

LEARNING FOR A
SUSTAINABLE
FUTURE

EMPOWERING LEARNERS IN A WARMING WORLD

A Climate Change Inquiry Guide
for Grade 7-12 Educators



Written by Dr. Ellen Field, Jennifer Stevens
and Dr. Karen Acton



with support from



Empowering learners in a warming world: A climate change inquiry guide for 7-12 teachers
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Preface

“I hope that the shock of this pandemic will jolt people out of their desire to ignore global issues like climate change. I hope our growing sense of urgency, of solidarity, of stubborn optimism and empowerment to take action, can be one thing that rises out of this terrible situation.” ~ Christina Figueres, former UN Executive Secretary for Climate Change, Chief Architect of the Paris Climate Change Agreement

When we started to write this climate change inquiry guide in the summer of 2019, we had no idea about COVID-19 or how it would change our lives in 2020 and beyond. Even after the first weeks of sheltering in place, we are still coming to know what changes will be lasting and what will be temporary. It is a bewildering and uncertain time.

As a climate change educator, I have experienced a lot of dissonance during this time — oscillating between grief over what and who we are losing and hope for the kind of disruptive possibilities the pandemic means for new ways of thinking, especially when it comes to carbon emissions. Throughout 2019, there was so much climate action momentum. Will COVID-19 hamper or help that momentum? While projecting how climate priorities will be met in a world recovering from COVID-19 is unclear, there are indications that positive possibilities are being seeded.

For young people living through the pandemic, this moment will be a touchstone — a memory when everything is divided between before and after. People are experiencing first-hand what it is like to work as citizens within a community where individual rights and responsibilities are connected to the health of the wider society. This time of personal sacrifice will be experienced differently by all young people depending on how the virus has impacted their homes — ranging from togetherness and cooperation or anxiety and grief. When the pandemic is over, young people will need to process their experiences to make sense of the legacy that it has brought and left for the future.

This kind of reflection and processing will be important not only for individual mental health and well-being but for viewing disciplinary subjects through a COVID-19 lens. The pandemic has challenged many of the underpinnings of the systems that run our society and as such offer a critical learning moment, an opportunity to pivot and to reorient these systems to better serve people and the planet. Emerging from the pandemic is an opportunity to think in new ways about how to address runaway carbon emissions, and in turn, runaway climate disruption.

Due to the lockdown, it is expected that carbon emissions will fall by 4-8 percent, or roughly by 2,000 megatonnes of carbon dioxide in 2020¹. To put this into context, the coronavirus could trigger the

¹ Evans, S. (April 9, 2020). Analysis: Coronavirus set to cause largest ever annual fall in carbon dioxide emissions. Carbon Brief.

largest annual fall in carbon dioxide emissions, more than during any previous economic crisis or period of war. If 2020 results in a 5 percent drop in emissions, then this period of time in lockdown would meet the kind of reduction required every year until net-zero emissions are reached in 2050. The trick will be to determine whether these reductions are possible through good climate policies rather than through strict regulations put in place due to a pandemic.

In the strange collective pause caused by COVID-19, we can decide our collective future. As the global economy recovers, will we make the mistake of ramping up high-carbon industries and projects, locking out the potential to “flatten”the curve of emissions? Or will political and financial leaders use this unprecedented historic opportunity to accelerate the energy transition to a safe path toward aggressive emissions reduction?² As we re-enter society from our homes the plans we set in motion will decide what kind of lives, and quality of life, we all will share from now on.

My hope is that we collectively seize this moment.

In stubborn optimism,

Ellen Field

<https://www.carbonbrief.org/analysis-coronavirus-set-to-cause-largest-ever-annual-fall-in-carbon-dioxide-emissions>

² Figueres, C. (March 24, 2020). 5 Lessons for Coronavirus That Will Help Us Tackle Climate Change. TIME. <https://time.com/5808809/coronavirus-climate-action/>

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This resource is the culmination of many conversations about and reflections on pedagogies for learning about climate change with an intersectional approach. Without the leadership, support and insights of Pamela Schwartzberg, President and CEO, Elaine Rubinoff, Director of Programs and Samantha Gawron, Manager of Programs of LSF this work would not have come to fruition. LSF would like to acknowledge The Cooperators for funding the creation of this resource. We would like to thank Gia Spiropolous, a M.Ed student from Lakehead University, who helped develop the foundational ideas for each thematic inquiry; Tim McGregor and Theresa McGregor for reviewing the inquiry theme on *Climate Action and decolonization: Indigenous perspectives* and working with us to ensure the theme is culturally appropriate; Dr. Susan Elliott, Learning Strategist for her input into the Human Health inquiry; Margaret Zyla, M.Ed student at Lakehead University and secondary teacher in Simcoe Muskoka District School Board and Sapphire Giberson, M.Ed student at Lakehead University for editing of several themes and suggestions for resources; and David Israelson, communications consultant, for expert editing and help with framing the resource for a covid-19 context.

This guide is hosted electronically so that it can be updated, adapted and modified as our learning about and response to climate change evolves. We look forward to the exciting contributions that teachers in the formal education system will make towards empowering learners in a warming world!

For our full reference list, please visit: www.climatelearning.ca/references

Introduction

Climate change is the most complex and wide-reaching challenge facing humankind today. It is essential that we help younger generations to be better equipped to take on this challenge and that we call on their energy, creativity and drive to help us all work towards a common goal.

Education is critical to the global and national response to climate change:

[Education] can be seen as a force multiplier. It acts as a driver and catalyst of all key development parameters: health and well-being, meaningful livelihoods, economic security and the full development of human potential...education influences the

trajectory of an individual's actions for decades and, in a collective sense, determines the course of human society itself ([World Economic Forum](#), 2017)

However, in order for education to be effective and purposeful to address climate change, teachers need to be equipped to take on this challenge.

A recent report, *Canada, Climate Change and Education: Opportunities for Public and Formal Education*, found that climate change is predominantly taught through science-related subjects in Grade 7 -12 classrooms across Canada. An interdisciplinary approach to climate change is preferable because climate change is not solely an ecological or scientific phenomenon; its wide-reaching impacts and our efforts to mitigate and adapt to it require engagement with social, political, and cultural underpinnings and processes (Selby & Kagawa, 2013). Therefore, climate change education requires not only an interdisciplinary framework where the natural sciences are employed to learn about climate systems and the social sciences are where students engage in learning and social changemaking but also processes that allow for students to share their perspectives, including traditional practices or emotional responses to the existential realities of the climate crisis. The good news is that in the report, [Canada, Climate Change and Education](#), the majority of teachers (75% of closed-sample educators and 81% of open-sample educators) believe that climate change education is the role of all teachers and that supporting an interdisciplinary framework.

While climate change presents educators with daunting challenges, these challenges also present valuable opportunities to evolve practice so that students have a sound understanding and are able to contribute to finding solutions in their schools and communities.

Complexity & Scope

Our understanding of climate change and its impacts requires an understanding of multiple related systems (from the physical environment, to ecosystems, to human society) that transcend traditional subject boundaries. The nature of this complex problem requires deep learning which not only expands students' knowledge and understanding about climate change but also touches their values, sense of place, feelings of responsibility, and capacities to enact change.

The nature of this complex problem provides endless opportunities for critical thinking, including dissecting these various systems, developing media literacy skills, and exploring multiple information sources to enhance comprehension of the issues.

Emotional Responses

Discussion of climate change can lead to feelings of fear and anxiety and cause people to distance themselves from the problem, leading them to disengage, doubt, and even dismiss it. Climate

change learning in the classroom needs to attend—and respond—to the psychological fallout that occurs as one learns more about the severity and urgency of the issue.

A first step to mitigating fear is to create a culture of trust in your classroom where emotions are honoured and students are supported through the knowledge-building process. This guide is designed to be implemented within an inquiry-learning framework, the antithesis of traditional, “right”-answer-driven teaching. This learning approach honours students’ past experiences and perspectives and puts students at the centre of their own learning. By framing students’ learning process as solutionary and action-oriented and by also allowing students to express their emotional responses to severe ecological degradation, can allow students to process their emotions and may help them feel empowered to work towards a goal rather than feeling isolated, overwhelmed or hopeless.

For many teachers, “having hope” is a complicated discussion, where there is a balance between remaining credible and honest with students while also being transparent about the latest scientific reports and what our collective inaction in the face of them suggests. This is where understanding developmental readiness and a learning progression for climate change education is necessary for teachers to gauge student readiness. A powerful starting point at any age is “[active-hope](#),” where having hope is framed as an intention rather than hope tied to a chance of an outcome. It is not maintaining the status quo or burying one’s head in the sand. Active hope means taking a position where ideas and projects are created that push forward the visions and ideas of a positive future.

Changing Perspectives

Climate change education requires a multi-pronged approach that directly addresses predominant misconceptions and also facilitates critical questioning of societal norms and cultural drivers. These drivers include the definition of progress. Some of the definitions include the idea of perpetual growth on a finite planet; the roles of science and technology; the viability of capitalism, consumerism, and the exploitation of nature; and values such as freedom, independence, comfort and success.

Climate change needs to be investigated holistically. It needs to be investigated through an integrated and transdisciplinary approach that includes systems perspectives, spans from local to global, cultivates respectful ways of approaching contested positions (such as deliberative dialogue), and develops capacity and collective action taking—all approaches that are transferable to supporting students’ development in other areas!

Transformative Learning: Why This Guide?

Conventional teaching, based on information transfer and finding the “right” answers, does not align well with the complexity of climate change or the evolving nature of the field. With the internet at their fingertips, students have access to more information than anyone could ever process. Students don’t

need to be told what to do, they need to be engaged in active problem-solving because climate solutions are nuanced and specific to regional realities.

Transformative teaching strategies like inquiry are better suited to tackling complex problems like climate change. These strategies often begin with the understanding and experiences that students bring with them. Educators, who themselves are grappling with climate change issues, take the role of facilitators and guide learners as the class works together to learn, critically reflect, and take action. In class learning is brought into context with the real world, allowing learners to cultivate creativity and innovation as they encounter real-life complexities. Students develop the attitudes and skill sets necessary to address challenges to which we don't yet have the right answers, which are the same skills they need to be successful in work and daily life.

This guide follows the guiding principles of inquiry learning. Its purpose is to present opportunities to evolve students' understanding of the climate and climate change, assess the risks and opportunities to mitigate and adapt to the changing climate, unpack ethical dimensions, and honour emotions that are part of the process of coming to understand the complexity and urgency of the issue. Lastly and most importantly, this guide aims to engage students in contributing to solutions in their schools, communities and homes. The guide connects educators to: instructional strategies that allow for students' perspectives and voice, currently available climate change science and research, teacher resources and activities, datasets, and action solutions.

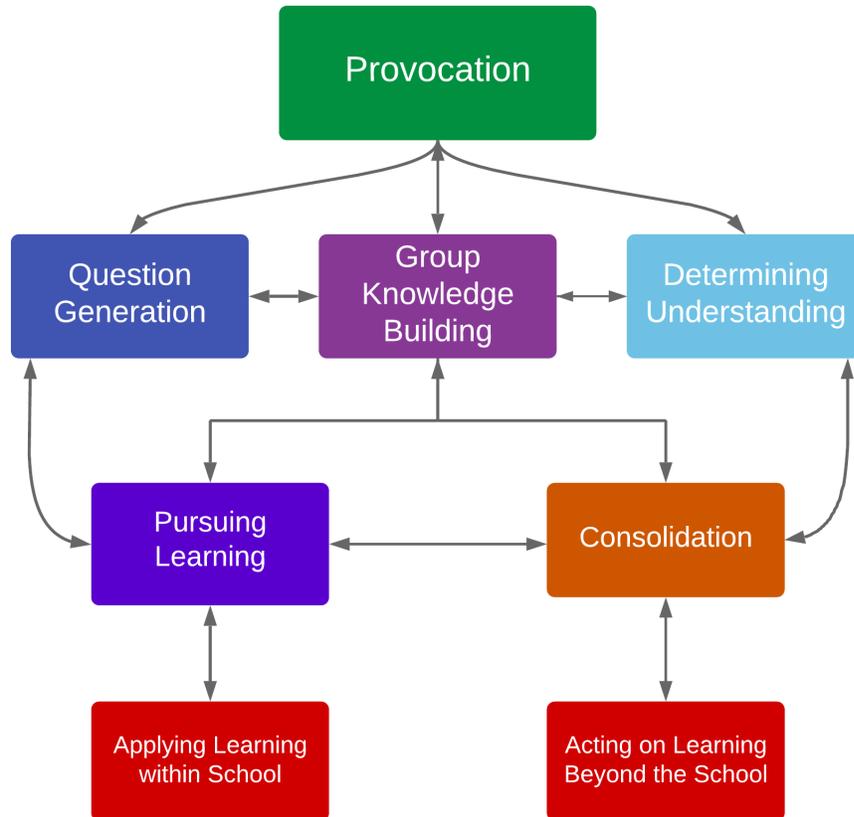
Inquiry

The information and resources presented in this guide are introduced with the teaching methodology of *inquiry* in mind. Inquiry-based learning, as cited by [Kozak & Elliott](#) "is most consistent with the development of skills for lifelong learning. It prepares students to know what to do when the options before them are unclear."

Inquiry learning can be defined as:

an approach to learning that is directed by questions, problems, a hypothesis or a challenge that individuals and groups of learners work together to address. At it's best the learning is driven by student generated questions. Students, assisted by the teacher, clarify the questions being asked and determine how to answer them. As knowledge is pursued, unplanned but important learning territory is often uncovered. ([Kozak & Elliott](#)).

A Structure of Inquiry Learning



Inquiry creates a learning environment where students can develop critical thinking and problem-solving skills. The learning that takes place throughout an inquiry, stemming from students' questions, is authentic and meaningful. The ideal goal of an inquiry is to apply learning and **take action**.

Stages of the Inquiry Process:



Provocation

An initial provocation, also sometimes referred to as a “hook,” is used to spark interest and curiosity.. “Experiences that spark students’ interest and elicit genuine ‘I wonders’ can set a course for authentic and sustained Knowledge Building.” ([Knowledge Building Gallery](#)).



Question Generation

Teachers should determine where students are in their initial understanding of a topic or an issue, then continue to evaluate their understanding throughout the learning process. Learners should be checking in with their understanding and determining direction and next steps based on their understanding. In order to continue to generate meaningful questions as knowledge and understanding advances, students should list, refine, re-state, clarify, and prioritize their questions.



