# Professional Learning Network # 2: Tweaking and Fortifying the Science Program

## Supporting your educators in identifying ways to enhance their own program in an intentional way

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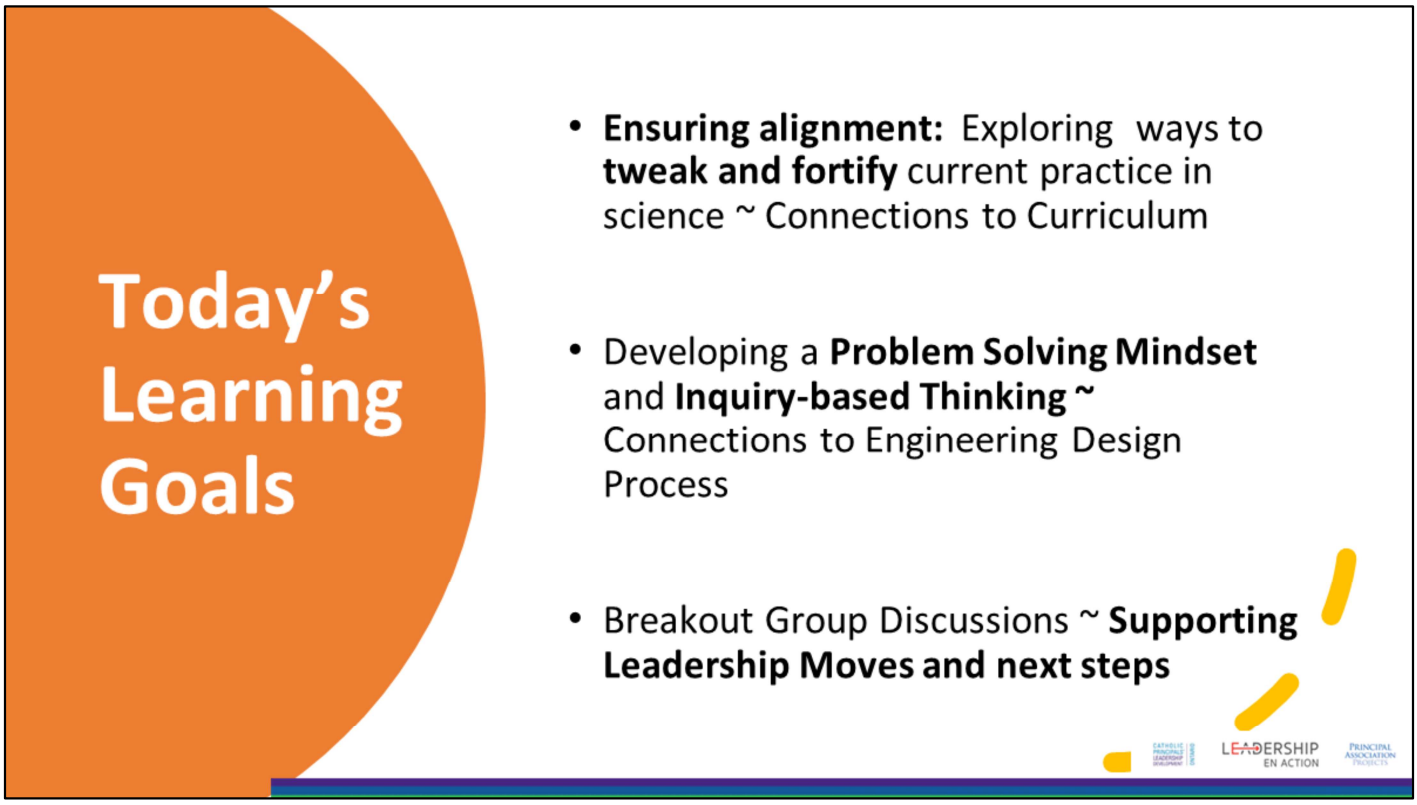
# Land Acknowledgement

Welcome everyone and thank you for joining us. I would like to begin by acknowledging the ancestral and treaty lands of of the Michizaagiig Anishinaabek also known today as the Mississaugas of the Credit, from where I am speaking to you today. We are grateful to the Michizaagiig people for their stewardship of this land and our invitation to share in this land. We are committed to the sacrament of reconciliation, and fulfilling our treaty obligations, duties and responsibilities as outlined in the Gdoo-naaganinaa (Dish with One Spoon) wampum.

Learning about the Anishinaabek histories, people and ongoing presence of the Anishinaabek nation, I am reminded that we are guests, who have been invited into this beautiful blanket of life. This is an important reflection for us, as it reminds us that as guests we are to be gracious of the privilege we have to inhabit these lands. It speaks to our ongoing responsibility to care for this land, the water and animals that inhabit it.

I would like to encourage you to acknowledge the lands on which you have been invited today and add them to the chat.




Jen - Today's learning goals

The language of Tweaking and Fortifying is borrowed from the Thinking Consortium.

Tweaking is about taking what is already good, and fortifying it/making it better by making slight adjustments.

That is the perspective we are going to come from today.

