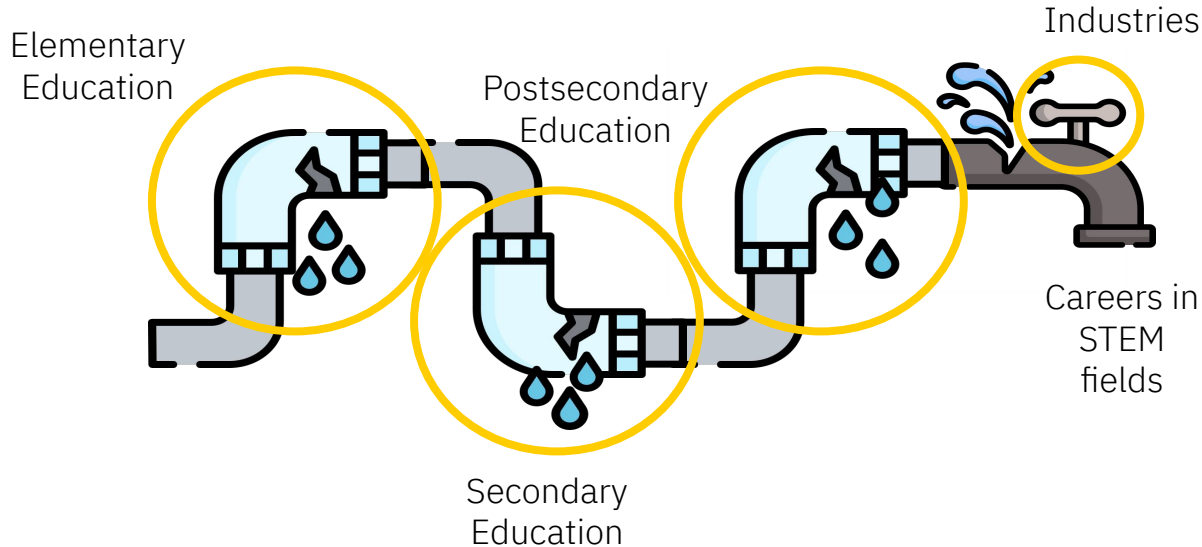
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**What comes to mind
when you think of an
engineer?**

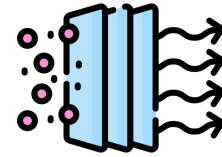
The Landscape of Engineering



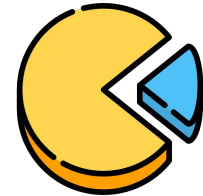
“Leaky” Pipeline Analogy



The analogy of the “leaky pipeline”, originally intended to show the journey of Women through their STEM education journey.

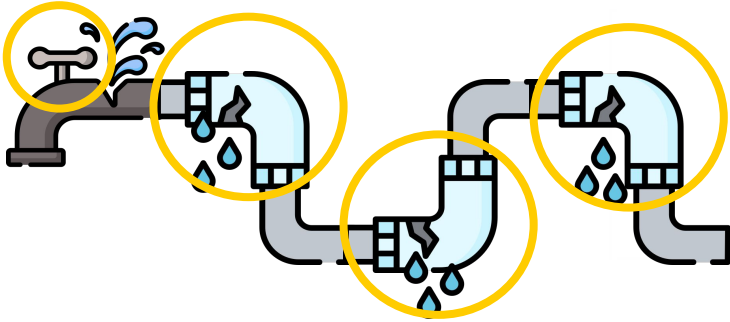


Is it leaking or filtering?



Can it be extended to other underrepresented youth?

Questioning the Analogy



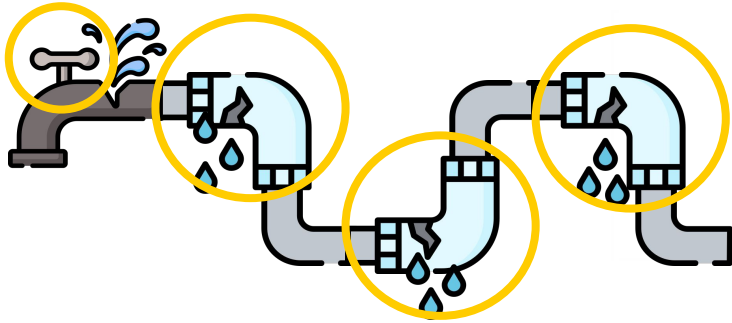
What material is the pipe made of?

Is the pipe designed for all the same type of fluid?

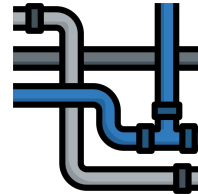
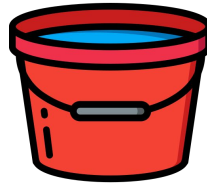
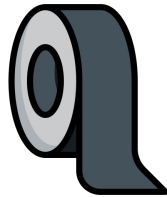
What if the pipe was expected to leak?

What if the pipe was designed to leak?