Determining Understanding

Determining understanding is an important step in the inquiry process used to gauge student understanding of new material, topics, and big ideas. Through an activity or assessment tool, teachers aim to assess student understanding and determine any questions or confusion that they may have. This information can help teachers to plan and to tailor the classroom activities to answer these questions and advance each student’s learning process. Determining understanding enables students to pause and reflect on their learning, taking ownership of the process and practicing metacognitive strategies. This type of reflection relies on self-assessment/self-monitoring behaviours and practicing the development of internal monitoring processes.



Knowledge Building

Knowledge building refers to a process of advancing and developing knowledge on a given subject. The goal is to further individual knowledge as a result of group discussions, common

goals, and synthesis of ideas. According to [Scardamalia and Bereiter](#), “Collaboration, determined by the ability of a group to function as a community of learners, is recognized as important in constructivist learning through knowledge building.” Learners work together through interactive questioning and continuously improving upon one another’s ideas.”



Pursuing Learning

Pursuing learning in the context of this guide refers to a process in which teachers help support students in the pursuit of knowledge, skills, perspectives and questions related to the topic being explored.



Consolidation

Throughout the inquiry learning process, often many different ideas are explored, and a critical step is formulating and extending learning. This stage of the process often occurs near the end of the learning process in order to synthesize, review, and consider how the knowledge and learning will be applied to action.

Prepare Students for Climate Change Learning

It is important that the sensitive material in this guide is managed carefully, and it is the educator’s role to help guide students through the process of accepting and understanding the facts that are presented and explored throughout. Mentally preparing students before beginning to uncover sensitive material and surfacing some difficult feelings is an important consideration. Pre-learning activities that enhance classroom trust and set a precedent for accepting only respectful behaviour towards one another is a starting point. Other strategies to prepare students may give them an opportunity to become familiar with methods of coping and understanding difficult information and finally, encouraging students to process information with both critical thinking skills and an open mind. This may involve encouraging students to get in touch with their existing perspectives on issues that are presented and preparing them to challenge these views by using critical literacies.

Pre-learning activities:

- Know your students. It sounds obvious, but navigating difficult discussions depends strongly on understanding student backgrounds, attitudes, expectations and beliefs
- Create confidential and optional student information sheets that could be a general ‘About Me’ or specific questions related to the discussion material to get to know your students a little better
- Do a [Four Corners](#) activity

- Work together with students to create an [Essential Agreement](#) for your classroom that creates a climate that is respectful and safe for discussion and potential disagreement
- Let students know ahead of time that the class will be presented with some sensitive material so that students have time to mentally prepare. Use a [V-Heuristic](#)

Principles for climate change discussions:

- Prepare to ‘Share the Air’: Ensure that everyone who would like a chance to speak, has a chance. This could mean preparing as a facilitator to moderate the discussion, or using a “speaking object” (something to hold on to while you share, and pass along when it is someone else's turn to speak)
- Discuss the importance of using ‘I statements,’ speak for yourself rather than giving advice to others or trying to fix one another's problems.
- Practice self-care throughout: monitor your own health and well-being and encourage personal coping strategies at any point throughout the learning process if the subject matter becomes too much.

How To Use This Guide

This guide will provide educators with a blend of quality content (resources, websites, books, videos and ideas) and exemplary pedagogy to guide you through an inquiry-driven approach to climate change learning. It draws upon seven key strategies that transform learning described in LSF’s *Connecting the Dots*:

- Learning Locally
- Integrated Learning
- Acting on Learning
- Real-World Connections
- Considering Alternative Perspectives
- Inquiry
- Sharing Responsibility for Learning with Students

In order to provide a comprehensive guide to climate change education, we have created eight different inquiries that are structured to follow the inquiry process:

Inquiry 1. What is climate change and why care?

Inquiry 2. Climate change: where are we now?

Inquiry 3. Monitoring change
using the Climate Atlas of Canada

Inquiry 4. Environmental impacts & restoration

Inquiry 5. Human health: Addressing climate change makes us healthier

Inquiry 6. A low carbon future: Economic transitions, risks and impacts

Inquiry 7. Climate action and decolonization: Indigenous perspectives

Inquiry 8. Ethical dimensions for children, youth, and livable futures

Inquiry 9: Youth Agency

There are also two appendices:

Appendix A. Active Learning Strategies Resource Bank

Appendix B. Mapping the Active Learning Strategies throughout this guide

Appendix C: Subject Alignment Chart

Throughout this guide you will notice that we have identified several active learning instructional strategies that have been woven into each inquiry. If clarification on these strategies or further explanation is needed, you will be able to locate them in the [Active Learning Strategies Resource Bank](#), where you will find a description, and a link to instructions for implementation.

Each inquiry will begin by presenting background information and provide an overview of the associated risks and trends. Each inquiry will include a series of potential provocations to invoke discussion, questions, interests and ideas among your students. This is followed by suggested strategies to generate questions, build knowledge, and ultimately engage in action for the purpose of mitigation and adaptation. We have also included a section within each inquiry called Pursuing Learning; this section links to stand-alone activities that teachers may want to integrate to ensure that students learn foundational concepts of climate change. Woven throughout each inquiry are lists of possible resources (including books and videos), and hands-on activities to pursue learning. Inquiries 1-8 are designed to stand alone, addressing different angles and lenses through which climate change can be explored. We do recommend beginning your journey through the guide with Inquiry 1. What is Climate Change and Why Care? This inquiry provides a good introduction to climate change and allows students to begin by thinking about the importance of this issue in their own lives and future.

1. What is Climate Change and Why Care?

In this initial inquiry, there are more activities than a class will most likely complete. We have included several activities so that every kind of class will find ideas, questions, activities that inspire learning.

Climate change is a wicked problem that is increasingly affecting human health, species distribution, and the ability of the earth's ecosystems to sustain our physical, economic, social, and environmental needs. The reports from the Intergovernmental Panel on Climate Change (IPCC) and other leading scientific organizations have become increasingly urgent. Alongside this urgency, media reporting consistently uses a doomsday framing, which can leave viewers with a sense of anxiety or paralysis.

In this inquiry, we suggest that educators begin by asking their students to identify one action that they've seen or heard of recently that inspires them about addressing climate change. We also suggest to frame learning pathways broadly by connecting to actions that students identify as personally relevant and important to them.



Photo: (2019). Michael Weatley Photography

Before you begin: Background Information for Educators

Canada's climate is changing at an accelerated rate: since 1948 Canada's annual average land temperature has increased by 1.5°C—roughly double the global average level of warming ([Natural Resources Canada](#)). “Human influence on the climate system is clear, and recent anthropogenic emissions of greenhouse gases are the highest in history. Recent climate changes have had widespread impacts on human and natural systems” ([IPCC](#)). It is true that there are many natural forces that play a role in determining the Earth's climate: the Earth's orbit around the sun, changing ocean currents, very large volcanic eruptions and the Earth's tilt, and there is a great deal of evidence that the world has warmed and cooled in decades before humans existed. However climate changes have never occurred at a pace as rapid or as drastic as we have seen since pre-industrial time, and these changes cannot be explained by any natural phenomena ([Prairie Climate Centre](#)). These changes are a cause for concern but, more importantly, they are also a call to action to mitigate current and future effects.

Some of the many impacts of climate change include: biodiversity, ecosystems, species loss and extinction. If the global community is able to limit the increase in temperature to 1.5 degrees, the impacts on terrestrial, freshwater and coastal ecosystems are expected to be lower. According to the [Council of Canadian Academies' expert panel on climate change risks and adaptation potential](#), Canada faces substantial risk with a likelihood of significant losses, damages, or disruptions in Canada over a 20 year timeframe in the following areas: agriculture and food; coastal communities; ecosystems; fisheries; forestry; geopolitical dynamics; governance and capacity; human health and wellness; Indigenous ways of life; northern communities; physical infrastructure; and water.

Overall, Canadians are quite certain that climate change is happening. According to a [recent survey conducted by Dr. Ellen Field and Learning for a Sustainable Future](#), 85% of all Canadians believe that climate change is happening. However, the population is less certain that humans are the primary cause of the warming climate; only 43% of respondents think that climate change is caused mostly by human activity. When this understanding is contrasted with the widespread scientific consensus that climate change is human caused, the urgent need for more comprehensive education on the subject is made clear. In a thorough literature review, [Cook and colleagues](#) found that after examining 11,944 climate abstracts from 1991 to 2011, 97.1% endorsed the consensus position that humans are causing global warming.

Another finding from the report, [Canada, Climate Change and Education: Opportunities for Public and Formal Education](#), found that 46% of students ages 12-18 are categorized as “aware,” meaning they understand that human-caused climate change is happening, but they do not believe that human efforts to stop it will be effective. This is an opportunity for schools to help students understand that there are strategies and solutions to address climate change if all sectors take action today.



A. Provocations: Understanding Climate Change

To hook student interest, choose one or more of the provocation ideas to initiate student thinking.

Idea 1: Affinity Mapping

Begin by asking students to identify one action that they've seen or heard of recently that inspires them about addressing climate change. Alternatively, you could ask students about one inspiring example of 'collective action' that they have seen around the world that proves countries or large groups of people can work together to accomplish change. Another alternative is to ask students to identify "a worry" they have about climate change.

Then together, create an Affinity Map to group, label and characterize the issues under different big ideas or related themes.

Example affinity map:



Photo from: LSF PD workshop at Thames Valley District School Board (2019)

Idea 2. Videos

- 1) [New report warns of climate change risks for Canadian communities](#) [The National]- 3:34 minutes

A news report done for the federal government highlights the top six areas of risk for Canadian communities.

- 2) [Climate Change 101 with Bill Nye](#) [National Geographic]- 4:09 minutes
Climate change is a real and serious issue. In this video Bill Nye, the Science Guy, explains what causes climate change, how it affects our planet, why we need to act promptly to mitigate its effects, and how each of us can contribute to a solution.
- 3) [My Cheeseburger Footprint](#) [Margaret Sanchez]- 2:14 minutes
This video tracks the 10 pounds of carbon dioxide gas emitted from the production of a single cheeseburger.
- 4) [The Physics of the Greenhouse Effect](#) [PBS]- 2:15 minutes
This video segment describes how human activities are increasing greenhouse gas concentrations and explains what effect this might have on global temperatures.
- 5) [Climate Change: The Earth's giant game of Tetris](#) [Joss Fong]- 2:48 minutes
This video explains climate change through the game of Tetris.
- 6) **Three finalists from [Climate Speaks 2019: Slam Poetry](#)** (High-school students from across New York describe, through eloquent and creative poetic language, their experiences and ideas about climate change)
 - a) [On Climate Denial](#) by Jordan Sanchez
 - b) [Earth's Downfall](#) by Jenny Gomez
 - c) [Off-Beat](#) by Eliza Schiff

Idea 3. Neighborhood Walk

Take your class outside on a [Neighbourhood Walk](#) to look for opportunities for local climate change learning. Ask students to identify natural, human, and built systems that impact climate change and to look for evidence of systems or features that may have been altered by climate change (purposefully or not).

During your walk-about, look at both the *natural environment* (flooding areas, stress of trees, buds or flowering at irregular times, etc.) and *built-environment* (non-permeable or permeable surfaces, energy sources, transportation options, opportunities for energy efficiency or active transportation, potential community partners, etc.).

Ask students to document their observations through photos, sketches and notes.

Some other examples of features to note on the walk:

- Bike paths
- Parks (natural areas)
- Cars

- Storm sewers
- Local businesses
- No idling zones



B. Question Generation

At this point in the inquiry, we want to harness students' curiosity and build off of the provocations that have captured their interest by generating meaningful questions to continue to drive the learning process. This section will outline several pathways for question generation depending on the provocation(s) that your class engaged with.

Idea 1. Affinity Mapping: Climate Inspiration

Working with the issues generated in your Affinity Mapping exercise, use the [Question Formulation Technique \(QFT\)](#).

With these questions, repeat the original [Affinity Mapping](#) exercise to see how the questions group together.

Once all questions have been sorted, develop categories and ask students to work in groups or individually to develop [Umbrella Questions](#) focused on the “big ideas” of climate change. These questions will help ground the inquiry.

Idea 2. Video Follow up Questions

General Questions:

- What did you hear that surprised you?
- Is there anything that you need to do more research on before you are fully convinced?
- How does this new information connect to what you already know about climate change?

Video 1

Speaking about community leaders, the CBC reporter says that their response options are: “they can either adapt or adapt.” What do you think he is really trying to say with this statement?

Video 2

What are some of the differences between historical climate changes and the current climate changes we are seeing today? Why is this distinction important?

Bill Nye says that the most important thing to take away from this video is that ‘climate change is real and it’s happening.’ This is a simple statement supported by a lot of evidence, but it is something that is not agreed upon by everyone; why could this still be the case? How might it be slowing progress?

Video 3

The connection in this video between human activity and greenhouse gases is not the most obvious one. Are you surprised at the impacts of a cheeseburger? Why or why not? Are there certain foods that you think would emit less greenhouse gases in production?

Video 4 and 5

Create a visualization of the greenhouse effect and depict some of the ways in which humans are increasing greenhouse gas concentrations.

Students as teachers: invite students to describe the greenhouse effect in their own words. How might you teach a peer, younger student, or parent about this phenomenon?

How does Tetris accurately depict the greenhouse effect? Can you think of another analogy that works in its place?

Video 6 (choose one video, or divide students into groups to analyze different poems)

- Watch the video at least twice, once alone and once in a group or as a class
- What messages were these students trying to get across?
 - Pull out the specific words and phrases that make you think that is the message
- How does the title of the poem relate to the spoken words?
- How did they use emotion and performance to convey this message?
 - How did it make you feel?

Idea 3. Neighbourhood Walkabout Follow-up

Adapted from Peel Region's Grade 9 [My Climate Awareness Lesson plan](#)

a) After the walk, students will individually reflect on how the features that they observed in their neighbourhood exploration can be adapted to climate change or contribute to mitigating it. Students are to print or display the photos that they have taken and post sticky notes on each photograph describing how the feature or system positively or negatively affects climate change and how it has been or can be adapted to climate change.

b) Map the interconnections. Create a large foundation map of the community walk. Post on the classroom wall.

c) Sort photographs into categories and create map symbols for the categorized features

d) Ask students to place symbols in appropriate places around the map.

e) Individually ask students to post three of their photographs around the map.

f) After all students have posted their photos, provide each student with three pieces of yarn.

g) Individually, students must find at least three climate change interconnections among the features/systems in the region. Students use string or markers to create a web of climate change interconnection on the map. Using sticky notes, students must describe their chosen interconnections and post it on the map.