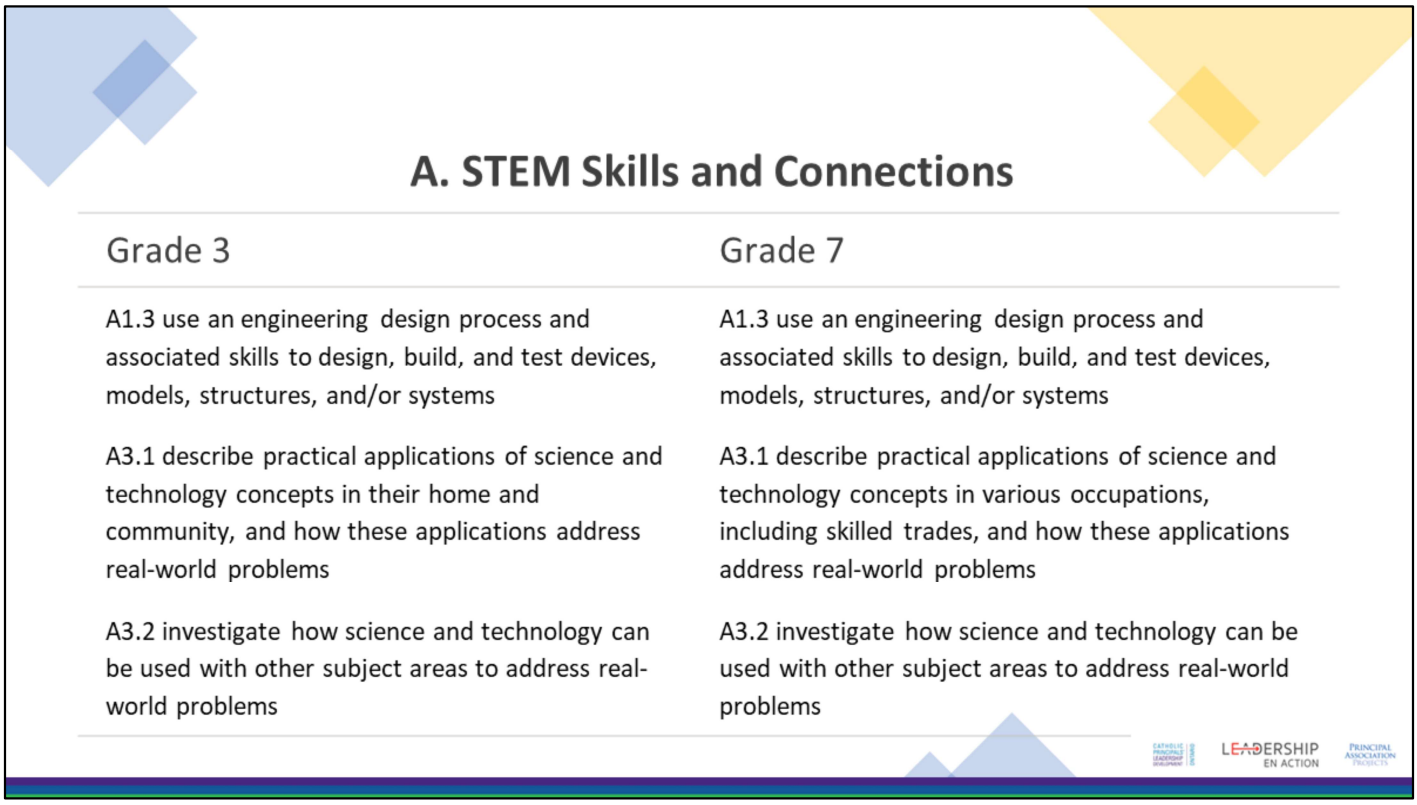
# Office Tower Challenge

USING ONLY 4 PIECES OF 8.5X11" PAPER, 4 PAPER CLIPS AND 1 METRE OF TAPE, CREATE THE TALLEST FREE-STANDING STRUCTURE POSSIBLE.

YOU WILL HAVE A TOTAL OF 5 MINUTES TO COMPLETE THIS TASK.

THE ONLY RULE IS THAT YOU NEED TO USE ALL OF THE MATERIALS PROVIDED, AND YOU CANNOT USE ANYTHING ELSE.