Questioning the Analogy



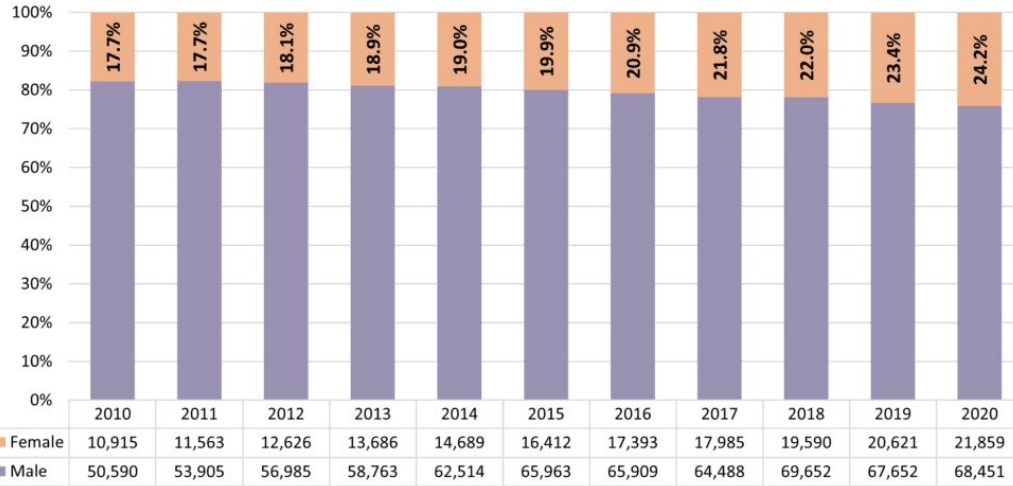
Where does the fluid go when it leaks?
Should we use duct tape to prevent leaks?
Do we simply catch the fluid or do we add more pipelines to reconnect the fluid?



What does STEM look like today?

Undergraduate Enrollment in Engineering

Undergraduate Engineering Enrollment by Gender 2010 to 2020



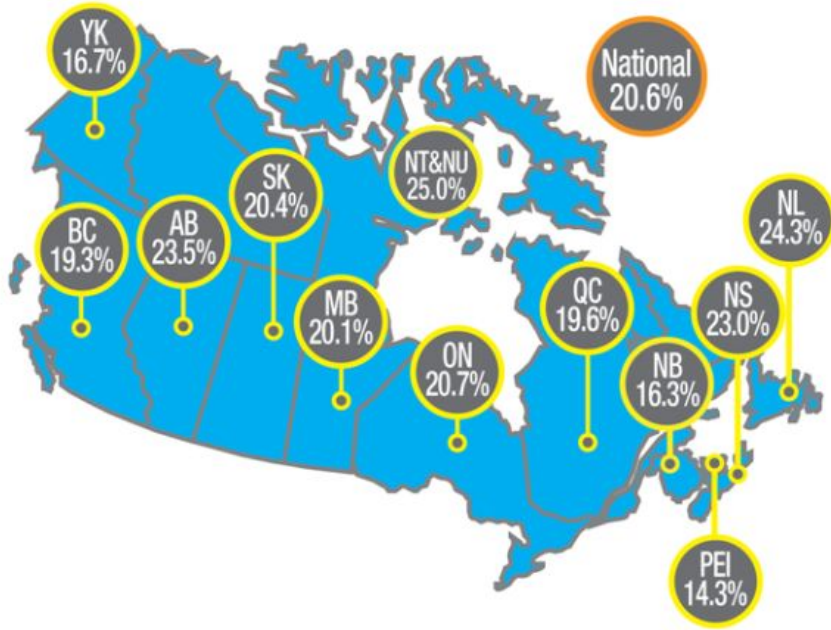
Girls interests for entering into the STEM Profession are different



Girls are less likely to apply for something if they are only partially qualified

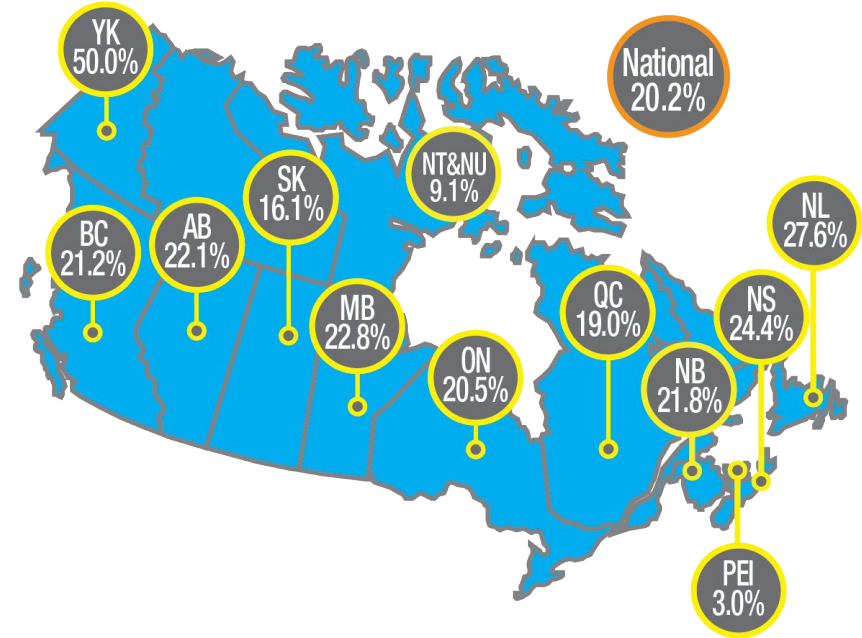
Percentages of newly licensed engineers who are women