Tool: Journal

Encourage students to record their thinking and learning throughout the learning process. The main reason for developing a journal is for students to then be able to look back and track their growth and progression with their connection to climate change. The entries can be a combination of personal reflections and assigned reflections. A journal can either be in a handwritten notebook or on a Google document.



C. Knowledge Building

De Bono's Six Thinking Hats

At this stage, students may be ready to engage in a group knowledge building activity. [De Bono's Six Thinking Hats](#) will encourage students to open their minds to many alternative ways of thinking about the provocations and ideas that have been generated thus far in the inquiry process. Each student will be assigned one of six different coloured "hats", each thinking hat will indicate a different perspective or way of thinking about what climate change is, and why it is important to care about this issue. This activity tends to be very effective when students are working in groups.

The following chart provides a brief outline of what each coloured hat represents:
(For a more detailed description of these hats, and question examples, please see our Active Thinking Strategy Bank)

White	Information	Asking for information from others.
Black	Judgement	Playing devil's advocate. Explaining why something won't work.
Green	Creativity	Offering possibilities, ideas.
Red	Intuition	Explaining hunches, feelings, gut senses.
Yellow	Optimism	Being positive, enthusiastic, supportive.
Blue	Thinking	Using rationalism, logic, intellect.

There are several options for which question to choose to fuel this exercise: you could use one of the questions generated after the provocations, the umbrella question that the class came up with, or you can take the freedom to focus in on a piece of information, perspective, or observation that the class was particularly drawn to thus far.



D. Determining Understanding

Ask students to fill out the “Know” and “Want” columns of a [KWL \(Know-Want-Learned\) Chart](#) in relation to the umbrella questions.

Use responses to inform and guide the learning process. They can provide insight into which concepts need clarity, what many students are already well informed about, and a general direction that many students want to pursue.

Sample KWL Chart:

TOPIC:		
K – What I Already Know	W – What I Want to Know	L – What I Learned



E. Pursuing Learning: Foundational Climate Science Concepts

At this stage, students may begin research to pursue their umbrella questions, or some of the following activities could be integrated into the process to ensure that students have an understanding of foundational climate science. The activities listed below provide foundational climate science and address predominant misconceptions:

- Weather vs climate

- Greenhouse effect
- Carbon dioxide trends

Activity 1: What's the difference between weather and climate?

Activity from a laboratory experiment at the Little Shop of Physics at Colorado State University

This activity is designed to provide clarity on the terms *weather* and *climate*. Through a hands-on demonstration (using M&M's) students will simulate documenting weather trends in a certain region over time. Students should understand, be able to explain and easily distinguish examples of weather vs. climate.

- Weather is a day-to-day state of the atmosphere, with short-term variation (minutes to weeks). It is what is happening when you look outside right now.
- Climate describes the range of what you might expect in a certain location at a general time of year. It describes the average and long-term weather trends.

Engage your students in the demonstration [here](#)

EXTENSION - Get Outside: Challenge students to find photo examples of climate and weather from the school yard. In the example below, students used photos of geese about to migrate to show climate.

L.Gorman, Science - Grade 10

1. To learn the difference between Climate and Weather, students went out into the schoolyard and took pictures of evidence of both, and created a photoshoot slideshow.
2. I always feel it's better for students to explore, and make their own connections, when learning certain new concepts, rather than me explicitly teaching it; more engaging when they go outside!
3. Technology always poses a challenge: access to it, slow systems, distractions, etc. Also, students found it challenging to find examples of climate around them. Next step: how do I assess this?

In your own words, explain what **weather** is.

Weather is when you look outside and see whats happening today. Like if it's raining or snowing. Or if it's sunny or cloudy. Or if it's hot or cold out.

The weather at school is windy today. This is weather cuz it could be something different tomorrow or next year on todays date. Like not windy.



The weather at school is warm (18 deg.) today. This is weather cuz it could be a lower temperature, colder like -25 in the winter time.



The climate at school is about to get cold soon so all the geese are getting ready to fly away. It gets cold every year soon.



I think climate is when you expect to see that same kinda thing at this time of year. Like its always hot in summer and cold in winter. U now what to buy for summer clothes when its spring cuz its supposed to be hot in the summer. And then you by big jackets in the fall cuz is supposed to be cold in the winter

From: LSF PD workshop on sharing teaching practices in Rainbow District School board

Activity 2: Natural Greenhouse Effect: Life Giving vs. Life Threatening

Courtney Strutt, a M.Ed student at Lakehead's adaptation of Tom Puk's macromodel *Stop Peeing into the Drinking Water* (2017)

This activity was designed to learn about the natural greenhouse effect through an active, embodied simulation. It requires a large open space for students to be actively running around. Each student represents either water vapour, carbon dioxide, a greenhouse gas or a light/heat wave, embodying different roles and experiencing the natural, life-giving wonder of the greenhouse effect.

This activity is followed by a debrief and discussion to help students consolidate their understanding of this natural process. Following the discussion, students will enact a different simulation: the anthropogenic greenhouse effect that is currently exacerbating climate change. Changing the ratios of molecules to represent the current state of the atmosphere should drastically change the outcome of the game. These differences should be discussed and used to motivate a “what now” discussion with your students.

See full instructions for the simulation [here](#)

Activity 3: Carbon Dioxide Trends

Activity from Climate Change: Connections and Solutions, Western Washington University (2013)

In this activity students will explore long-term atmospheric carbon dioxide trends over the past 45 years. They will predict future carbon dioxide emissions based on the graph as well as examine historical carbon dioxide data.

After a discussion about the greenhouse effect and the human activities that contribute to it, students will work in pairs using climate data provided by Western Washington University to graph the data and note any trends that they observe. This resource provides discussion questions that address general correlations like carbon dioxide and time of year, predicting carbon dioxide levels in future years based on past data, and predicting activities that may speed or slow increasing levels.

Access the full lesson [here](#) (page 19).



F. Consolidation

This step is designed to encourage students to integrate and synthesize key ideas. When students make connections and see relationships within and across lessons, this helps them to solidify knowledge and deepen understanding.

Idea 1. Journal reflection prompts:

- This is why I care about climate change.
- Thinking about my umbrella question, this is why I think the question is important and what I currently know.
- Reflect how you would explain (text or drawing) any of the following to a classmate, family member, or neighbour: climate vs. weather, how the greenhouse effect works,

carbon dioxide as a primary cause for climate change.

Idea 2. Visual processing cards:

Using a deck of [visual processing cards \(chiji or climer cards\)](#), spread these out on the floor or on a table. Ask students to pick a card that reflects something that they have learned today. This is ideally facilitated in a circle and can be a go-around, popcorn-style, or a jigsaw.

Idea 3. Mental health check:

Engaging in learning and teaching about climate change can be profoundly depressing, since coming to terms with the environmental and societal challenges required means confronting challenges that are on a scale that has never before been faced by humanity. While climate change is a large-scale problem, it is also a direct result of our collective choices and actions. There are strategies that can mitigate the worst projections and too often we do not focus enough on these.

If students are feeling overwhelmed, then build in reflection time to write in journals, spend time outside in a natural space, and honour emotions such as anxiety, grief, and despair. While the future is uncertain, there are many examples of positive actions happening all around the world, and too often these stories do not get media coverage (check out [The Happy Broadcast](#) to get some good news for a change!). Finding actions that students can get involved in is paramount and in the subsequent thematic inquiries there are many examples of school projects and activities. As we collectively oscillate between optimism and outrage, stories of the past can also be important for active hope pathways.

Case Study: Two Billion Trees and Counting - The Legacy of Edmund Zavitz

Edmund Zavitz (1875-1968) rescued Ontario from the ravages of increasingly more powerful floods, erosion, and deadly fires. Wastelands were taking over many hectares of once-flourishing farmlands and towns. Sites like the Oak Ridges Moraine were well on their way to becoming a dust bowl and all because of extensive deforestation.

Zavitz held the positions of chief forester of Ontario, deputy minister of forests, and director of reforestation. His first pilot reforestation project was in 1905, and since then Zavitz has educated the public and politicians about the need to protect Ontario forests. By the mid-1940s, conservation authorities, provincial nurseries, forestry stations, and bylaws protecting trees were in place. Land was being restored.

Just a month before his death, the one billionth tree was planted by Premier John Robarts. Some two billion more would follow. As a result of Zavitz's work, the Niagara Escarpment,

once a wasteland, is now a UNESCO World Biosphere. Recognition of the ongoing need to plant trees to protect our future continues as the legacy of Edmund Zavitz.

This massive tree planting campaign occurred in the last hundred years—just think what could be accomplished in the next hundred years!

Assessment Idea



Teachers will assess learning at different points throughout the inquiry using multiple methods. The following assessment provides an alternative evaluation method to standard quizzes and tests, that can be used after consolidation or at any point in the lesson to check for understanding.

< RAFT Strategy

The **RAFT** (Role, Audience, Format and Topic) is a strategy that helps students understand their role and how to effectively communicate their ideas clearly to their chosen audience. It incorporates the principles of Universal Design Learning (UDL) by encouraging multiple formats for their assignment, and the topic they'll be writing about. Teachers put the different choices for each category on the board and allow students to select their individual RAFT. Check [here](#) for more information on this strategy.

Sample Ideas for Each Category of the RAFT Strategy

RAFT			
R - Role	A - Audience	F - Format	T - Topic
Journalist Blogger News anchor Instagram influencer Student Politician Scientist	Newspaper reader Internet followers Teacher Students Parents Politicians General Public	Blog Rant Video Poster Newspaper article Letter Campaign Commercial	To be chosen by the group or individual



G. Take Action:

Allowing time for students to take action is an essential part of the learning process on climate change, as it empowers students and eases their eco-anxiety.

Ideas for Taking Action:

- Educate your community about the risks posed by climate change
 - Create posters that represent some of the local risks to your community
 - Organize an assembly to present information in an engaging manner
- Perform a school-wide waste audit, and make a plan for a less wasteful path forward
- Take a personal or class pledge to make lifestyle changes
 - Reduce meat intake
 - Reduce use of single-use plastics
 - Walk or bike to school

Action Project Examples:

- Project Drawdown, Chelmsford Valley District Composite Schools - Chelmsford, ON
 - Students were asked to research the 100 solutions to climate change on the [Project Drawdown Website](#) and then chose one that they thought was viable at the family level that they could encourage others to implement. Students then created a video, slideshow, infographic, or newspaper article outlining the actual costs and challenges of implementing the solution. Students were quite excited to learn that there are things that can be done by individuals to create change. They asked many questions, and researched actual current prices required to implement, after which they concluded if the solution was/was not viable for them and/or the average family.
- Multifaceted Sustainability Awareness Campaign - Grant Park High School Green Team - Winnipeg, MB (2019)
 - By creating and selling hoodies and plants-in-a-bag, the Grant Park Green Team raised money to support a number of sustainability initiatives including: an assembly on the topic of turning social media passion and activism into real change, encouraging students to make a pledge to change something for an entire month, working to change the school light bulbs to LED, better access to recycling around the school, and investing in materials for a school wide vermicomposting system. [See their project here](#)

2. Climate Change: Where are we now?

One of the many challenges of climate change is context and scale. While impacts vary from region to region, climate change is a globally shared existential threat. Over the last thirty years of climate science data and policy papers from many levels of government, it has been challenging to ascertain the impact of our collective actions, risks, and timelines. However, this has recently shifted, and more resources and tools have been developed to help individuals, communities, cities, and municipalities find answers to this question.

In this inquiry, students can explore tools and resources that help determine where we are now in terms of climate change, research big idea questions, consult with local political leaders or municipal planners, and visually map their understanding through concept mapping to explore different dimensions of climate change. They can also explore consensus on climate change, mitigation and adaptation, and policy analysis.



Photo by UN Photo

Before you Begin: Background Information for Educators

In the past 10 years, climate change has moved from a peripheral issue to one that is recognized as deserving a spot at center stage. Surveys worldwide demonstrate a general awareness and sensitivity to the issue of climate change; however, global policies do not necessarily reflect that same awareness. The actions and policies that are feasible depend in

many ways on the changing attitudes of global citizens, but also on the governing bodies and their points of view.

One of the issues standing in front of major global action being taken to combat climate change, is the [collective action problem](#). This kind of problem is defined as a situation when multiple individuals would benefit from specific actions taking place, but it is impossible for one individual to solve this problem alone. Individual countries often think of their duty to rectify the problem of climate change only in relation to their contribution to the problem, which may only be a small portion. In order to enact real change, countries and individuals need to take ownership of the problem and work together as changemakers, working to make a positive difference through cooperation and feelings of accountability. [Canada is the 9th largest emitter of Greenhouse Gases](#), leaving worse offenders like China, the United States and Russia ahead in emissions. However per capita Canada ranks 4th on the list, and we are positioned to be more heavily impacted by the effects of global warming than many other countries, providing a very good reason to become a leader in global action.

We will now provide a brief overview of some of the key global and national policies related to climate change to date.

- Canada entered into the [Kyoto Protocol](#) in 2002 aiming to reduce GHGs by 6% between 2008 and 2012. Canada instead increased emissions by 30% and withdrew in 2011—a controversial decision for many. Reasoning was in part attributed to the lack of involvement from large contributors, China and the United States ([Canadian Geographic](#), 2016)
- [The Copenhagen Accord](#) was signed at the UN Climate Change Conference in 2009 (aiming to reduce GHGs by 17% below 2005 levels by 2020). Canada announced in 2014 we would not meet the target.
- [The Paris Agreement](#) was signed by the Federal government in 2015, committing to spending \$2.65 billion between 2015 and 2020 to support developing countries and aiming to keep global temperature rise below 2°C
- In 2019, [A Climate Summit](#) was held to check in with countries, businesses and civil societies on their commitment to the Paris agreement, and showcase any new initiatives enacted to reach their goals. According to the Climate Action Network, Canada needs more robust action in order to reach the 2030 target of reducing GHGs 30% below 2005 levels.
- At [COP25](#) Chile, hosted in Madrid, Canada came forward with a net-zero emission legislation to achieve by 2050, with milestones every five years to remain on track. Much of the public reception of COP25 was plagued with disappointment. Executive director of Greenpeace Jennifer Morgan, told journalists that despite the “fresh momentum” provided by the growing global climate movement, it had yet to penetrate the “halls of power.”

Around the world, global climate movements are demanding more action from policymakers. Since 2019, high school students, largely inspired by Swedish teen Greta Thunberg have participated in global climate strikes demanding action from their governments, acknowledging the weight and danger that their generation will bear and the need for urgency to divert from the current path.