# Possible Curriculum Connections

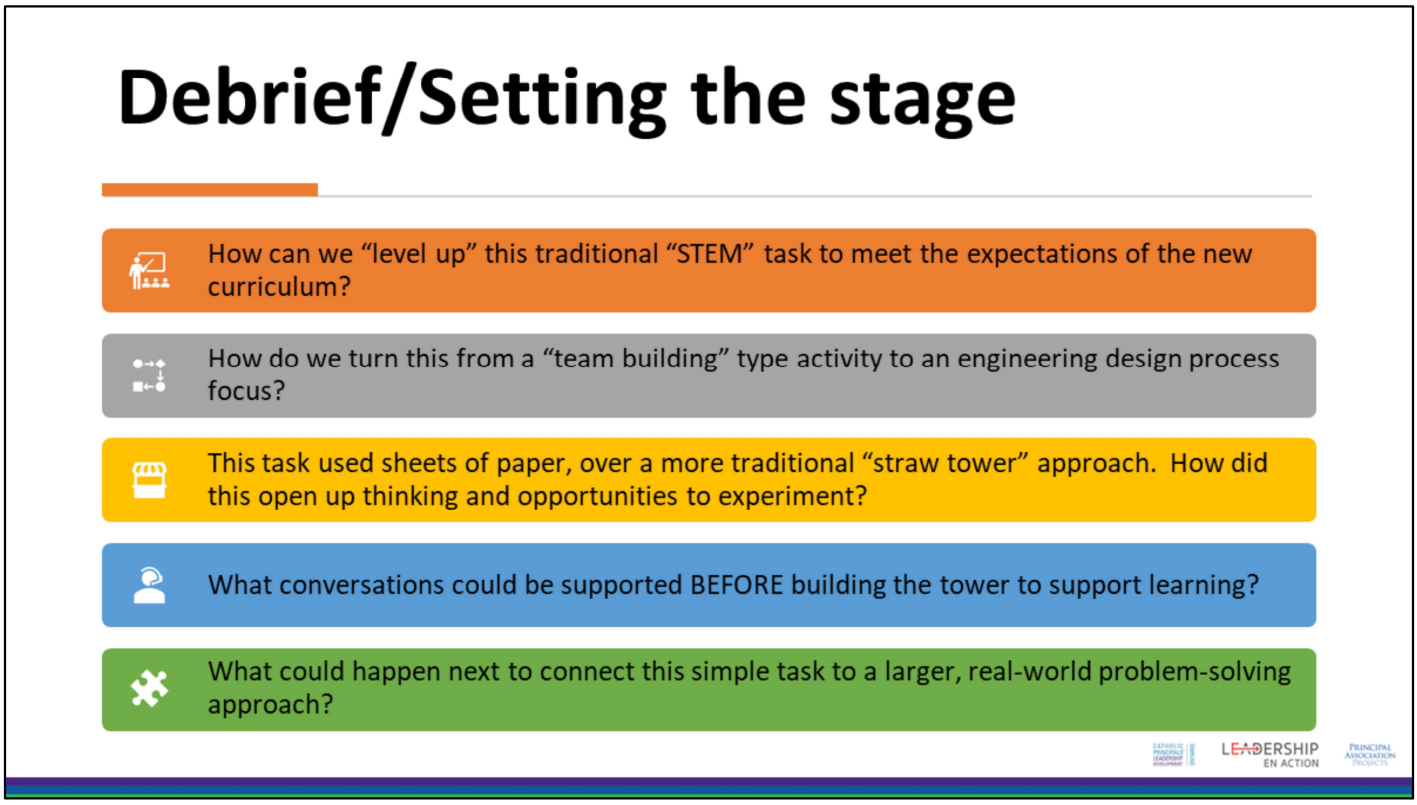



Equity conversation - Real-world problems are an opportunity to explore social justice issues related to global inequities such as the environment, poverty, gender gaps, water, etc, etc..

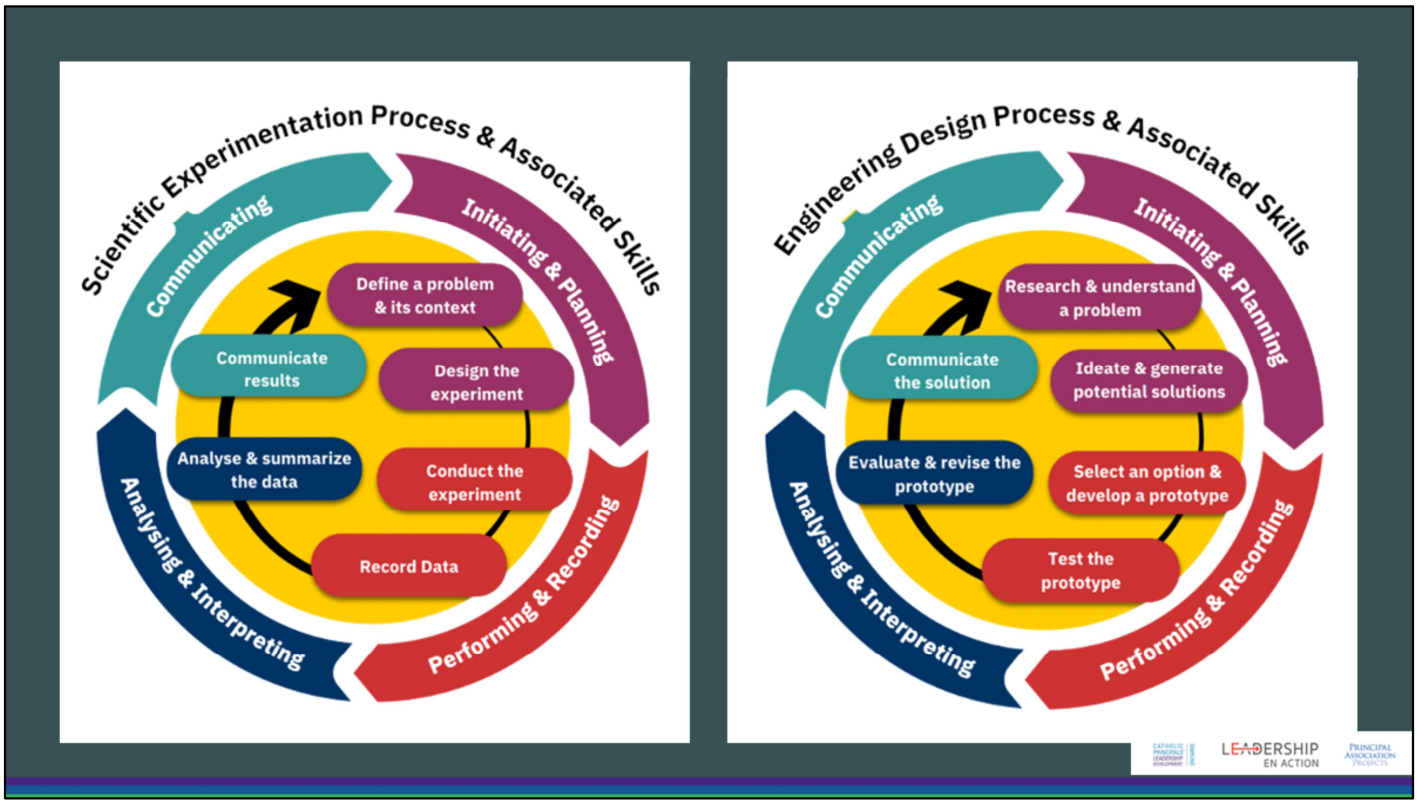
## D. Structures and Mechanisms -Form, Function, and Design of Structures