As of December 31, 2020



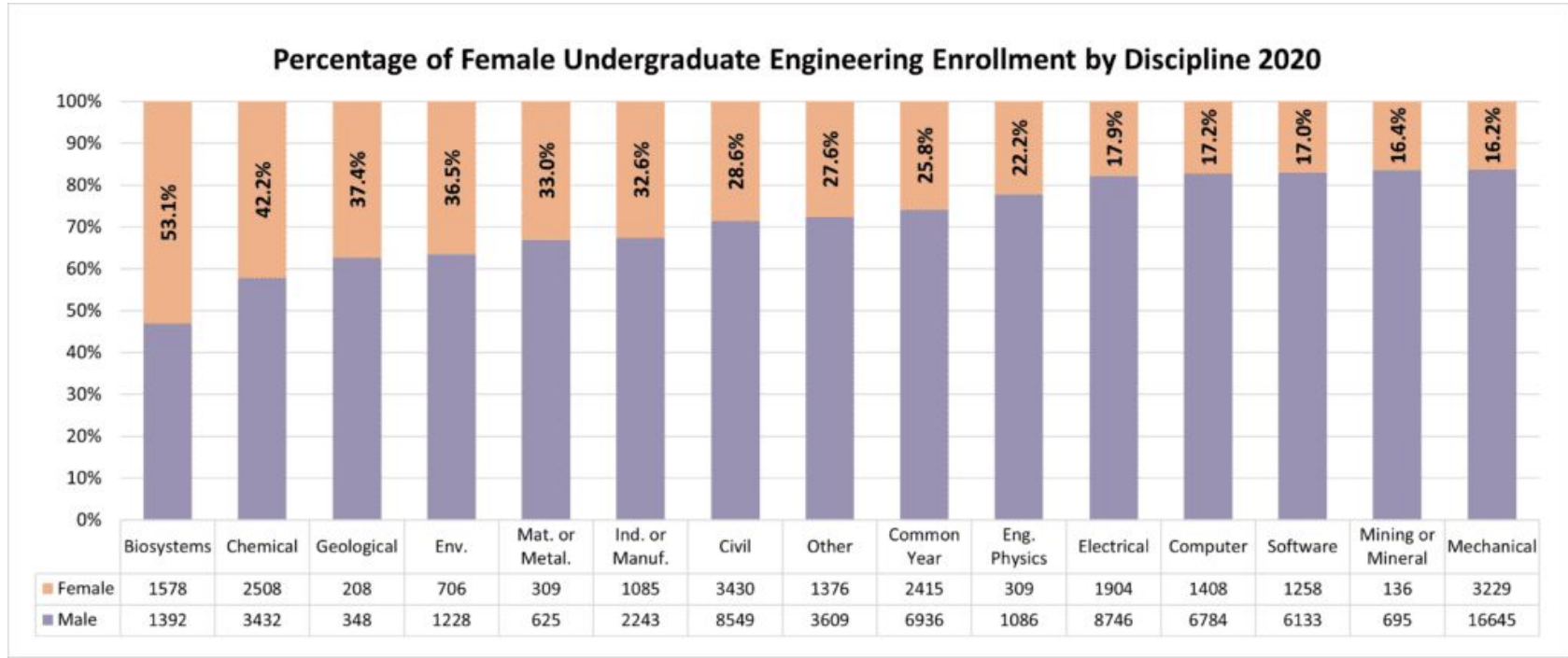
Percentages of newly licensed engineers who are women

As of May 2024



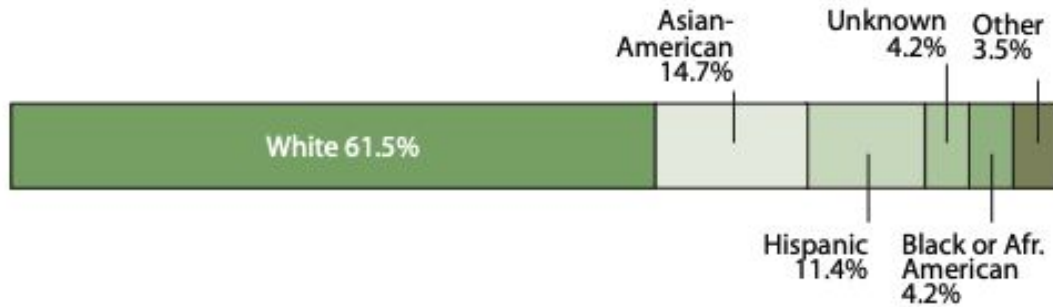
What does STEM look like today?

Undergraduate Enrollment by Discipline



What does STEM look like today?

BACHELOR'S DEGREES BY ETHNICITY, 2018*



This is an example of race distribution in the American context

A large issue with understanding diversity within engineering in the Canadian context is a lack of race based data.

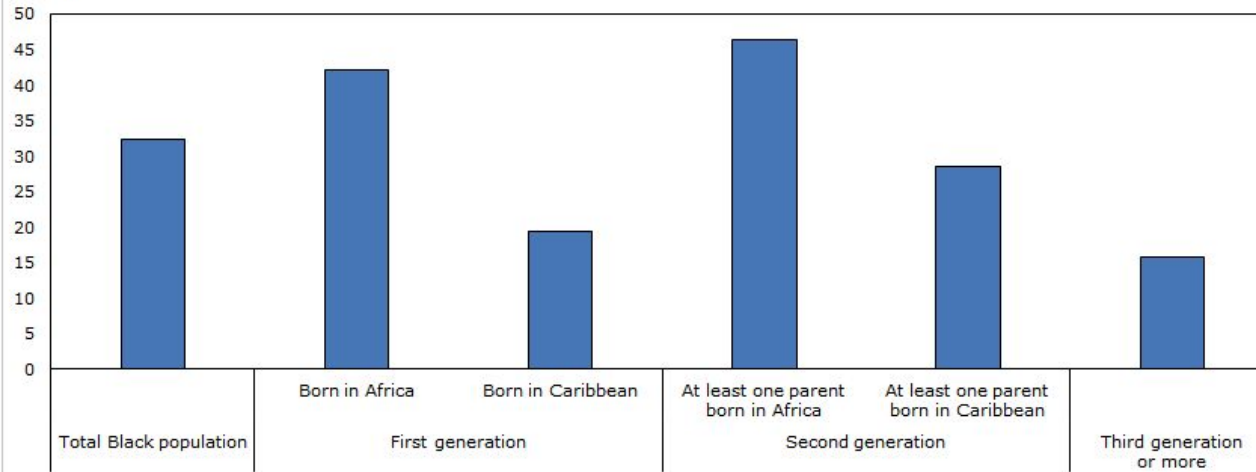
School systems and workplaces only require gender to be reported and if race data is collected it is optional and lacks substance.