In terms of policy and action, big promises and failed outcomes have brought us to the place that we are now. This is not to say that both large-scale and individual efforts have not been made. Of course, big change takes into account many important actors. Canada enacted a [federal carbon tax](#) to help incentivize reduction in emissions by taxing products that create emissions. The theory is that people will want to avoid paying this tax and subsequently reduce emissions.



A. Provocations: Where are we now?

To hook student interest, choose one or more of the provocation ideas to initiate student thinking.

Idea 1) News Videos

[Greta Thunberg speech at COP 24](#) [Connect4Climate]: 3:24 minutes

15 year old activist Greta Thunberg speaks truth to power at the UN COP24 climate talks

[Climate Change and a path forward for Canada](#) [The National]: 11:04 minutes

A panel discussion with three climate experts on Canada's path forward. Catherine Abreu, from the Climate Action Network Canada, Marc Cameron from Canadians for Clean Prosperity, and Blair Feltmate from the University of Waterloo.

Idea 2) Online Resources

[Climate Action Tracker](#) [CAT]

Read through Canada's "Country Summary" and the "Assessment" section of the Climate Action Tracker. The Climate Action Tracker is an independent scientific analysis that tracks government climate action and measures it against the globally agreed Paris Agreement aim of "holding warming well below 2°C, and pursuing efforts to limit warming to 1.5°C."

[Carbon budget clock](#) [Mercator Research Institute on Global Commons and Climate Change]

Scroll down to the carbon budget clock. Select 2°C and observe the timeline on the carbon budget clock then select 1.5°C and observe the timeline.



B. Question Generation

Ask students to write “[I wonders](#)” or questions that they have after the chosen provocation. This is an opportunity for students to review the umbrella questions that they drafted in the first Inquiry: *What is Climate Change and Why Care*. If students have shifted their focus, encourage them to draft new questions

Here is a list of example questions:

- 1) Are we on track to reduce warming to 1.5 or 2 degrees?
- 2) What role does the government have in protecting local communities from the effects of climate change?
- 3) How can we do more at a local level to mitigate the effects of climate change?
- 4) How do we spread awareness of strong policies or lack of policies in our local community?
- 5) How do we ensure our local community is doing their part to meet provincial, federal and global goals?



C. Knowledge Building

Invite a speaker

Invite a local political leader or climate adaptation planner to the class to discuss local plans.

Places to look for a climate leader

- Municipality or city - some jurisdictions have a Climate Mitigation and Adaptation Planner and others will have an Environmental Compliance Manager
- [Climate Reality Project Speakers](#)



D. Determining Understanding

Concept Mapping

[Concept mapping](#) is a powerful way to assess students’ understanding of key concepts and relationships. Developing a concept map on a dimension of climate change allows for students to think about relationships between systems. It also enables them to consider dimensions of climate change holistically and visually. This process also allows the teacher to identify any

misconceptions or knowledge gaps that students have. A concept map can also be iterative and students can come back to their concept maps to expand or modify them as they learn. In this particular instance, concept mapping climate change would be used as a means to determine understanding and then direct student learning.

To concept map a dimension of climate change, model how to create a concept map. A concept map is composed of key ideas or concepts (enclosed in shapes such as circles, boxes, triangles, etc.) and then a directional arrow is drawn to denote the relationship between the ideas. Along the line of the directional arrow, a preposition statement is included that explains the relationship.

Students can work individually or in small groups (4 or 5) to show what they think are the important elements/concepts of climate change. The concept map can be made through an online platform or on a large piece of chart paper with markers.

Depending on the focus of the class, here are some options for key ideas:

1) Understanding of climate science

Suggested concept prompts: greenhouse gases, greenhouse effect, global heating, climate, weather

2) Impacts of climate change

Suggested concept prompts: forest fires, flooding, deforestation, carbon cycle, water cycle, the greenhouse effect

3) How people respond to climate communication

Suggested concept prompts: scientists, mainstream media, government, family, friends, neighbours, companies, non-governmental organizations

4) Cultural narratives

Suggested concept prompts: Indigenous perspectives, Gross Domestic Product, consumerism, dominant vs minority perspectives

5) Social justice of climate change

Suggested concept prompts: those most at risk (vulnerable and least able to adapt), those least at risk (less impacted and able to adapt), per capita emissions, children and youth

6) Climate Actions

Suggested concept prompts: refrigerant management, wind turbines (offshore), reduced food waste, plant rich diet, tropical forests, educating girls, family planning, solar farms, silvopasture, and rooftop solar. These are the top 10 solutions according to [Project Drawdown](#), students could reference the website to research and add to their concept map.

Here are a few concept map examples:

Climate Change Actions

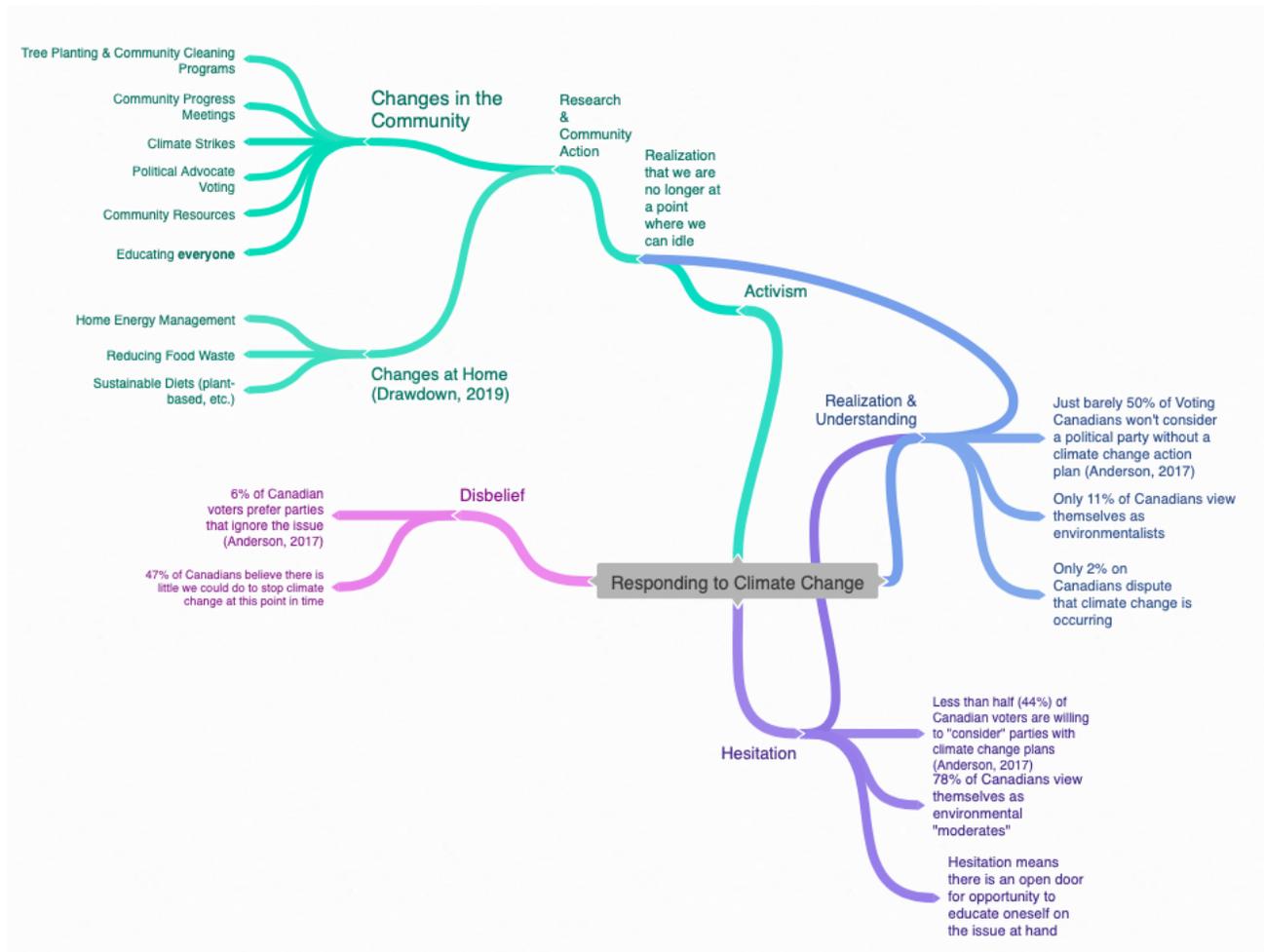


Photo: Climate Change Education grad student from Lakehead University

Holistic understanding of climate change:

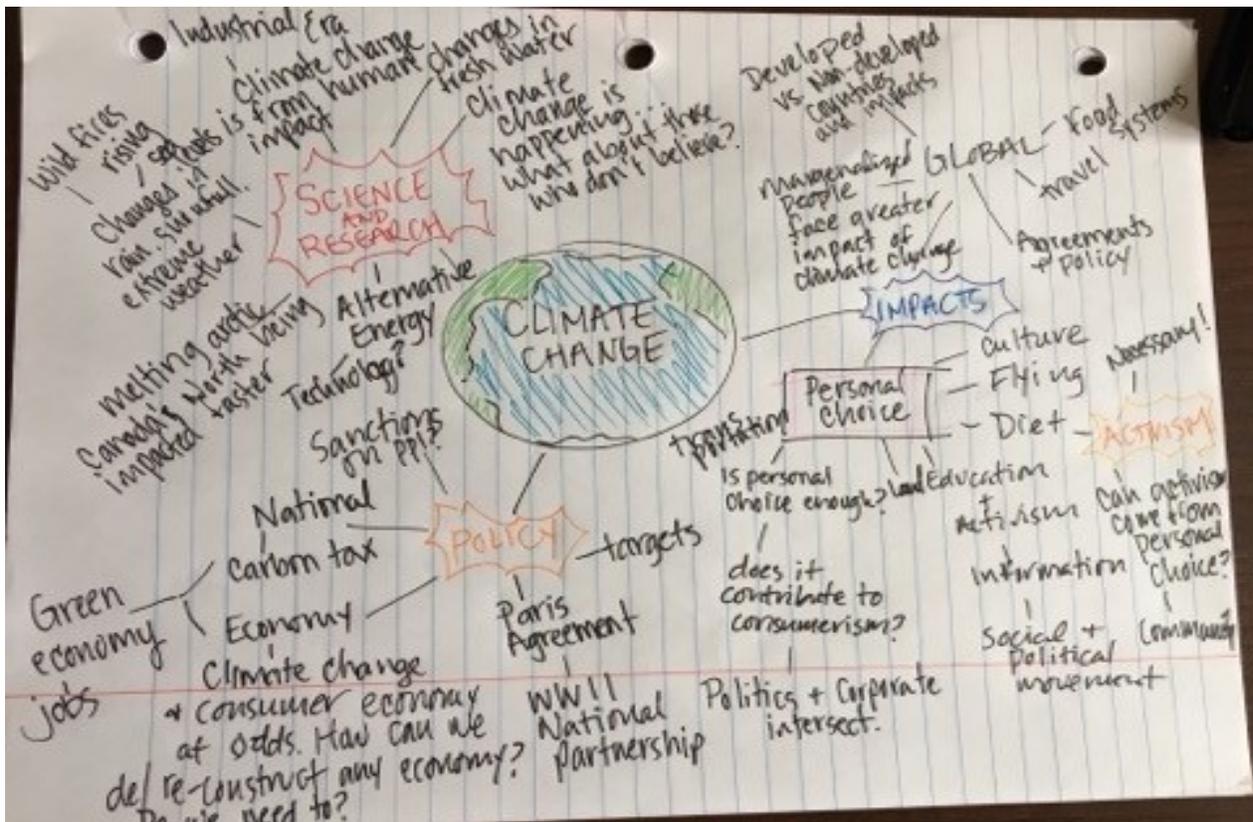


Photo: Climate Change Education grad student from Lakehead University

Activity 1: Scientific Consensus on Human-caused Climate Change

[Lesson from the National Center for Science Education](#) (2018)

This lesson is designed to engage students through exploration of climate data. Students will be working in small teams to analyze samples of climate data to look for trends and consider possible “climate drivers” that they can report back to the class. Scientists make conclusions through rigorous analysis of data. In science, consensus is only reached with ample evidence and analysis of data.

Note: Climate drivers can either be anthropogenic or natural forces that result in changes to the earth’s climate. For instance, greenhouse gases are an anthropogenic climate driver, and solar activity is a natural climate driver. Any changes to these phenomena can have an impact on climate.

By interpreting real data and forming conclusions, students will only be exposed to misconceptions about climate change at the very end of the lesson, when they have already constructed their own understanding and may be able to defend this understanding in the face of misinformation. The class will explore various methods of science denial ([FLICC](#)) and examine conflicting conclusions provided by climate experts vs. a source like the ‘[global petition project](#),’ turning misinformation into an education opportunity.

The goal of this lesson is to learn that consensus on human-caused climate change increases with expertise and to understand the strength in the 97% consensus among global climate experts.

Duration: 60 minutes

You can access the full lesson [here](#), or in Teacher Aids.

Activity 2: Who’s in Control?

Resource created by [Practical Action](#).

Students participate in a role play to explore the question of who should take responsibility for reducing the effects of climate change. Using background information provided, students represent different perspectives in a discussion/debate as to whether or not they would support a national commitment of greater emission reductions than those proposed by other countries.

The lessons conclude with students calculating their own carbon footprints and considering what practical action they are personally prepared to take to reduce greenhouse emissions.

Designed to take place over 3 class sessions, the resource provides support for students and teachers in both print and video formats.

Full resources can be accessed [here](#).

Activity 3 (for advanced classes): Policy investigation

Using the following resources, students are invited to begin a policy investigation: The IPCC report, Canada's commitments to the Paris Climate Agreement, Provincial Policy, and information from local government members.

The tool that students will use for this investigation is called a reverse mind map. This activity is aimed to help students examine the current status of climate change at all levels of government. Reverse Mind Mapping is a tool for navigating information overload when you have more content than you know what to do with.

This can be completed individually or in groups, with certain members splitting up to focus on one area (e.g. federal) and then sharing their findings with the rest of the group

- To complete a [reverse mind map](#), students collect data on a specific topic (the current status of climate change in Canada), then categorize, analyze, sequence, and recognize trends surrounding the “big idea”
- Students may need to use a rough sketch and create categories and themes before creating a final product
- At the bottom of the page, students are encouraged to create a list of questions and concerns regarding how their local initiatives are meeting the federal and provincial goals set in place

[Link](#) for more information



Reverse Mind Mapping



F. Consolidation

To encourage students to integrate and synthesize key ideas, configure the class into a circular seating formation and facilitate a [Knowledge Building Circle](#).