| Grade 3 | Grade 7 |
| --- | --- |
| D2.2 demonstrate an understanding of the relationship between form and function for various structures<br><br>D2.3 identify the strength of a structure as its ability to support a load and describe ways to increase the strength of structures, including ways to increase the strength of different materials used to build them<br><br>D2.4 describe the stability of a structure as its ability to keep its shape, maintain balance, float, and/or stay fixed in one spot when a force is applied to the structure, and describe ways to improve a structure's stability<br><br>D2.5 identify properties of materials that need to be considered when building structures | D2.2 describe ways in which the centre of gravity of a structure affects the structure's stability<br><br>D2.4 describe the role of symmetry in structures, and identify instances of symmetry in various structures<br><br>D2.5 describe factors that can cause a structure to fail<br><br>D2.7 describe methods engineers and other professionals use to assess, improve, and maintain the safety of structures |

| | Grade 3 |
|---|---|
| **Mathematics** | E1.2 compose and decompose various structures, and identify the two-dimensional shapes and three-dimensional objects that these structures contain<br>E2.1 use appropriate units of length to estimate, measure, and compare the perimeters of polygons and curved shapes, and construct polygons with a given perimeter |




jamboard - 5 groups. One page on each question.
https://jamboard.google.com/d/1ZPLWfr9PySr4YQB8LxqSa4gjeRKhoHGJ35m_zcrrxOc/edit?usp=sharing
Again - thinking about 'real world problem solving' in terms of social justice....there are many models for doing so including looking at the UN Sustainable development Goals:
https://sdgs.un.org/goals
And, the Truth and Reconciliation Commission's Calls to Action:
https://www2.gov.bc.ca/assets/gov/british-columbians-our-governments/indigenous-people/aboriginal-peoples-documents/calls_to_action_english2.pdf




The elementary science & technology curriculum includes a variety of approaches to problem solving. By interweaving opportunities for students to use these strategies, it strengthens their ability to become creative problem solvers. Both the scientific experimentation process and the engineering design process are ways to question, discover, and understand the world around us. They are also tools that allows each of us to create solutions to social and environmental justice challenges (UN Sustainable Development Goals - Global to local).

As we create curricular connected experiences for students, we need to remember that diverse perspectives, worldviews, and student experiences matter. We don't solve problems using either processes without understanding context, developing an understanding of the problem, and drawing from prior knowledge and/or researched knowledge. Creating a space for students to engage in the learning from a variety of perspectives including personal lived experiences based on the intersection of their own identities connects learning to students, community, and works towards creating an inclusive space for all learners.


Scientific research process is an important part of problem solving. The research process enables students to define questions and a process to seek out different perspectives, critically think about information and data, develop arguments with supporting evidence and find ways to summarize and communicate their findings.

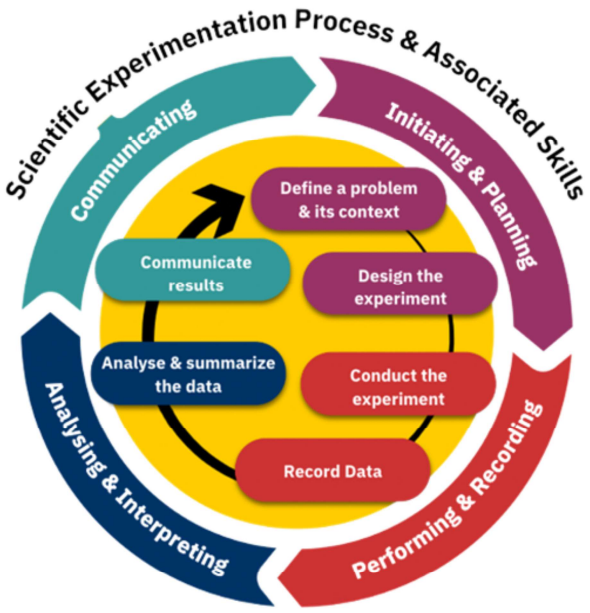
As we work with students to develop their scientific research skills, help them to seek out sources that elevates diverse perspectives, knowledges, and people.