What does STEM look like today?

Chart 4

African-origin Black populations were the most likely to have a bachelor's degree or higher

percent



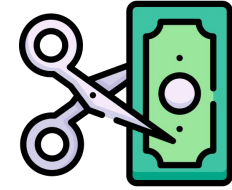
Source: Statistics Canada, Census of Population, 2021.

What does STEM look like today?

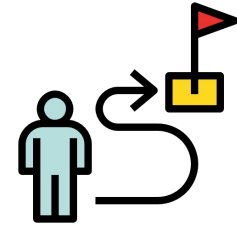
Chart 1 - Racialized and Aboriginal Academic Staff, Labour Force and Students



Racialized, aboriginal and women are less likely to have full time positions in post-secondary and are faced with lower wage earnings



Racialized youth experience biases, microaggressions, lack of mentors and lack of institutional support through their learning journeys.



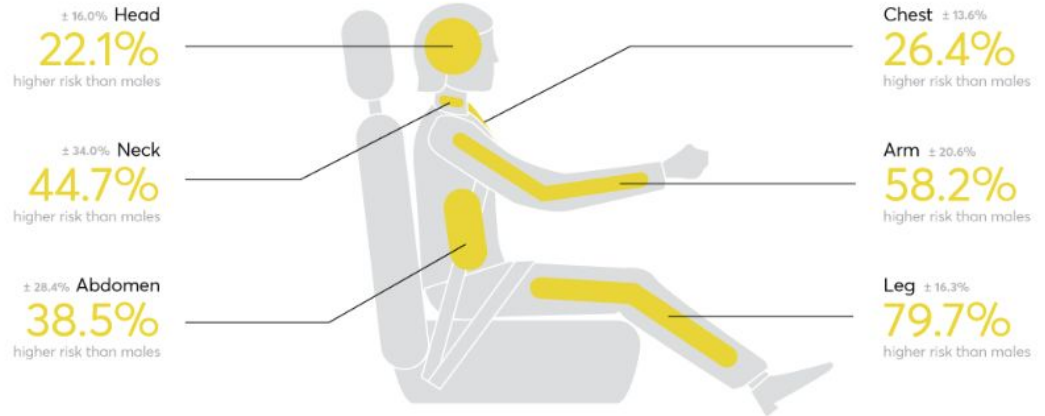
Why is equity, diversity and inclusion important?

The Innovation of Seat Belts

The current three point seatbelt was invented back in 1958, reduce injury and death in the population significantly. Despite, it's innovation, the device was designed for the “average” male, placing women or individuals differing from the sample body at a great risk of injury and death.

Female Increased Risk of Injury

Estimated increase of risk for moderate injuries in a car crash compared to a male driver or right front passenger of the same age



Source: NHTSA Injury Vulnerability and Effectiveness of Occupant Protection Technologies for Older Occupants and Women

Why is equity, diversity and inclusion important?

The World of Artificial Intelligence

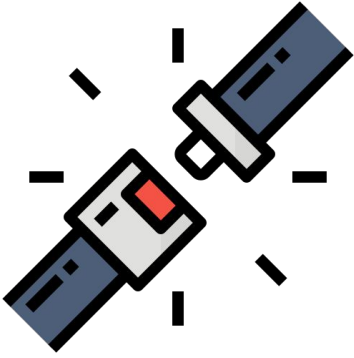
AI is taking over industries by providing fast and accessible solutions. The issue is these systems such as facial recognition systems are only as intelligent as the data used to develop them. These systems have drawn racist and sexist conclusions from data sets.



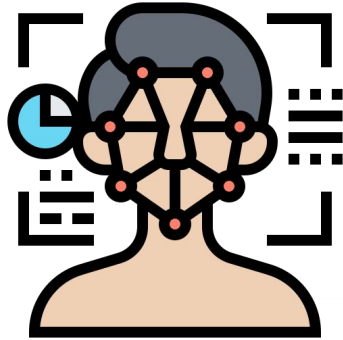
Cybernetics 3.0 Exhibit

Prompt: “Portrait of an African Person”

Why is equity, diversity and inclusion important?