Here are some suggested reflective questions:

- What climate impacts are we already experiencing?
- How are we personally and collectively taking action to address climate change? Where are there opportunities to direct focus and attention to taking action?
- What mitigation and adaptation efforts are we aware of?

Assessment Idea



Teachers will assess learning at different points throughout the inquiry using multiple methods. The following assessment provides an alternative evaluation method to standard quizzes and tests, that can be used after consolidation or at any point in the lesson to check for understanding.

< **Thirty-Second Sound Bite Strategy**

The [Thirty-Second Sound Bite](#) is an activity where, individually or in small groups, students are asked to create a 30-second sound bite that mimics what Greta did when addressing global leaders. Students will research a specific topic (of their choice) pertaining to climate change to discuss in their sound bite designed to get students' and or listeners' attention about an issue. For more information on this strategy look [here](#).



G. Take Action:

Allowing time for students to take action is an essential part of the learning process on climate change, as it empowers students and eases their eco anxiety.

Ideas for Taking Action:

- Invite a local political leader to the class to discuss local climate mitigation and adaptation planning and create an opportunity for student voice to reach government
- Complete a carbon footprint calculator and then develop a list of things you can personally do to mitigate carbon dioxide emissions
- Engage and partner with local community organizations that are involved in relevant projects and initiatives

Action Project Examples

- The Green Phoenix - Resurrection Catholic Secondary School - Kitchener, ON (2017)
 - Students were inspired to take various actions in their community such as planting trees, advocating for better recycling programs, installing bike racks etc. But one of the major steps that these students took in their project was to educate themselves and their community. Speakers were invited for earth week to educate, inspire and help the community understand the current status about environmental issues. [See their project here.](#)
- Student Town Hall on Climate Change - Headwaters - Guelph, ON (2019)
 - This student group decided to create a space for the government and leaders to hear their voices to take into consideration when implementing policies and projects to ensure a more sustainable future. This took place at a youth-led town hall where any high school or elementary student could ask their Mayor, MPP and MP questions about climate change and hear open and honest answers from their government representatives. [See their project here](#)

3. Monitoring Change: Using the Climate Atlas of Canada

This inquiry closely aligns with the previous inquiry, *Where are we now?* It focuses on the importance of monitoring change and focuses predominantly on the interactive website the Climate Atlas of Canada. The use of this site will enable students to research past, present and future climate impacts in their communities under different emission pathways. From a psychological and educational standpoint, investigating climate change from a regional scale is preferred because 1) planning for and adapting to climate impacts is often undertaken at a city/municipal/community level, 2) students can engage directly with local experts and 3) this ensures learning is in alignment with the scale of jurisdictional response and in alignment with students' locus of control. After exploring climate change impact projects, students can develop Action Projects that focus on mitigating or adapting to climate risks.



Photo by: Learning for a Sustainable Future (Nov 2018)

Before you Begin: Background Information for Educators

Monitoring change is an integral part of each theme discussed throughout this guide. Changes are happening faster than we can track when it comes to climate, climate science, impacts on human health, policy, regulations and technology. Therefore, the central theme of this inquiry is empowering your students with the tools and skills necessary to conduct accurate and relevant research in order to effectively monitor the changing climate and changing world around them.

In Canada, mitigation of anthropogenic climate change and global warming is being addressed more seriously than ever before. In the 2015 election, the federal leadership made climate change a top priority and pledged actions based on the best scientific evidence and advice.

Using recent advancements in technology such as GIS and satellite monitoring, scientists can track climate change. This also allows scientists to narrow in and see the current and projected trends in specific areas and how these will affect our day-to-day lives.

Note: How to Navigate Climate Atlas of Canada: See [handout here](#)

Within this inquiry, students will become very familiar with the Climate Atlas of Canada. Up until recently, it has been difficult to find student-friendly websites and modelling tools to show the effects of climate change across all categories (rainfall, temperature, growing season, etc.) over time. By allowing students to focus locally and continuing to foster that connection, they can bring the issue of climate change closer to home before looking into specific effects in the upcoming inquiries. Often, it is only when we see the statistics or numbers to support certain claims that we truly see the reality of an issue.

With the Climate Atlas allowing students to look at “More or Less” Climate Change (more or less carbon emissions), they can see the results visually on a map or by looking at the data, making the issue more real than ever before. After using the Climate Atlas Map and recording the climate variables and discussing their findings, in groups, students are asked to graph the top variables to be put on display for the school to share the impacts in an engaging way.

To finish the inquiry and to continue moving forward in partnership with the community, a class trip to a local conservation area is encouraged to allow students to:

- see how local groups are monitoring the effects and trends of climate change
- see their concerns with the patterns they have noticed and
- have an opportunity to use some of the sampling apparatus themselves and contribute to data collection initiatives



A. Provocations: Mapping and Modelling Change

The following three videos from the Climate Atlas of Canada can be used to hook students' interest. They give students an opportunity to begin connecting how climate monitoring can not only give us useful information about local climate trends and predictions, but how we can use that information to our benefit. It also allows them to see the extreme effects that will take place if we do not act now and alter our lifestyles to keep our global temperature increase below 1.5 degrees Celsius.

[Climate modelling](#) [Climate Atlas Canada]: 3:21 minutes

Dominique Paquin of Ouranos specializes in climate data. In this video she breaks down the different parts of a model and explains how her work can help us understand and prepare for

the future.

[Dendroclimatology and the Canadian Prairies](#) [Climate Atlas Canada]: 4:39 minutes
Dave Sauchyn is a dendroclimatologist who studies tree rings to learn about climate trends in history and what that might mean looking forward. His research shows that climate change is increasing the risk of droughts that are both severe and for extended periods of time, creating somewhat of a “new normal” for the Canadian prairies.

[Roy McLaren, Lifetime farmer observing changes to farming industry](#) [Climate Atlas Canada]: 4:30 minutes
Roy McLaren has farmed in southwest Manitoba for most of his life. In this video he is concerned looking at maps of climate projections. “That is pretty bad,” he says, looking at maps showing a huge increase in very hot weather. “With that kind of heat,” McLaren muses, “we’d have to change our farming methods. We’d have to adopt new crops.”



B. Question Generation

Use the [Bloom’s Taxonomy – Question Starters](#) to generate higher order thinking questions. As a group or individually, students can generate their own questions using the prompts for each of the six Bloom’s Taxonomy levels: remembering, understanding, applying, analyzing, evaluating, creating. To access a pdf of the question starters click this [link](#)

Here are some sample questions to guide this inquiry using the six categories:

Remembering:

- Have you been able to see the impacts of climate change in your lifetime, specifically with the weather and climate patterns and trends?

Understanding:

- How can climate modelling help us at a local level?

Applying:

- How would you change the way we currently hear about climate change in the media?

Analyzing:

- Why should we rely on climate modelling?

Evaluating:

- Can we trust climate monitoring tools and climate modelling? Why or why not?

Creating:

- How would you generate a plan to mobilize the knowledge you learned so that others can benefit?

Resources for information on climate modelling in Canada:

- Modelling Future Climate Change Chapter 3 from [Canada’s Changing Climate Report](#) provides an in depth overview of climate modelling processes.

- [Climate Change Projections: how computer models help us understand climate.](#)
- The Government of Canada monitors changes through a program called the [Climate Trends and Variations Bulletin](#).



C. Determining Understanding

Ask students to reflect on their current understanding of climate change, climate modelling, and the importance of data tracking and monitoring changes as it pertains to climate change by using three simple statements to answer some or any of the guiding questions.

I was thinking...

I've noticed...

I've heard...

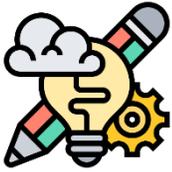
These simple statements can be kept in a journal to refer to as the inquiry and learning progress, or students can share with a partner or group to provoke a thoughtful discussion. Teachers should take an opportunity to read students' thoughts to gain insight into student understanding.



D. Knowledge Building

Carousel Brainstorm

Engage in a brainstorm and create a list examining how “Climate Modelling” is helpful for monitoring change. This can include different sectors that are or will be impacted and how to prioritize adaptation planning based on these shifts. You can do a whole class brainstorm if time is an issue, but to encourage active participation from all students, you can use a Carousel Brainstorm technique that includes movement, discussion and reflection. With this strategy the teacher posts 4–5 large sheets of chart paper around the room, each with a different question or statement on how “Climate Modelling” is helpful for monitoring change. Students work in small groups and move from one station to another together, adding responses to each chart paper as they go. In the end, the class will have generated a list of ideas for each topic, that can be further discussed.



E. Pursuing Learning: Mapping and Modelling

The following activities are designed to structure and guide students as they pursue learning within the Climate Atlas and gain skills and knowledge as it pertains to monitoring changes to the climate.

- Climate Atlas Open Exploration
- Mapping and graphing local data

Activity 1: Climate Atlas Open Exploration

With the Climate Atlas, students will have the opportunity to explore a variety of scenarios. You can model for your students how to examine *different variables* (such as very hot days $>30^{\circ}\text{C}$, tropical nights, cold weather, precipitation, or agriculture), through various *emission pathways* (i.e. different predictions for the concentration of GHGs in the atmosphere over time), and at *different time periods* (recent past, 2021-2050, 2051-2080). Through the “find local data” section of the website, all these variable options are available. Give students a fair amount of time to really dive into the website and test several combined variables and scenarios. Ask students to take a few minutes to examine the region that your school is located, but ultimately, students can focus on any geographic region that is meaningful or of interest to them.

This [guidebook](#) provides an overview on the basics of using the Climate Atlas, using the map, downloading local data, and interpreting climate data.

Students can organize data into an infographic by choosing three variables and looking at changes over two emission scenarios. Here is a student example:

CLIMATE IMPACTS

Orillia, ON



DATE OF FIRST FALL FROST

2021 - 2050: October 24
2051 - 2080: November 5



HEAVY PRECIPITATION DAYS

2021 - 2050: 7.1
2051 - 2080: 8.1



MAX TEMPERATURE IN SUMMER

2021 - 2050: 26.8
2051 - 2080: 29.2



via www.climateatlas.ca

Photo: Lakehead university student infographic

After exploring the Climate Atlas, students will recognize immediately that the effects of climate change are not the same across the country or even across one province. You may want to debrief with your students by asking consolidating questions like: *Do the findings from the Climate Atlas make you think about where you want to live? Are you surprised which areas are more greatly impacted? Why or why not?*

Check [here](#) for student worksheets to guide them through exploring the Climate Atlas.

Activity 2: Mapping and graphing local data

Students should be instructed to visually represent some of the research that they conducted in Activity 1 on a map or a graph. Students can break into smaller groups (2-3 students) and discuss which information that they want to collectively graph. The visualization should depict climate change impacts on your community. Try to encourage groups to focus on diverse variables. The graph should include three time periods (recent past, 2021-2050, 2051-2080) and examine what would happen with “increased climate change” or “mitigated climate change.”

Note: To assist with data visualization you can view information on the page “find local data” as a time series, frequency plot, scatterplot, or climograph. Data can also be downloaded into a .csv file to use for the data management or probability explorations.

Share your results with your school

From here, students can share their findings with the rest of their school community by putting these climate graphs on display. Students should be prepared to explain “why care.” This is something brief that can be included on the poster to further spark a conversation for students or staff walking by.

Extension: Invite your community to engage with the maps.

- The class could include an interactive piece where students walking by can ask questions on sticky notes and post them on data that they are curious about.
- Have “emoji like reactions beside the maps for the school community to choose to indicate how this data makes them feel. Allow other students, teachers and staff to post their reaction to the maps.

Include instructions for your community on the wall or make an announcement in the morning to draw attention and invite interaction.



F. Consolidation

After using the Climate Atlas Map and recording the climate variables and discussing, allow students to turn to a partner and then [“Think, Pair, Square”](#). Give students a few minutes to

think about the following questions on their own, then share their thoughts with a partner, and finally group with another pair to share as a group of four.

- 1) What surprised you most about the Climate Atlas Investigation?
- 2) What questions do you still have?
- 3) What concerns you most about where our school community is?
- 4) Why is climate monitoring so important?

Assessment Idea

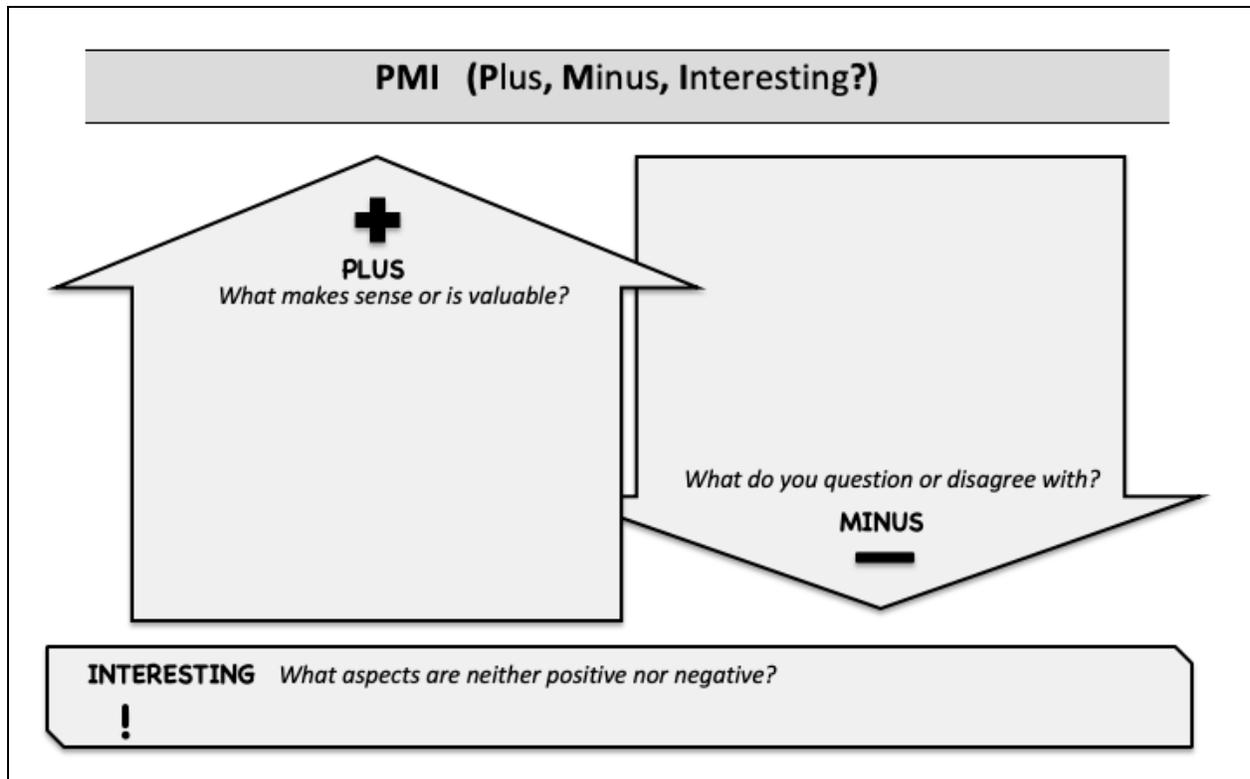


Teachers will assess learning at different points throughout the inquiry using multiple methods. The following assessment provides an alternative evaluation method to standard quizzes and tests, that can be used after consolidation or at any point in the lesson to check for understanding.