These are not always separate processes but are interconnected depending on the problem to be solved. The work here is to strengthen students' skills to be able to become flexible, adaptable, creative problem solvers as they engage in this learning from kindergarten to grade 8 and beyond.

As we work with students, we need to consider how the curriculum connected programs and experiences affirms Black, Indigenous, racialized and marginalized identities in the classroom. Create spaces that takes an asset based approach and enables students to embrace and explore their intersectional identities within science education.

## Let's take a look at a scientific experiment…

- What is the problem identified in this experiment?
- Who designed the experiment?
- How was the experiment conducted?
- How was the data recorded?
- How was the data analysed? Who designed the process? Why?
- What do you think are the learning outcomes of this experiment?




Encourage teachers to take a look at the experiments that they are currently doing in their classrooms. Have we considered these questions? Why were these instructional decisions made? What is the learning that comes out of conducting the experiment as designed?

# Let's look at a scientific experiment…

**Vinegar and Baking Soda Experiments**

The chemical equation for the overall reaction is:

$NaHCO_3(s) + CH_3COOH(l) \rightarrow \mathbf{CO_2(g)} + H_2O(l) + Na+(aq) + CH_3COO^-(aq)$

Sodium bicarbonate + acetic acid → carbon dioxide + water + sodium ion + acetate ion

**This makes carbon dioxide!**

Note: $CO_2$ extinguishes fires because it is more dense than air and will displace air therefore fire goes out (without oxygen, fire stops)

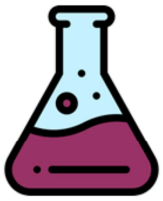
**DID YOU KNOW!**
Hydrogen peroxide + yeast has a similar looking reaction!

$H_2O_2(l) \rightarrow \mathbf{O_2(g)} + H_2O(l)$

BUT it makes oxygen!

**Not the same! Why science is important!**

https://www.scientificamerican.com/article/make-elephant-toothpaste/
https://www.flinnsci.ca/elephant-toothpaste
https://www.ctvnews.ca/sci-tech/sort-of-who-i-am-cree-youth-hopes-to-inspire-others-with-science-videos



LEADERSHIP EN ACTION

Vinegar and baking soda is used a lot in elementary classrooms. How is it used? What is it used for? What is the science learning? So let's take a look briefly… The chemical reaction produces carbon dioxide. Carbon dioxide extinguishes fires..

Did you know that hydrogen peroxide can have a similar looking reaction to baking soda and vinegar… this reaction can be sped up with yeast. Hydrogen peroxide however decomposes into Oxygen.. Not good for fire extinguishers! Science matters!

Google search: Vinegar and Baking Soda Lab - found: https://www.d11.org/site/handlers/filedownload.ashx?moduleinstanceid=11095&dataid=31926&FileName=Baking%20Soda%20Vinegar%20Lab%20Write%20Up.pdf

The chemical equation for the overall reaction is:

$NaHCO_3(s) + CH_3COOH(l) \rightarrow CO_2(g) + H_2O(l) + Na+(aq) + CH_3COO^-(aq)$

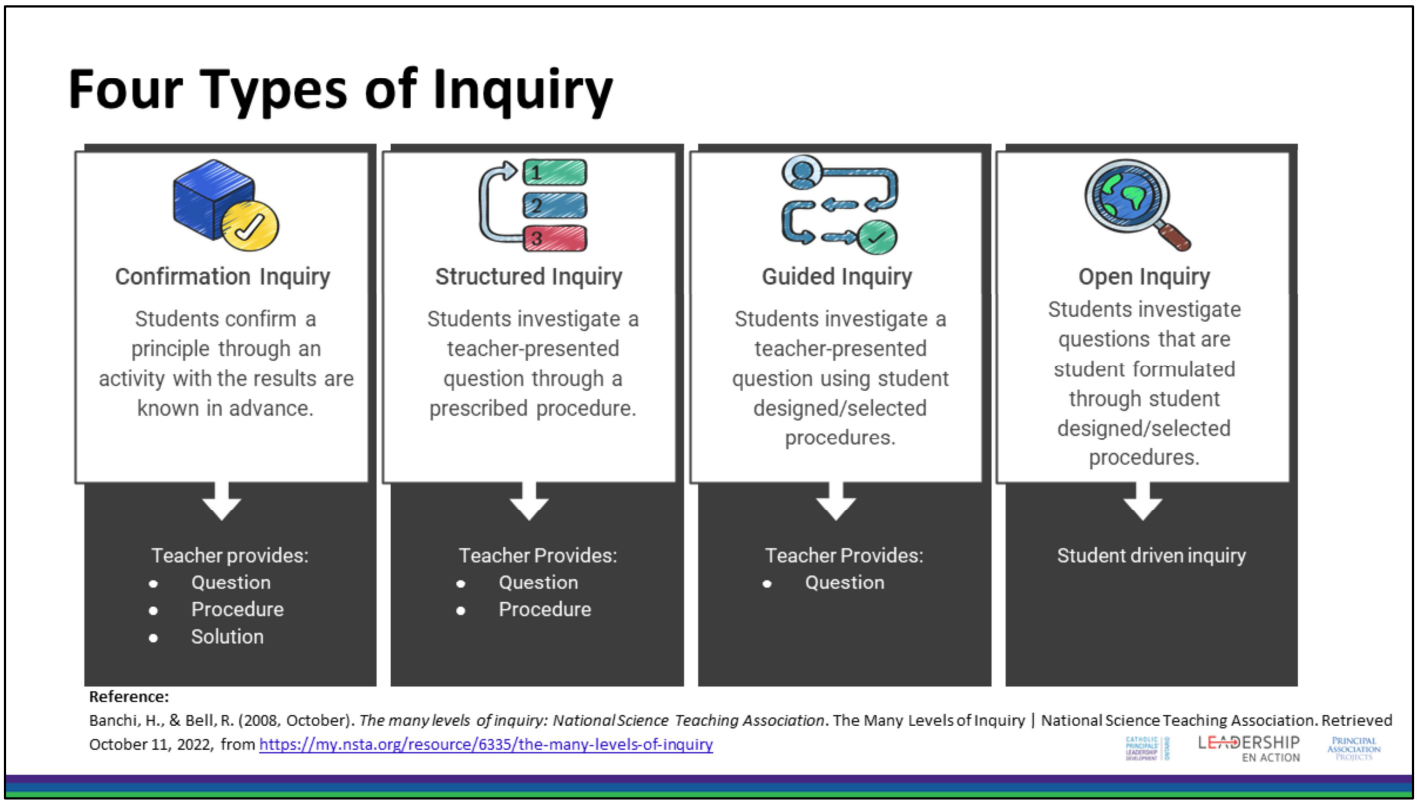
Sodium bicarbonate + acetic acid → carbon dioxide, water, sodium ion, and acetate ion