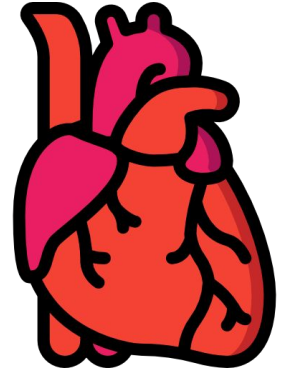
First seatbelts built and tested solely on “average” male dimensions



Facial recognition systems are racial biased against non white users



Medical training often only teaches signs and symptoms on white skin



First heart valves not suitable for all women

The Problem

Beyond Representation in STEM



Lack of race based and intersectional data including non-binary gender in Canada

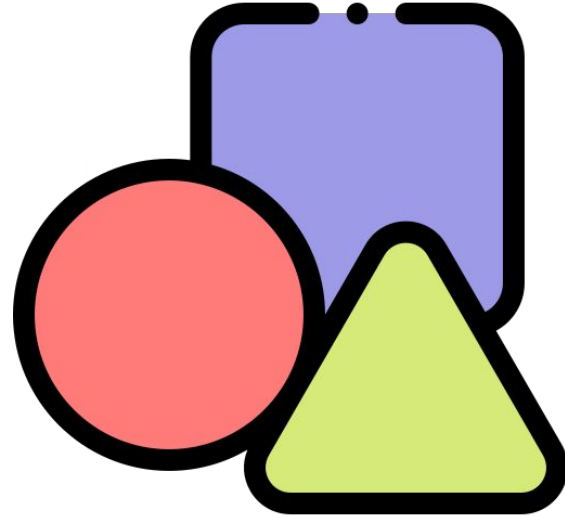


Lack of research and policy to see the impact of current initiatives for formal and informal STEM Education



Interventions focus on getting youth interested in STEM but fail to address systemic barriers, not providing a sense of belonging and access

What is equity,
diversity and
inclusion?



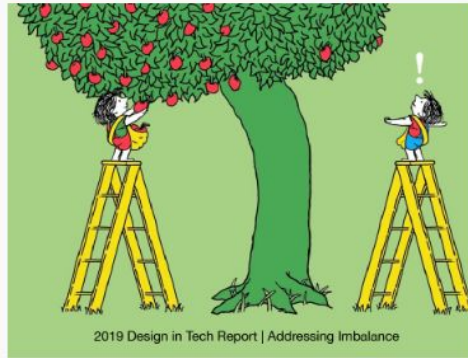


What does equity mean to you? What does it look like in engineering?

Equity



INEQUALITY



EQUALITY



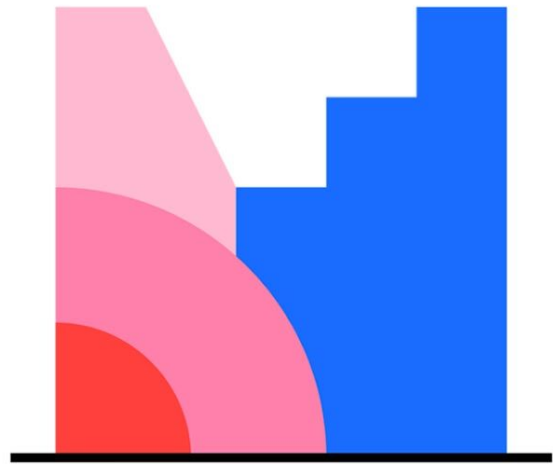
EQUITY



JUSTICE

Fair treatment, access, opportunity and advancement for all people, while at the same time striving to identify and eliminate barriers that have prevented the full participation of some groups.

These barriers are often systemic barriers to opportunities.



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What does diversity mean to you? What does it look like in engineering?

Diversity



Diversity is including or involving people from a range of different social and ethnic backgrounds and of different genders, sexual orientations, etc.



What does inclusion mean to you? What does it look like in engineering?

Inclusion



Inclusion is providing equal access to opportunities and resources for people who might otherwise be excluded or marginalized, such as those who have physical or intellectual disabilities and members of other minority groups.

Inclusion is not bringing people into what already exists; it is making a new space, a better space for everyone.

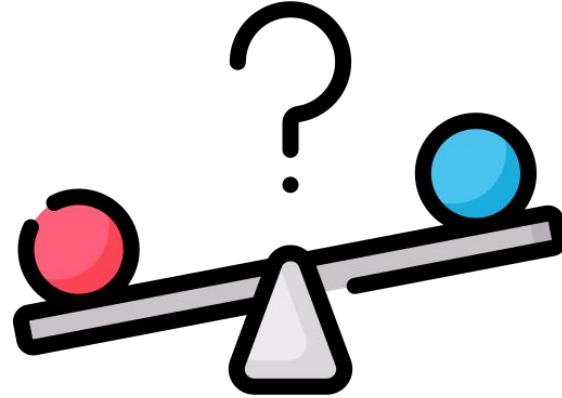
- George Dei



Riddle Break

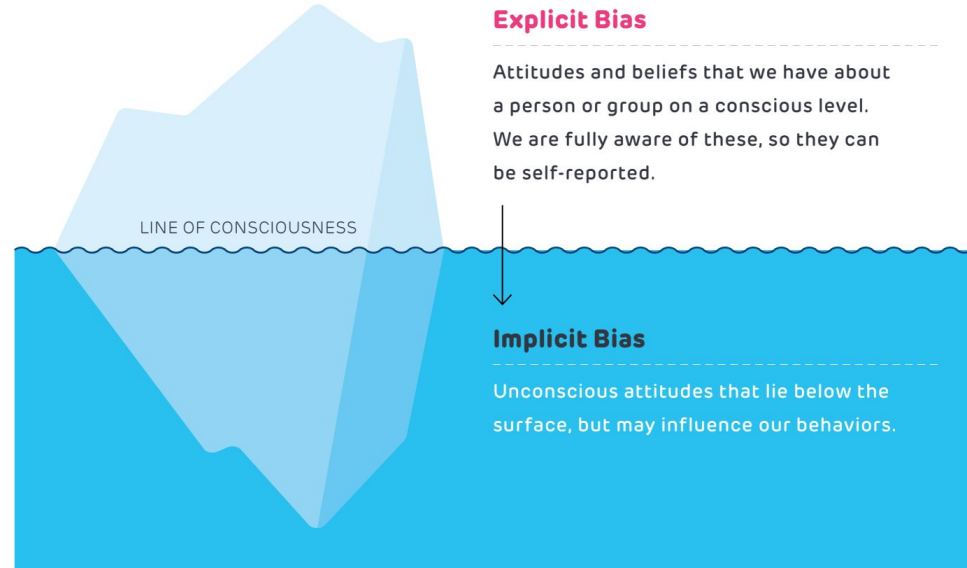
A father and son get in a car crash and are rushed to the hospital. The father dies. The boy is taken to the operating room and the surgeon says, “I can’t operate on this boy, because he’s my son.”
How is this possible?