< **Plus, Minus, Interesting (PMI) Strategy**

The **PMI strategy** is a critical thinking tool developed by Edward de Bono that allows teachers to determine student understanding of a concept. Students are instructed to write down the positives, negatives and interesting features of a topic, question or situation. PMI tool can also be used as a closure activity for students to write down the takeaway or key points of the lesson and collected by the teacher for reevaluation. For more information on the PMI strategy, click on the [link](#).

Sample PMI Organizer



G. Take Action:

Making Connections – Moving Beyond School to Community Integration:

To complete the inquiry and continue moving forward in partnership with the community, a class trip to a local conservation area can extend engagement with students' sense of place. Depending on the conservation areas near the school community and the educational opportunities they provide, students are able to explore techniques and monitoring practices.

A hands-on opportunity would be to have students participate in some of the sampling practices themselves, to further understand the time and precision involved in keeping track of local changes. Lastly, this is a way to create a bridge between future careers and jobs within the field of climate change and environmental conservation.

Ideas for Taking Action:

- Citizen Science
 - Conduct an ongoing experiment to track local changes in a specific aspect of the environment. Monitoring local changes can create a vivid first-hand account of the effect that climate change is having on the surrounding environment so close

to home. This can reinforce the research that has been conducted through the Climate Atlas and provide new insights to inform action.

- Support Policies that support sustainability and climate change mitigation strategies
 - Research and understand current government policies and then take action by getting in touch with local government officials. For instance: write letters to local MP's voicing concerns about environmental policies and help students learn the importance of civic action; present Climate Atlas graphs and presentations to the local council.

Action Project Examples

- Carden Water Quality Monitoring - Patrick Fogarty Catholic Secondary School - Orillia, ON (2015)
 - For the CAPSTONE program, students monitored the pollution that comes from cattle grazing (an essential component of maintaining alvar conditions) learning water quality measuring skills such as: temperature, turbidity, nitrogen, pH etc. They partnered with a local conservation authority and presented their findings to their city council. [See their project here.](#)
- Bioblitz Action Project - Rossland Summit School - Rossland, BC (2017)
 - A three-part Action Project starting at a local wetland, taking recordings and observations from the temperature to the local flora and fauna. Students applied for funding to purchase learning tools to be able to engage more deeply with the wetland and spend more time exploring. Students also educated their local community about what should and should not go down the drains to avoid algae blooms and engaged them in a huge, community-wide bioblitz to cap off their project! [See their project here](#)

4. Environmental Impacts & Restoration

This inquiry delves deeper into the multifaceted environmental effects of climate change. We encourage students to harness their curiosity of the local environment by examining changes to the ecosystem, species at risk, large scale environmental impacts, etc. or by connecting with a community expert and exploring restorative practices. We have included a multitude of external resources and guiding questions to help support and extend student research.



Photo by: NASA/Kathryn Hansen

Before you Begin: Background Information for Educators

Regions across Canada are already experiencing the effects of climate change. Many ecosystems are changing rapidly, and animals' habitats are changing at a faster rate than they can adapt. The [Living Planet Report](#) shows an average decline of 60% in animal populations between 1970 and 2014. In order to conceptualize some of the major environmental effects that can be attributed to climate change and trends that could emerge in coming years, the effects have been broken down into the following sub-categories: changes in temperature and precipitation, changes to the [cryosphere](#) (portions of Earth's surface where water is in solid

form, including ice caps, glaciers, sea ice, snow cover, etc.), changes to freshwater resources, changes to ocean climate, and biodiversity changes.

Changes in Temperature and Precipitation:

- In Canada, temperatures have increased by [1.5 degrees](#) above pre-industrial levels. Canada's position in the far northern hemisphere means that we are experiencing the effects of climate change at a higher rate than many other regions in the world .
- Warmer air has the potential to absorb more [surface water](#), resulting in both droughts and more intense precipitation events. Overall trends indicate that [Canada has become wetter in the past decade](#), with increased rainfall and decreased snowfall across many regions of southern Canada.
- Temperature and weather extremes are expected (very hot and very cold as well as very wet and very dry) leading to a higher risk of associated environmental hazards such as floods and droughts.
- Overall temperature warming is enhanced in the northern latitudes of the country

Changes to the Cryosphere

- [Permafrost](#) temperatures in Northern Canada have been fairly consistently rising 0.2 degrees per decade over the past 20-30 years
 - Globally between 2007 and 2016, there has been an average increase of 0.29°C ± 0.12°C in permafrost temperatures ([IPCC, 2019](#))
 - The effects of melting permafrost include release of harmful [greenhouse gases](#) previously trapped within the ice and reduction of structural support in regions previously covered by permafrost
- [Glaciers have been melting at an accelerated rate since the beginning of the 20th century](#)—glaciers lost 11% and 25% of their surface area in Alberta and British Columbia, respectively, between 1985 and 2005.

Changes to Freshwater Resources

- Changes to freshwater resources across Canada are difficult to categorize as a whole, nationally, due to the extreme regional variation that exists
- Canadian data shows that water quality has remained stable in the vast majority of monitoring stations across the country (81%) between 2002 and 2016, improved in 10% of locations, and decreased in 9%.
- However, the levels of [PBDEs](#) (Polybrominated diphenyl ethers, persistent organic pollutants) remain above prescribed guidelines in the following locations: The Great Lakes, Pacific Coastal, St. Lawrence.
- Excessive nutrients in both the Winnipeg River Basin and The Great Lakes area have caused detrimental [algae blooms](#) in these locations

Changes in the Ocean Climate

- [Trends in the Pacific, Atlantic and Arctic oceans indicate long-term warming of approximately 0.1 percent per decade](#), both surface temperatures and bottom waters

- Ocean temperature, acidity, and oxygen levels are affected by increasing atmospheric carbon dioxide levels
 - Since the 1980's the ocean has absorbed between 20-30% of total anthropogenic carbon dioxide emissions
- The rate of ocean warming has more than doubled since 1993 ([IPCC](#)).
- Ocean levels are rising at a concerning fast rate (in part due to the melting ice caps), which is increasing the risks of flooding and potential contamination of freshwater and groundwater, among other issues
 - In Canada, a country surrounded by three different ocean bodies, the changes to ocean levels, temperature and composition are of paramount importance

Biodiversity changes in Canada:

- Increases in the frequency and intensity of droughts, forest fires, and insect outbreaks in combination with direct human impacts like deforestation, pollution and overharvesting are resulting in habitat loss and threatening the survival of many species ([Canada and a Changing Climate](#)).
- Changes to season lengths and times (such as earlier springs) are changing the growth and reproduction patterns of many plant species, which directly affects animals that rely on them for food and habitat
- Physical changes in the landscape (e.g. higher water levels or human barriers such as roads, farms, and dams) can prevent animals from accessing food or breeding/rearing areas



A. Provocations: Impacts on the Environment

To hook student interest, choose one or more of the provocation ideas to initiate student thinking.

Idea 1) Picture prompts

Images can provoke strong responses. Find some topical photos and ask students “What do you think this image is saying?” A few suggestions are listed below. (For more ideas on how to use them, go to the New York Times resource on [How to use Picture Prompts](#).)

Click on the links below to access the following picture prompts

- [Falling Bottles](#)
- [In Your Head](#)
- [Student Climate Strikes](#)

Idea 2) Videos

[1 °C and its impacts: what does climate change mean for Canada?](#) [Climate Atlas]: 2:49 minutes

Climatologist, Damen Matthews describes how the climate changes that are being observed are human-caused and “unparalleled in geologic history.”

[How we children save the world](#) [Plant for the Planet]: 5:21 minutes

The story behind Plant for the Planet—a youth perspective on how children can change the world and make a real impact in the climate crisis.

[Canada Living Report](#) [World Wildlife Fund]

WWF’s 2017 living planet report brings attention to the significant wildlife loss and takes a look forward to see “what can be done?”

[Ask the Experts about Climate Change](#) [CBC] - Watch to 1:38

Nicole Mortillaro, CBC News science reporter, Ulrich Wortmann, professor of Earth Sciences, and Mark Winfield, environmental policy expert answer questions on climate change.

[Why we must adapt where we live to reduce weather impact](#) [Global News]: 10:16 minutes.

Senior Climatologist for Environment Canada, David Phillips believes that governments should be putting restrictions on building in flood zones and preventing paving lawns, “investing in green infrastructure not grey infrastructure”.

Idea 3) Neighbourhood Walk

Go for a walk around your school yard or neighbourhood and ask students to three to five “[I wonders](#)” about how climate change is affecting or may affect the environment in your local area. Compile “I wonders” into a list for students to refer back to when developing umbrella questions. For example, “I wonder how bees are being affected by climate change.”

Biodiversity or species at risk modification:

Before leaving for your walk, encourage students to download the free app, [iNaturalist](#). The app allows them to take photos of plants, animals or insects for identification and will suggest probable species. Data uploaded into iNaturalist is shared with scientists to help conduct research and monitor invasive species.



B. Question Generation

Using the “[Question Formulation Technique \(QFT\)](#)”

Reflecting back on “I wonders” from the neighbourhood walk, ask students in groups to generate as many questions as they can in the allotted time (suggested 5 min). To generate questions, follow QFT rules for producing questions:

- Ask as many questions as you can
- Do not stop to answer, judge or to discuss the questions
- Write down every question exactly as it is stated
- Change any statement into a question

Review the difference between open-ended and closed-ended questions and ask students in groups to identify open questions with an “O” and closed questions with a “C”. Ask students to rewrite three closed-ended questions into open-ended questions and three open-ended questions into closed-ended questions.

Prioritize questions

Next ask students to review their questions and prioritize them according to which ones they believe will help the class better understand how local natural systems are being affected by climate change.

Sample questions:

- What is the biggest environmental impact in our area?
- Which species are most at risk in our area and why? What are the main risks?
- What adaptation strategies do we have to protect areas most at risk of environmental impact (e.g. flooding or droughts)?



C. Knowledge Building

Invite a speaker

Invite a local community expert to learn about local climate impacts and local climate action responses.

Places to look for a local community expert:

- Naturalist groups
- Climate adaptation representative (municipal, provincial)
- Ministry of Natural Resources
- Conservation Authority/Agency

- Conservation NGO

Students can have the questions they generated on hand to prompt them to ask the speaker.



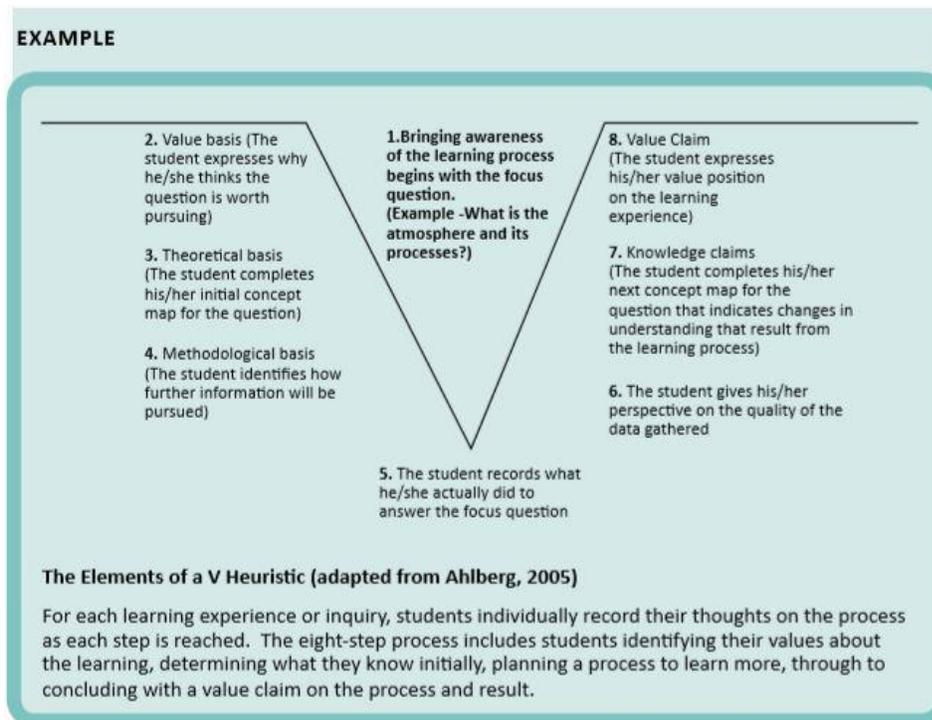
D. Determining Understanding

V-heuristic

After hearing from a guest speaker, have students review their questions, make notes about what they've learned and develop any new questions.

Then ask students to select one question as a top priority. Working with this question, students will each go through the v-heuristic process steps 2-4. These steps will help students focus on how and where to direct their learning.

EXAMPLE





E. Pursuing Learning: Impacts on the Environment

Individual or group research

At this point, students can individually pursue their own research process, or you can facilitate students working in groups as they begin to conduct research.

What is the biggest environmental impact in our area?

- [Climate Atlas of Canada](#)
- [An Overview of Canada's Changing Climate; in Canada in a Changing Climate: Sector Perspectives on Impacts and Adaptation](#)

Which species are most at risk in our area and why? What are the main risks?

- Government of Canada's [Species at Risk Public Registry](#)
- [Biodiversity and Protected Areas: in Canada in a Changing Climate: Sector Perspectives on Impacts and Adaptation](#) p. 159-190

How are we all connected? How do the environmental impacts across the country affect us in our location?

- [Climate Atlas of Canada](#)
- [An Overview of Canada's Changing Climate; in Canada in a Changing Climate: Sector Perspectives on Impacts and Adaptation](#)

What adaptation strategies do we have to protect areas most at high risk of environmental impact (Example: flooding or droughts)?