First: $NaHCO_3 + HC_2H_3O_2 \rightarrow NaC_2H_3O_2 + H_2CO_3$ (double displacement reaction)

Second: $H_2CO_3 \rightarrow H_2O + CO_2$ (decomposition reaction)

Note: $CO_2$ extinguishes fires because it is more dense than air and will displace air therefore fire goes out (without oxygen, fire stops), if water is removed then left with sodium acetate which will crystallize and release heat.

Alternative experiment with hydrogen peroxide and yeast (catalase as a catalyst): https://www.scientificamerican.com/article/make-elephant-toothpaste/ (chemical reaction, decomposition of $H_2O_2$ to oxygen gas and water - exothermic reaction) However, this one creates oxygen gas… have you ever wondered by hydrogen peroxide comes in a dark bottle and has an expiry date? This reaction happens over time with exposure to light and simply with time. The yeast has catalase, that speeds up the reaction in this case.

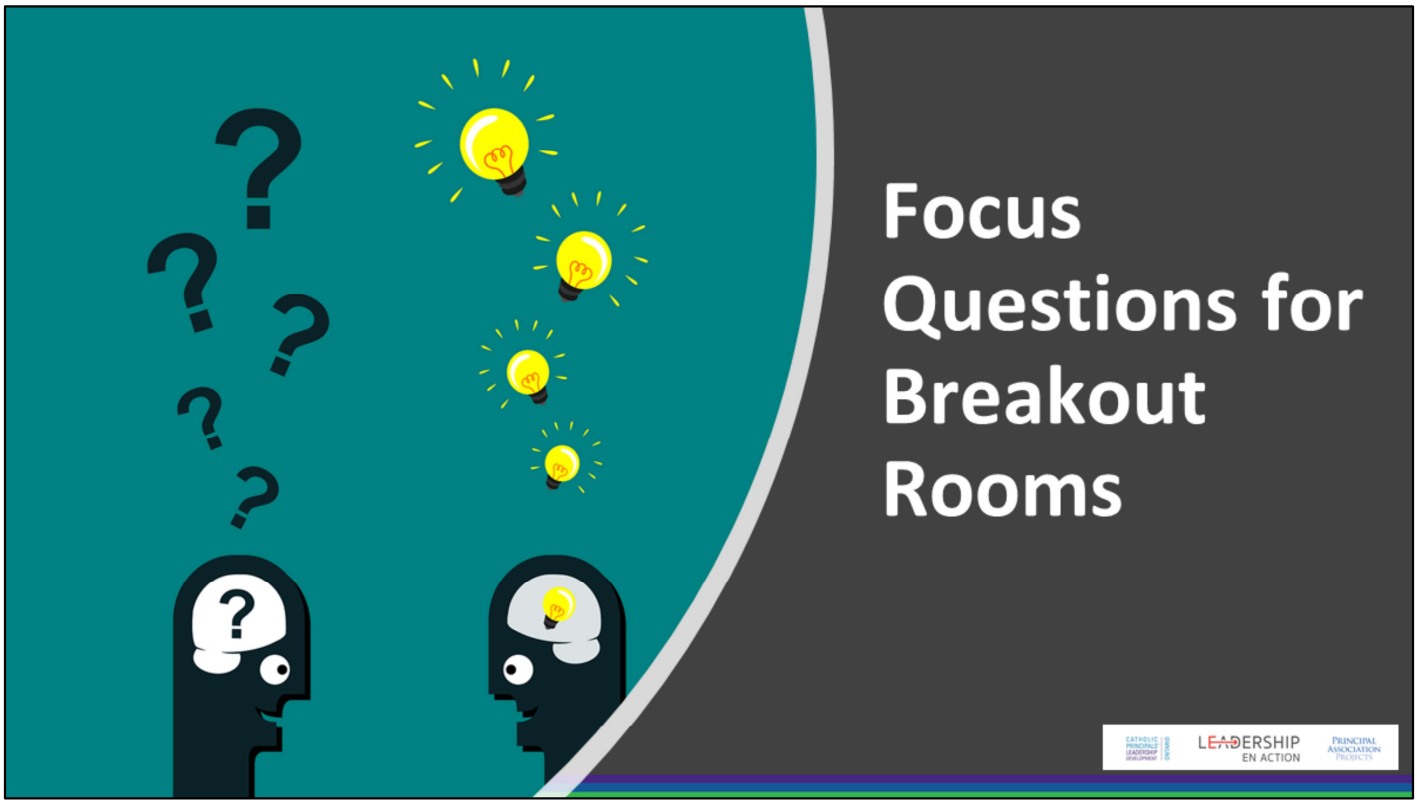