Exploring Biases

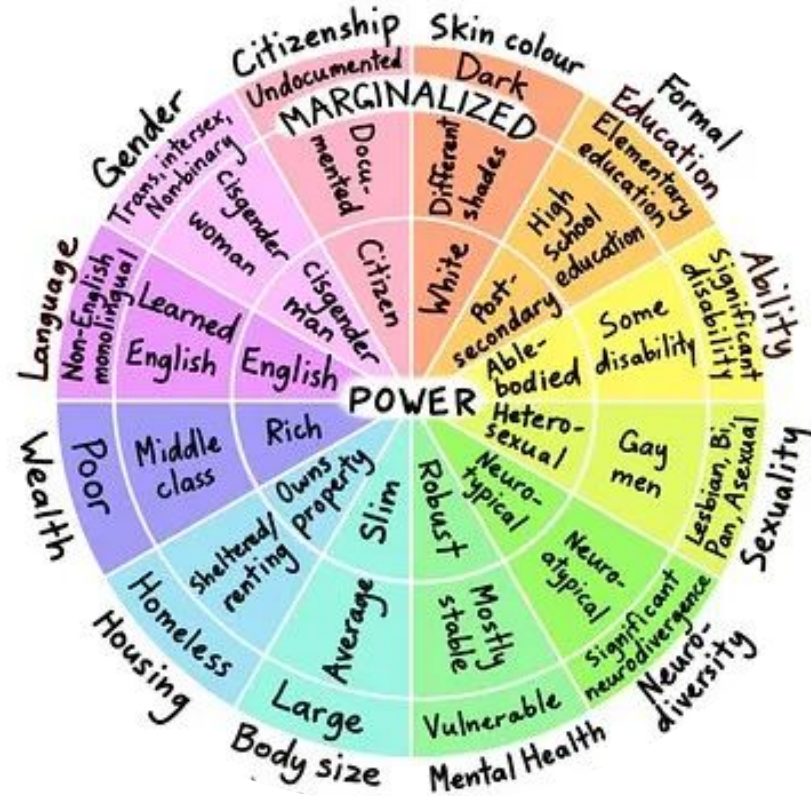


Bias

- A predisposition, prejudice or generalization about a group of persons based on personal characteristics or stereotypes.
- **Implicit or unconscious** bias refers to unconscious attitudes, reactions, stereotypes, and categories that affect behaviour and understanding.
- It is critical for everyone to consider their biases, especially those which are implicit.

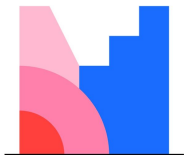


The Wheel of Power



Stereotypes

- An idea or belief that assumes the sameness of all members of a particular group.
- Fails to recognize individual differences and attribute the same characteristics to all members of a group.
- There is no such thing as a positive stereotype.



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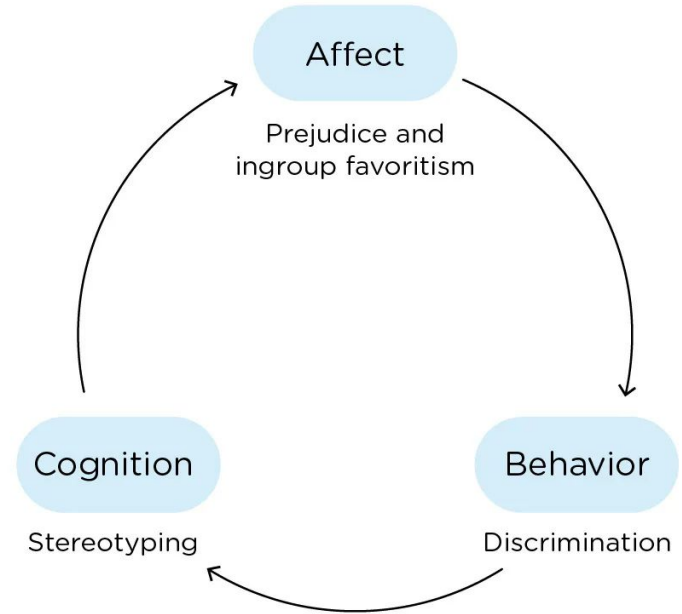
What are the stereotypes that people associate with engineering?



Example: In a study the word “woman” was used in combination with “home” and “children”, where “man” was used with words like “career” and “work”.