- [Federation of Canadian Municipalities Resource Database](#) (2019)
*Search for local municipal examples among 49 case studies from Canadian municipalities
- Government of Canada's [Long Term Infrastructure Plan](#) (2018). [See Green Infrastructure section]

What are the best restoration actions for mitigating climate impacts?

- [Examining the viability of planting trees to help mitigate climate change.](#) NASA
- [5 things to know about fighting climate change by planting trees.](#) *Science News.*
- [To Ensure a Stable Planet, 30% of the Earth needs protection by 2030.](#) *National Geographic.*



F. Consolidation

After students have had an opportunity to do some extensive research, a valuable consolidation tool to conceptualize and organize large amounts of information is a [reverse mind map](#). Students can complete a reverse mind map in a group with other students who have chosen to address a similar topic. By combining all of the research that students did, information can be consolidated and hopefully some clarity will begin to arise.

Assessment Idea



Teachers will assess learning at different points throughout the inquiry using multiple methods. The following assessment provides an alternative evaluation method to standard quizzes and tests, that can be used after consolidation or at any point in the lesson to check for understanding.

< 3-2-1 Strategy

The [3-2-1 exit slip strategy](#) is a method for students to summarize their learning as follows:

Three: Students write three things they learned in today's lesson.

Two: Next, students write two things they would like to learn more about.

One: Finally, students write one question they still have about the lesson.



G. Take Action:

Allowing time for students to take action is an essential part of the learning process on climate change, as it empowers students and eases their eco anxiety.

Ideas for Taking Action:

- Plant trees
- Habitat restoration
- Collect data as citizen scientist
- Support policies that improve environmental conservation and climate
- Join student council, municipal youth committee, or youth advisory board of a non-governmental organization
- Innovate sustainable solutions for school or community questions and problems
- Share your learning within your school and share your learning outside the class

Action Project Examples

- Ecological Park- Masseur Elementary School - Regina, SK (2013)
 - Students created an endangered ecosystem and species ecological park on the school grounds. [See their project here.](#)
- CBS Ocean Monitoring - Holy Spirit School - Conception Bay, NL (2015)
 - Students collaborated with fishers, scientists and fellow citizen scientists to develop a better understanding of Conception Bay. Goals included: familiarizing students with the conditions of the ocean and ultimately creating a database to track changes caused by climate change. [See their project here.](#)
- Earth Day: Sustainable Hands-On Workshops - Miles Macdonell Collegiate - Winnipeg, MB (2019)
 - Students took on two different initiatives. First they wanted to tackle waste from single-use plastics. Using creative thinking skills and entrepreneurship, the class held a workshop teaching staff and students to make their own reusable and compostable beeswax and cotton food wrap to replace plastic bags and plastic food wrap. To further promote their initiatives, the students planned and implemented an Earth Week sustainability campaign, where students who were observed participating in sustainable behaviours were entered into draws to win eco-friendly prizes like reusable water bottles or the handmade food wrap. They report that “students and staff have reported eye-opening transformations on their consumption of single-use plastics.” For Earth Day, students organized presentations and workshop sessions from several keynotes and facilitators about topics ranging from Climate Change, Environmental Justice, Indigenous Art and so forth. [See their project here.](#)

- Carden Water Quality Monitoring - Patrick Fogarty Catholic Secondary School - Orillia, ON (2015)
 - Students partnered with a local conservation authority to assess their local watershed, which they found to be at risk. They learned to perform numerous water quality tests and conducted an observational survey of the creek to determine its health, designed and carried out a survey of local residents to explore possible causes and awareness of the issue, and interviewed members of the Ministries of Natural Resources & Forestry and of the Environment & Climate Change. They then took their findings to the Orillia Environmental Advisory Committee (EAC), making a deputation on the results of their research and their recommendations for action. The EAC formed a working group a few weeks later to conclusively determine the cause of the issue and investigate and implement solutions. [See their project here.](#)
- Solar Greenhouse - Ecole McTavish - Fort McMurray, AB (2016)
 - Students at Ecole McTavish created a solar greenhouse for their school. Through this process, they educated themselves on alternative energy, methods of planting and growing inside a greenhouse, and educated their community about farm to table production as it contributes to an eco-friendly lifestyle. [See their project here](#)

5. Human Health: Addressing climate change makes us healthier

This inquiry explores sensitive material. It explores the connection between climate change and many facets of human health. We have included resources, activities, and knowledge to inform students of the serious and widespread effects that climate impacts have on physical and mental health across Canada. This inquiry also invites students to reflect and consider their own health in the face of these serious climate changes. We explore how many of the actions to reduce greenhouse gas emissions also have the co-benefit of improving our health.

Through open-ended discussion probes, thoughtful provocations, and several hands-on activities, this inquiry provides multiple directions for educators to take as human health and climate change are explored side by side.



Photo by asonwoodhead23

Before you Begin: Background Information for Educators

In order to help you have conversations with your students about how they are feeling about the existential threats of climate change, we recommend several additional resources to consult. Before feeling ready to create a safe space where students can explore issues of climate

change, you should feel supported and informed with the help of expert voices on the subject. Here is a list of both theory and practices from some of the leading voices in this field:

Theory

- Jennifer Atkinson - (Climate grief podcast) - [Facing It](#)
- Sophy Banks, Transition Town: [What is 'Inner Transition'](#)
- Dr. Avivit Cherrington - [Global Education \(Episode 17\): How Children Experience Hope](#)
- Leslie Davenport - Emotional Resiliency in the Era of Climate Change
- Bob Doppelt - Transformational Resilience
- Katie Hayes - [5 Ways Communities are Coping with Climate Anxiety](#)
- Rob Hopkins with Lise Van Susteren - [Pre-Traumatic Stress Disorder & The Imagination](#)
- Renee Lertzman - (TedTalk) [How to turn climate anxiety into action.](#)
- Panu Pikhala - [Climate Anxiety](#)
- Sarah Jaquette Ray - [Teaching Climate Change.](#)
- Espen Stoknes - [How to transform apocalypse fatigue into action on global warming.](#)

Practices

- Jennifer Atkinson - [Emotional Impact of Climate Change](#)
- Climate Therapy Alliance - [Emotional Resilience Toolkit for Climate Work](#)
- Leslie Davenport - [Climate Psychologist on using guided imagery](#)
- New Zealand Ministry of Education (2020). [Climate Change Wellbeing Guide](#) (second PDF listed)
- Panu Pikhala - [Spectrum of ecological emotions activity](#)
- David Selby and Fumiyo Kagawa - [Unleashing Blessed Unrest](#) - Climate Change Despair and Empowerment
- Dr. Lise Van Susteren's Resources: Climate for Health

The climate is changing at a rapid rate, and this change continues to have [implications for human health](#) in a profound way. It is important to consider human health as more than simply the absence of disease; human health is a multidimensional framework that encompasses mental, physical and emotional well-being as equal contributors. [Climate change has both direct and indirect implications for mental health and psychosocial well-being.](#) Overall, recent studies have found that Canadians are increasingly experiencing mental health conditions and symptoms related to the effects of climate change. As well, in terms of the impacts on physical health, ["climate change can affect human health directly and indirectly through changes in the ranges of disease vectors \(e.g., mosquitoes\), water-borne pathogens, water quality, air quality, and food availability and quality"](#) (IPCC, 2001). In order to properly address the urgency of climate change in Canadian classrooms within a health and well-being framework, it is important to understand the impact of climate change on all facets of human health.

Educating students about the health-related effects of climate change is critical due to the close link between comprehending and acting on climate change. [Psychological Research and Climate Change](#) showed that people are better able and more motivated to act on climate change solutions when they can relate information and solutions to their own health and well-being or local environment.

There are many additional factors that can affect an individual's or region's susceptibility to the negative physical effects of climate change including: geographic location, the presence of pre-existing illness or disability, and inequalities (socioeconomic, demographic, education level, economic status and age).

Physical Health

The Public Health Agency of Canada has classified physical health risks as a result of climate change into five categories: temperature-related morbidity and mortality, weather-related natural hazards, air quality, water- and food-borne contamination, and health effects of exposure to ultraviolet rays. Some health effects can be directly linked to concrete climate events like natural disasters (droughts, floods, storms), but other changes are more gradual. ([Health Canada](#))

Temperature-related morbidity and mortality: periods of higher than normal heat and the numbers of days per year above 35 degrees Celsius are multiplying and, on this trajectory, will continue to do so throughout the next century, causing:

- respiratory and cardiovascular illnesses
- increased occupational health risks

Weather-related natural hazards: climate change is increasing both the severity and frequency of natural hazards throughout Canada which can cause:

- damaged public health infrastructure
- injuries and illnesses
- social and mental stress
- increased occupational health hazards
- population displacement

Air quality issues: cars, planes and industrial facilities are causing air pollution and it is being intensified by warmer temperatures, causing:

- increased exposure to outdoor and indoor air pollutants and allergens
- respiratory diseases
- cancer, heart attacks, strokes
- other cardiovascular diseases.

Water-borne contamination and food safety: climate change causes increased precipitation, storm surges, and water temperatures [which can contribute to flooding and runoff](#) that can

spread sewage, chemicals, diseases, bacteria, and toxic algae. Climate change can also [put food safety at risk](#) due to changing environmental and social conditions that increase the likelihood of contamination.

Health effects due to exposure of ultraviolet rays: Increased UV exposure poses a high risk and has the potential to cause:

- skin damage and increased risk of skin cancer
- cataracts
- disturbed immune function

Mental Health

Mental health is influenced in many ways by climate change, both directly and indirectly, and it can have both acute and chronic impacts on human health. Chronic mental health impacts can be less obvious than in physical illness, but no less important. Individuals may experience fear and feelings of helplessness that can manifest into [serious mental health conditions](#) such as post-traumatic stress disorder, anxiety, depression, grief, substance abuse disorders, and others.

Acute mental health consequences often occur as a reaction to a natural disaster which has caused damage to infrastructure, food systems, medical services, transportation, home and belongings, or loved ones. Natural disasters can cause or exacerbate stress, and the psychological effects can be profound and long-lasting.

Chronic mental health consequences can occur as a result of gradual climate changes. Feelings of powerlessness, despair, and constant worry about the future of the planet, one's own health, and that of future generations have been termed "[eco-anxiety](#)."

According to [Mental Health and Our Changing Climate](#), both acute and chronic mental health effects can include:

- Anxiety
- Depression
- Post-traumatic stress disorder
- Compounded stress
- Loss of personal and occupational identity
- Feelings of fatalism and helplessness
- Trauma and shock

Click [here](#) for an in-depth look at the specific impacts of climate change on mental health.

It is crucial to be informed about and cognizant of students' mental health when addressing climate change in the classroom. There are clear risks associated with catastrophizing the problem and leaving students solutionless. However, when the emphasis is placed on taking

action against climate change, the impacts on mental health can be positive rather than negative. Encouraging students to make lifestyle choices that benefit the environment or taking collective action can curtail some of the negative effects of climate change. According to the [American Psychological Association](#), “climate solutions not only improve the quality of air and food but also enhance our cognitive abilities and strengthen our mental health.”

Learn more about the relationship between Mental Health and Climate Change by reading [Mental Health and Our Changing Climate](#)



A. Provocations: Impacts on Health

To hook student interest, choose one or more of the provocation ideas to initiate student thinking.

1. News Reports

[How climate change can impact your health](#) [CBC]: 6:01 minutes

Changing environmental conditions can change the frequency of illnesses like asthma, allergies, Lyme disease, anxiety, and more. Doctors may not be prepared for these changes.

[Climate Change biggest threat to human health: report](#) [CBC]: 7:05 minutes

A report in the Lancet has found that air pollution from greenhouse gas emissions contributes to the deaths of millions of people worldwide every year. The report posits that fighting climate change may be the most significant thing governments could do to improve people's health.

2. TEDx Talks

[Climate Change is Affecting our Health: Is there a Cure?](#) [TEDx: Johnathon Patz]: 19:07 minutes

Jonathan Patz, MD, MPH, is Professor & Chair in Health and the Environment at the University of Wisconsin-Madison, where he also directs the Global Health Institute. This talk includes recent analyses that show how mitigating global warming provides extensive health opportunities, as well as major savings in healthcare costs.

3. Comics

[Climate Change Comics](#) [Public Health Insider]

CLIMATE CHANGES THE AIR WE BREATHE.

Wildfires are more common with rising temperatures and drought.



The smoke from fires — even from places as far away as China and Siberia — results in more asthma, heart attacks, and other health conditions.

CLIMATE CHANGES THE FOOD WE EAT.

Our local food supply is changing.



Warmer water temperatures reduce the salmon population and also create conditions that make shellfish unsafe to eat.

CLIMATE CHANGES THE LIVEABILITY OF OUR NEIGHBORHOODS.

More frequent and severe storms will increase local floodings and power outages. Floods also expose people to water contaminated with sewage and toxins, and also indoor mold.



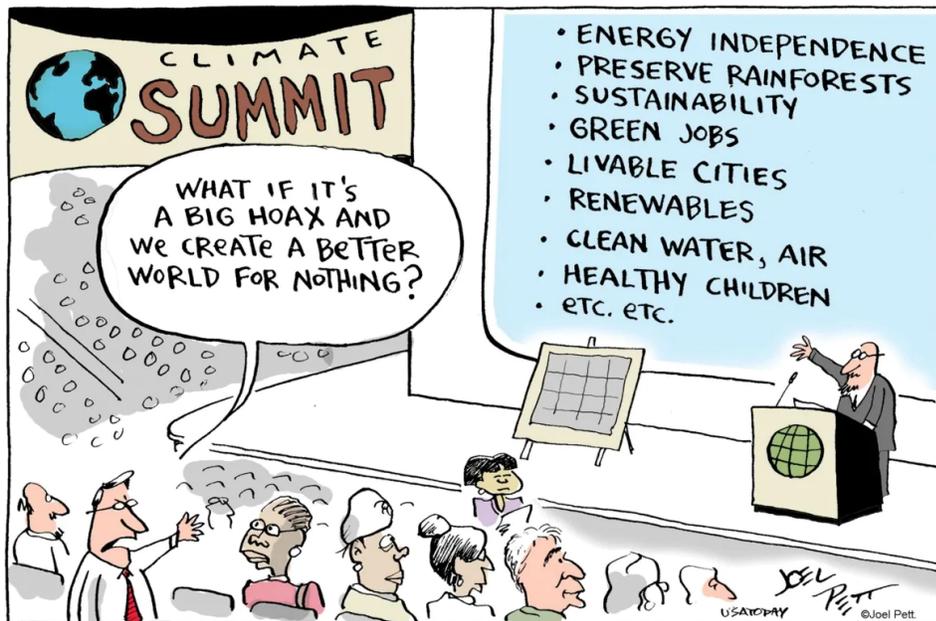
CLIMATE CHANGES HOW WE FEEL.