Inquiry comes in a variety of forms. In order to strengthen students' ability to problem solve, it is important to scaffold the development of skills through the different types of inquiry. Intentionally deciding when to use which form of inquiry can help students become creative problem solvers and develop strengths in designing more open inquiry questions and investigations.

When students are provided with choice, it creates an opportunity for students to bring their own perspectives, talents, skills, experiences, and interests into the inquiry. It opens up an opportunity to apply Universal Design for Learning, Differentiated Instruction and Culturally Relevant and Responsive Pedagogy.

Reference:
Banchi, H., & Bell, R. (2008, October). *The many levels of inquiry: National Science Teaching Association*. The Many Levels of Inquiry | National Science Teaching Association. Retrieved October 11, 2022, from https://my.nsta.org/resource/6335/the-many-levels-of-inquiry

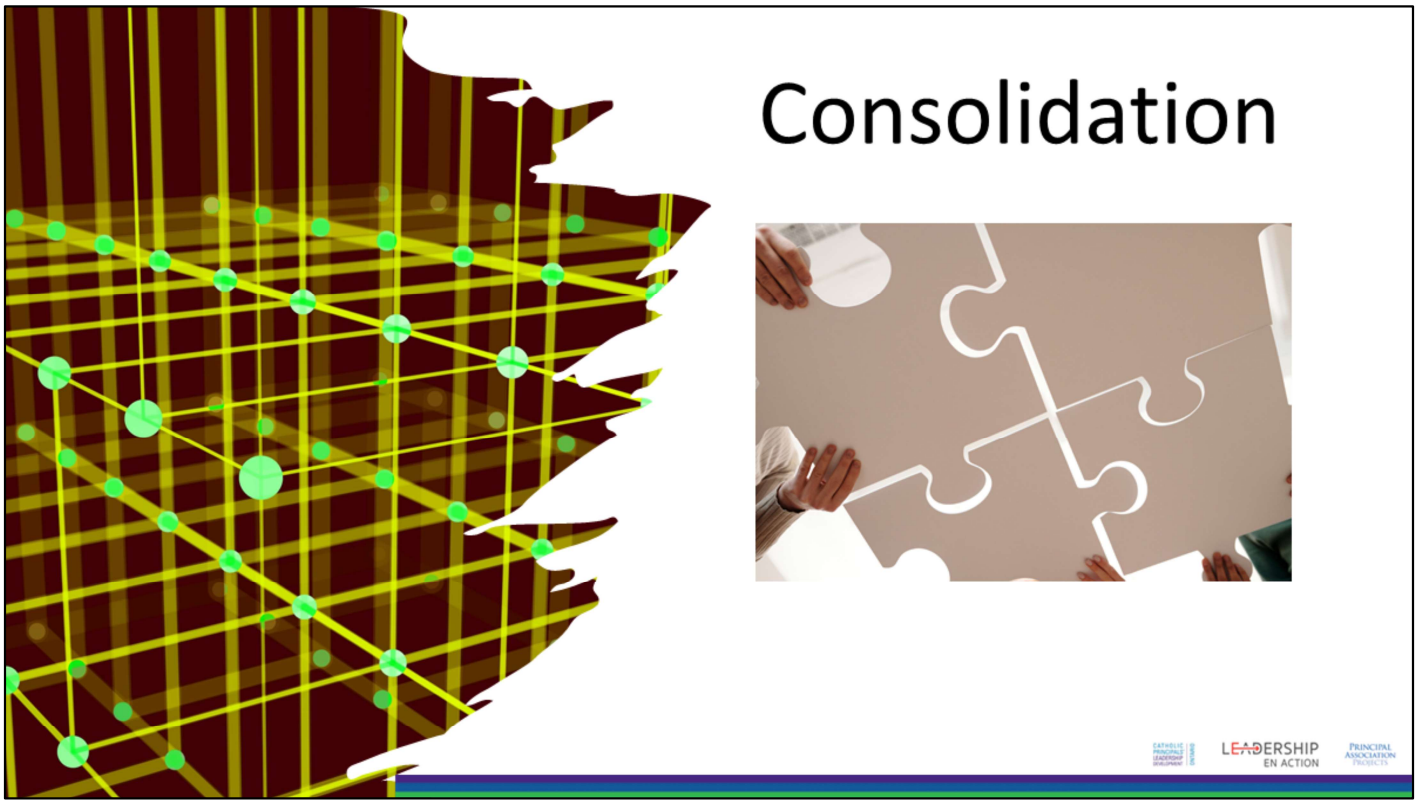
https://www.michiganseagrant.org/lessons/wp-content/uploads/sites/3/2019/04/The-Many-Levels-of-Inquiry-NSTA-article.pdf