Prejudice

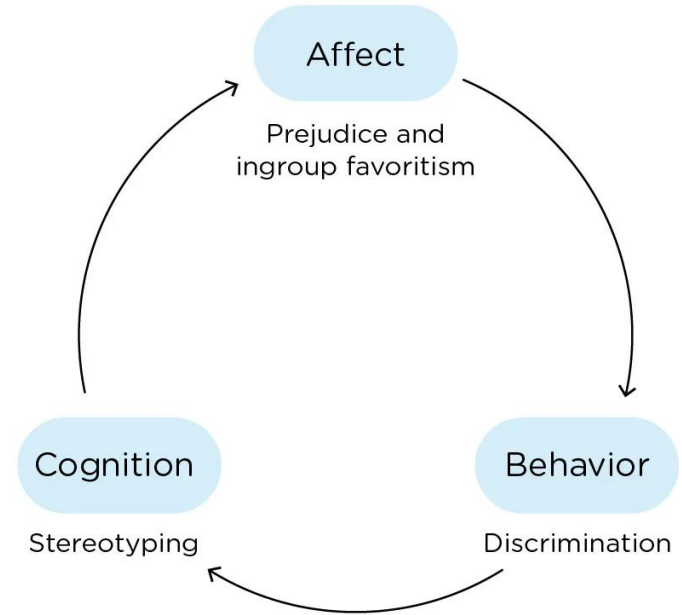
- A prejudgement or assumption about a person or a group of people without adequate knowledge of who they are.
- It is an irrational thought or attitude, often based on stereotypes.
- Can affect someone's behaviour towards another person or group.



Discrimination

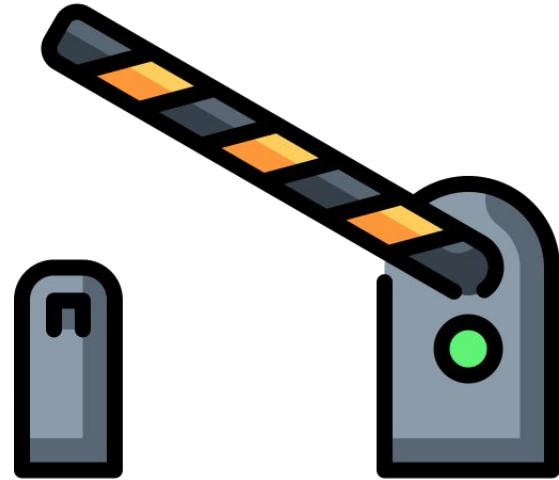
Prejudice + Power = Discrimination

- Is an action based on prejudiced attitudes.
- It is the unfair/inequitable treatment of someone based on their race, ethnicity, gender identity, sexual orientation, ability, age, socio-economic status, language, faith or other part of their identify, and it can be conscious or unconscious.
- To discriminate, one group must have social, economic and/or political power to affect another group.



As an engineer, when might you be in a position of power?

Systemic Barriers to Opportunity in Engineering

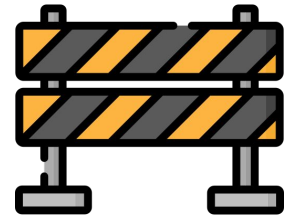




What systemic barriers do individuals face throughout their education and careers pursuing engineering?

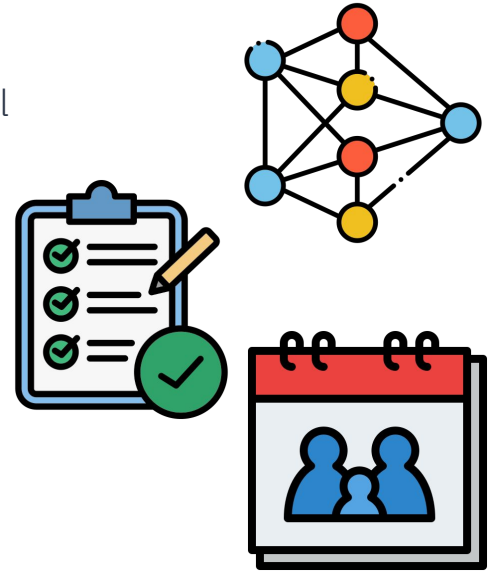
Systemic Barriers to Opportunity within Education

- Recruitment process and application process
- Students may have to choose between paid work and learning opportunities
- Not being able to afford further education
- Students have already decided not to pursue STEM at an early age and are not enrolling in prerequisite courses such as physics
- No role models or access to mentors
- No networks to provide advice for post-secondary studies
- Geographically living in a community that is distant from a post-secondary institution



Systemic Barriers to Opportunity within Workplaces

- The demand of personal networks to secure roles
- Biases and discrimination within job hiring processes and internal processes
- Inflated job requirements to exclude certain groups
- Child care and familial responsibilities
- Transportation and geographical barriers
- Microaggressions, harassment and discrimination within the workplace



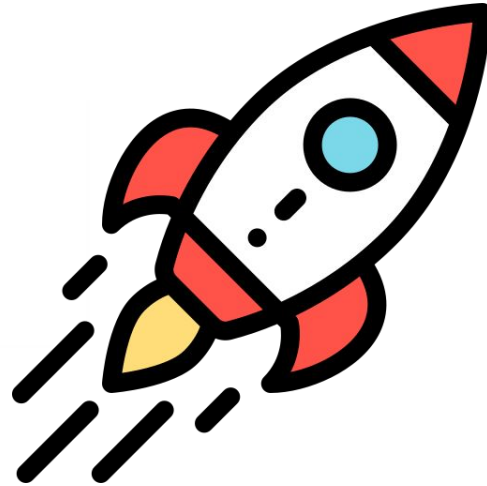
Intersectionality

It is important to understand that barriers to opportunity are intersectional, meaning that every individual has a unique journey and life experience that impacts the barriers they face, and these can not be viewed in isolation, nor simply counted and added together.

The Wheel of Power



Current Initiatives



Ontario Human Rights Code

Ontario's Human Rights Code, the first in Canada, was enacted in 1962. The *Code* prohibits actions that discriminate against people based on a protected *ground* in a protected *social* area.

Protected grounds are:

- Age
- Ancestry, colour, race
- Citizenship
- Ethnic origin
- Place of origin
- Creed
- Disability
- Family status
- Marital status (including single status)
- Gender identity, gender expression
- Receipt of public assistance (in housing only)
- Record of offences (in employment only)
- Sex (including pregnancy and breastfeeding)
- Sexual orientation

Protected social areas are:

- Accommodation (housing)
- Contracts
- Employment
- Good, service and facilities
- Membership in unions, trade or **professional organizations**



Anti-Racism and Equity Code

Government of Canada

The Government of Canada has STEM education as a priority with the creation of many programs such as:

- CanCode
- Chairs for Women in Science and Engineering
- NSERC Young Innovators
- NSERC PromoScience



Government
of Canada

Gouvernement
du Canada

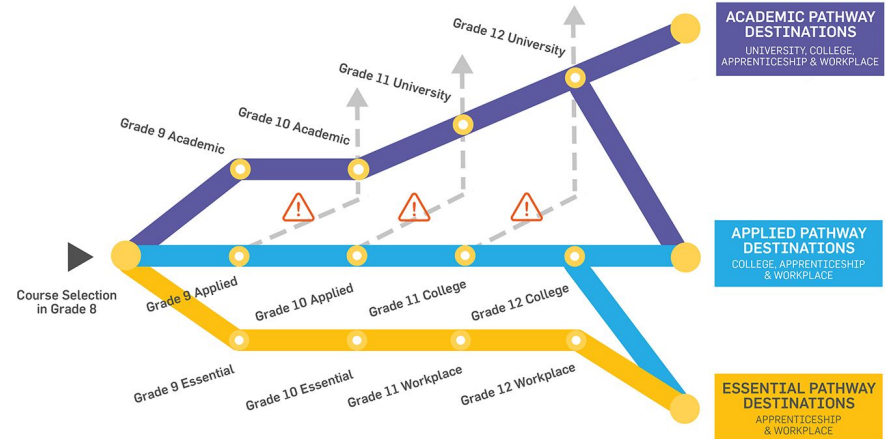
Canada

Government of Ontario

The Ministry of Education within Ontario has also made steps toward prompting STEM career pathways with:

- **De-streamed grade 9**
- Incorporating of coding starting in grade 1
- Incorporating engineering design into the curriculum
- Requirement of 1 trade credit in high school
- Specialist High Skills Major programs in STEM

Ontario

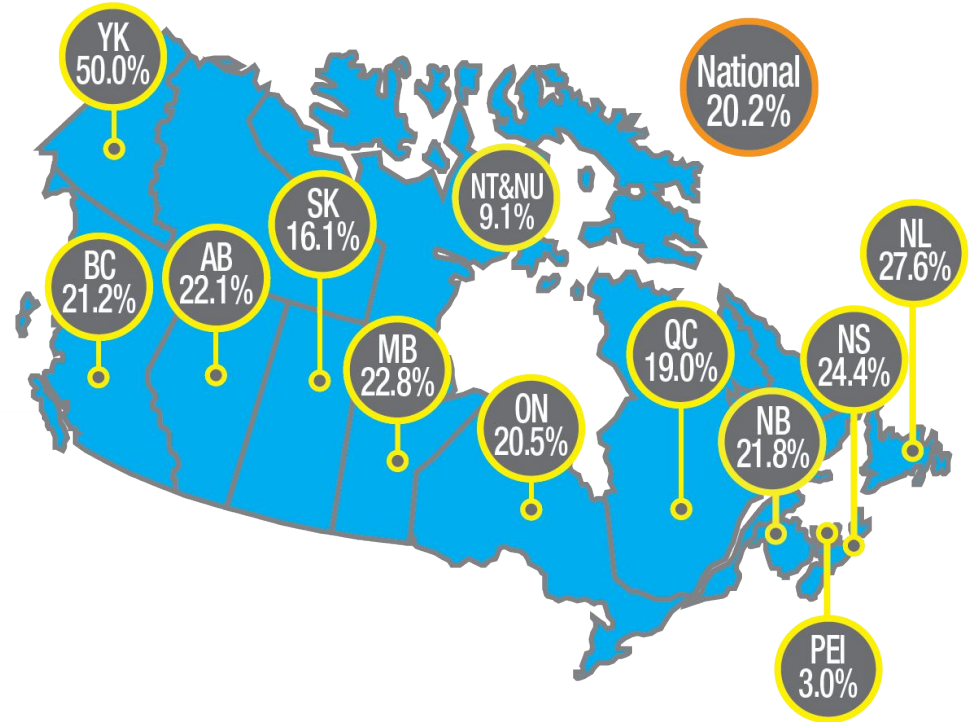


30 by 30

This is an initiative driven by Engineers Canada to get 30% female-identifying individuals as newly licensed engineers by 2030 in collaboration with various institutions.

Percentages of newly licensed engineers who are women

As of May 2024



Outreach Organization

Various institutions across Canada have outreach programs within their departments to expose youth to STEM as well as many organizations geared towards supporting undergraduates and graduates as they navigate university.

McMaster hires undergraduate for their outreach programs and so do we at k2i academy!





You are the future engineers of society

The designs and solutions you create will hold power in the world, the environment you create in your institutions and organizations hold power.

What kind of engineer do you want to be? How can you create spaces that promote equity, diversity and inclusion?



Thank you!

Any questions?

Vanessa.Ironside@Lassonde.yorku.ca



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