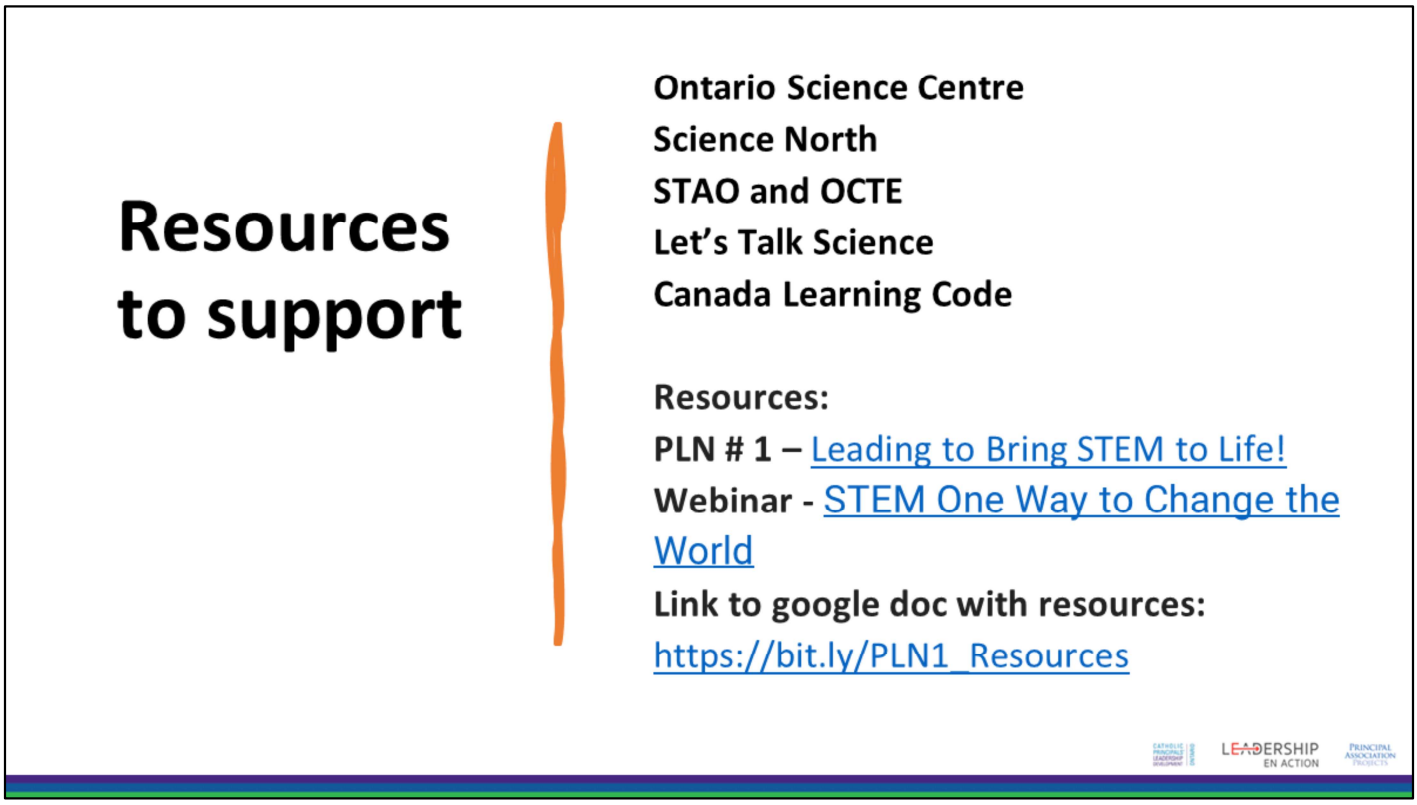

We will now move into breakout groups for 15 minutes. Your group leader has a series of questions to facilitate discussion. We will record ideas in a google doc to share with participants afterwards.

1) As a school leader, how do we support teachers in understanding how to tweak and fortify their current practice in science to ensure they are meeting the vision of stem learning and engineering design process?
2) How do we support teachers in making connections to real world problem solving and inquiry?
3) How do we shift staff mindsets to engage in this work? For example, approaching science from an equity/student centered approach? Intentionally approaching teaching in culturally relevant and responsive ways - in particular for black students, Indigenous, racialized, marginalized groups.. Or, approaching this new science with a learning stance?
4) What more do our staff need to try to envision these types of tasks?

Each group, please be prepared to share with the whole group when returning from the breakout.




Consolidation:
Facilitate back to large group
Consolidation Conversation with a focus on the big ideas.
What is the take away? How will you mobilize this?
Why is this important?




**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/OCTE have created**
https://scitechontario.ca/
Long range lesson plans have been created and shared by STAO and OCTE.

**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
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Thank you….