HOW WE FEEL.



Not surprisingly, wildfires, heavy rainfall, flooding, and windstorms increase stress and anxiety. When the weather feels unpredictable and out of control, people's mental health suffers.

Climate Comic



Encourage these provocations to spark questions, and for students to document these questions in a journal to refer back to.



B. Question Generation

In order to address student anxiety, it is important to find out what is causing this distress. With this knowledge, misconceptions can be unearthed, lack of knowledge understood, and solutions can subsequently be offered. One questioning technique to delve deeper into student understanding is the [Five-Whys](#), an iterative interrogative technique used to explore the cause of a particular issue. As with any discussion of sensitive issues, the feelings of the student should be considered throughout the activity, and questions appropriately chosen. In the Five-Whys activity, a question is asked and students, often in pairs (to create a safer space than in a whole-class discussion), respond to their classmate's answer to the posed question with "why?" or "Why is that?". The number 5 is simply a suggestion, as the questioning ends when the responses no longer give further insights.

Some sample questions to initiate the Five-Whys activity include:

- How does it make you feel when you hear and see climate change denial communication?
- Is there a *right* way to talk about climate change as it pertains to human health and well-being?

- What concrete actions can we—as individuals and as a community—take to alleviate the stress/anxiety climate change causes?



C. Knowledge Building

Knowledge Building Circle

After using a consequence map to flesh out some initial ideas, engaging in a class [Knowledge Building Circle](#) is a good opportunity to delve deeper into the topic of human health and encourage participation from many students in the classroom. Find your way into a circle where everyone can see one another and if this is your first knowledge building circle, make sure that everyone understands their role in the circle. You could pose some guiding questions to the group and mediate the conversation as required. It is a good idea to take notes throughout the discussion or otherwise record the experience to look back at in order to gauge students' growth in understanding.

Example guiding questions:

- How does addressing climate change also help improve our health?
- What climate solutions are also healthy lifestyle choices?

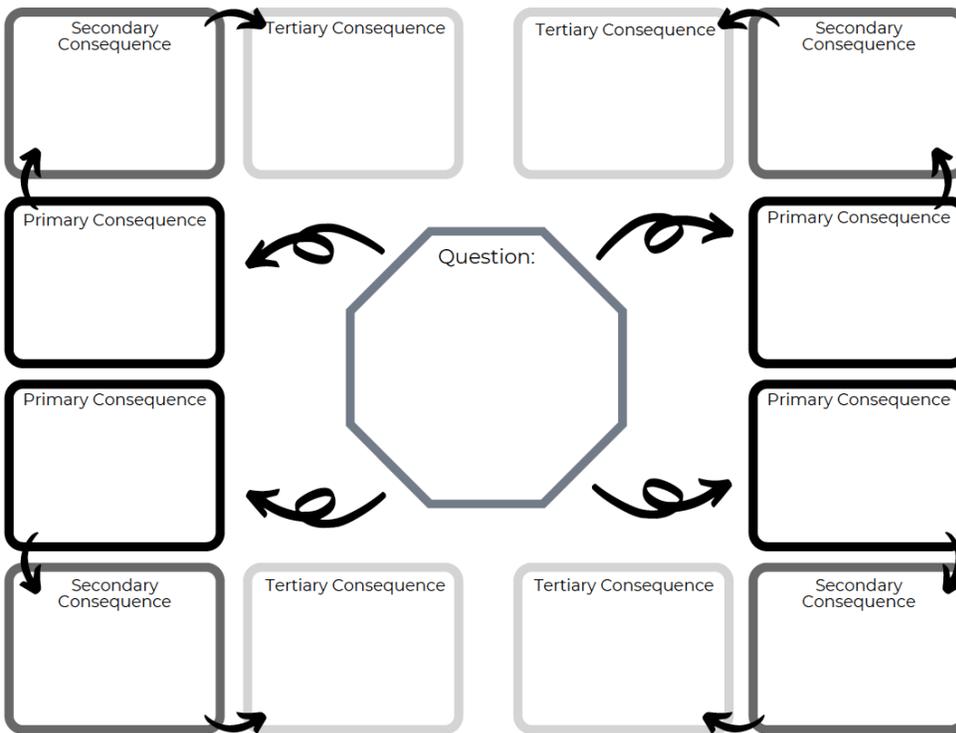


D. Determining Understanding

In order to determine students' understanding of this topic, have students create a consequence map depicting the physical effects of climate change and what the possible implications might be on physical and/or mental health. Students use a template to map several primary (immediate), secondary and tertiary consequences arising from the key question.

As an extension to further allow students to check their own understanding, provide them with different colour markers or sticky notes to add a different layer to the consequence map. Have students suggest mitigation or strategies that could help decrease climate impacts. This layer can help illustrate the co-benefits of addressing climate change and healthier people. For example, active transportation (walking or biking) helps reduce GHG emissions and you get more exercise; shifting to plant-based eating helps reduce GHG emissions and improves many people's diets.

Sample Consequence Map



Adapted from <https://letstalkscience.ca/educational-resources/learning-strategies/consequence-mapping>



E. Pursuing Learning: Impacts on Health

Students may choose to continue their own exploration of health and climate change. If there is interest, the activities listed below offer deliberate, focused opportunities for students to pursue learning about physical- and mental-health-related impacts and responses to climate change.

- Vector-Borne Diseases and Climate Change
- Student Exploration of the Global Impacts of Climate Change on Human Health
- Climate Change & Health: Media investigation
- Despair and Empowerment

Activity 1: Vector-Borne Diseases and Climate Change

In this activity, students learn about vector-borne diseases, in which the disease-causing microbe is transmitted to humans through an animal (e.g. a mosquito) rather than

person-to-person. Students will develop hypotheses about how climate change may affect vectors, the pathogens they carry, and the diseases they spread. They perform an experiment to model the transmission of vector-borne diseases and discuss how climate change may impact the spread of such diseases.

This lesson includes useful background information on vector-borne diseases and the impacts of climate change on rates and transmission of vector-borne disease.

Duration: 60 minutes

You can access the full activity [here](#) or find it in Teacher Aids.

This lesson is from 2010, but it stands the test of time. The modelling activities, discussion questions, and worksheets are extremely valuable. However, if you or your students would like to supplement some of the research with more up-to-date information, here are some resources on this subject from the past few years:

- Global News: [Global warming may facilitate spread of mosquito-borne diseases in Canada: expert](#)
- BC Medical Journal: [Vector Borne Diseases in Canada and BC](#)
- Government of Canada: [Climate change and infectious diseases: The challenges](#)

Activity 2: Student Exploration of the Global Impacts of Climate Change on Human Health

The objective of this activity is to support students' ability to describe the impacts of climate change on human health with a specific emphasis on more vulnerable populations. Through the construction of a visual model, students will delve into the complexities of this relationship and form a deeper understanding.

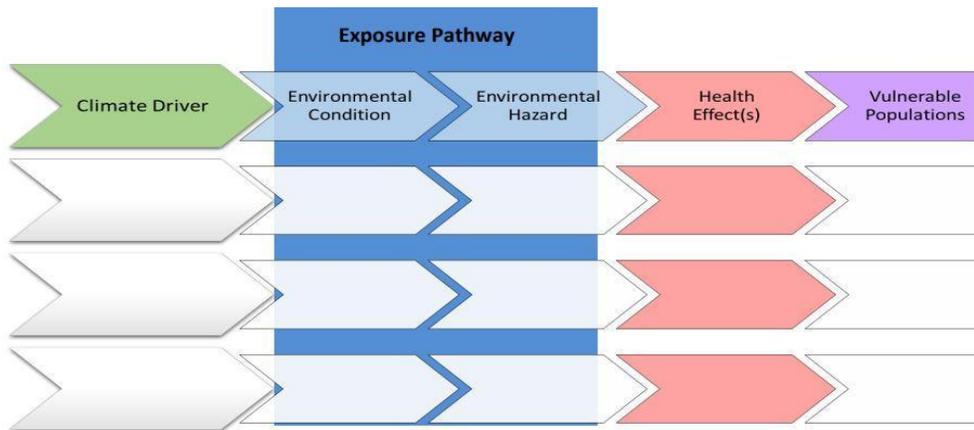
This resource provides detailed background information, setting the stage for students and educators to understand and explore the complex relationship between climate change and human health. The outline also provides educators with options for assessment strategies. Below you will find a simplified version of the concept that we have summarized. You can access the full resource, developed by the National Institute of Environmental Health Science [here](#).

This activity invites students to develop their research and literacy skills by investigating different information sources and synthesizing their research into a graphic organizer to present their findings.

Students will work in groups of 3-4. Each group will focus on a specific area of human health & climate change to research. For instance, if using the IPCC report, a group could focus on Chapter 11. Groups could focus on one of the following areas: 1) Temperature-, storm- and radiation-related impacts (sections 4.1-4.3), vector-borne and other infectious diseases (section 5.1), food- and water-borne diseases (section 5.2), air quality (section 5.3), nutrition and occupational health (6.1-6.2), or mental health and violence/conflict (6.3-6.4).

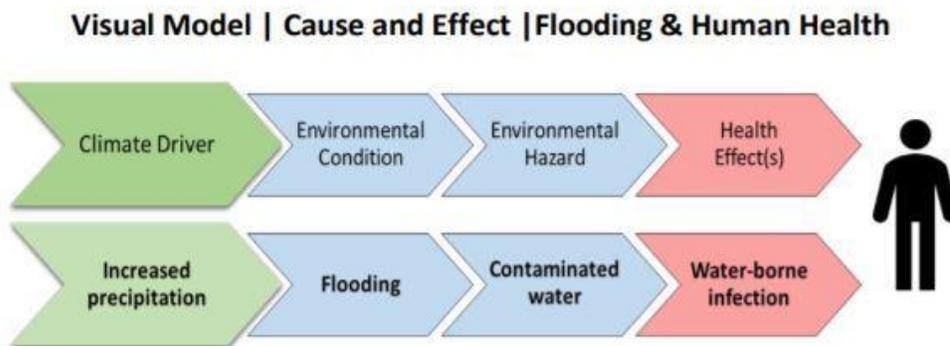
Using this table as a reference point, define key terms like: climate driver, environmental condition, environmental hazard, and health effects.

Use this information to construct a visual model of the “cause-effect mechanism” using the following template:



Encourage students to continue their research and fill out the remaining sections of the cause and effect chart.

For instance:



You can find the online resource [here](#) or downloaded in Teacher Aids.

Activity 3: Climate Change & Health: Media investigation

Phase 1: Ask students to research 3 recent climate change news stories from a major media outlet. Have them read each article and take note of the language used, how the issue is framed, and the image(s) used. Once finished, ask students to engage in a discussion about their perception of how the news and media portrays climate change events. Was the language positively or negatively framed? Are there certain reporting styles that are consistent across articles? If so, what are they? Ask students to reflect on how they felt after reading the articles.

Note: Often news outlets catastrophize events and make readers feel immediately crisis ridden. The purpose of this exercise is to evaluate some of the angles and tactics that exist in the media to grab our attention and create headlines. The following newsletter is compiled of action-oriented solutionary messaging that will leave students feeling more empowered and give perspective to the media stories.

Phase 2. In this next media analysis, students will read through 3 recent articles from CBC’s e-newsletter “What on Earth?” This weekly newsletter is a compilation of all the environmental news stories that highlight trends and solutions of the week (sign up for the newsletter [here](#)). Have students compare the reporting styles of these 3 articles. Ask them to compare the rhetorical reporting style between the CBC e-newsletter and the original analysis from mainstream news articles. (Venn diagrams are a good choice of graphic organizer for this type of compare and contrast activity.) Ask students to then reflect on how they felt after reading the articles on the environmental good news.

Media curriculum connection: This activity could be expanded to a comprehensive review of climate change communication in mainstream media and how reporting affects viewers/readers.



F. Consolidation

This step is designed to encourage students to integrate and synthesize key ideas. When students make connections and see relationships within and across lessons, this helps them to solidify knowledge and deepen understanding.

Activity: Despair & Empowerment

Developed by David Selby and Fumiyo Kagawa for ‘Teaching Teens about Climate Change.’

The purpose of this activity is to encourage students to share their anxieties about a future impacted by climate change. This exercise will help them to learn that others share the same fears, to feel empowered in the face of these fears, and to foster a disposition that prepares them to act.

This will take students on a journey of powerful emotions, ending in student consideration of their “personal change agency potential, by recalling the power students have been able to find in seemingly disempowering circumstances”.

You can find the full lesson [here](#).

Activity: Mental Health Check Activity: Coming Home to Yourself, A Centering Practice

Climate Therapy Alliance - Pacific Northwest. [Emotional Resilience Toolkit for](#)

Take time to support and guide students through a meditative practice. Read the following passage slowly, and pause after each paragraph.

“Close your eyes, or let them have a soft focus, and take three clearing breaths. As you breathe in, infuse your body, heart, and mind with fresh oxygen, feeling and imagining it traveling from head to toe. When you exhale, release the focus on thoughts and invite your body to relax. Let your mind follow the movement of the inhalation and exhalation in your body, inviting each clearing breath to be slow, full, and long.

Let your breath settle into its own rhythm now. Now call into your awareness, one by one, the significant interactions of the day – clients, friends, and strangers. As each one appears, take a moment to honor the interaction and person, and then with a breath of kindness, release them from your focus, sending their energy back to themselves.

When they are all released, turn your awareness toward the direct experience of your own vitality and sense of wellbeing. Sense those qualities in your body. You may recognize your vitality as an image, a color or light, or a physical sensation. However you experience it, take the next few minutes to practice nourishing breaths.

When you breathe in, feel and imagine the oxygen from your breath strengthening your vitality. If you imagine it as a light, it may gradually shine brighter. If it is a color, it may shift and change. Simply breathe in, receiving nourishment; breathe out, simply rest. While the images may or may not change, the practice is simply to breathe in, receiving nourishment; breathe out, simply rest.

After five minutes, notice any changes, however subtle, in your body, mind, and emotions. Feel yourself present and grounded in your body, and when you are ready, open your eyes. Take the next few minutes to move a little more slowly than you usually do, (as you continue into your day or evening... or... as you open your eyes and bring your focus back to the group.)”

Assessment Idea

Teachers will assess learning at different points throughout the inquiry using multiple methods. The following assessment provides an alternative evaluation method to standard quizzes and tests, that can be used after consolidation or at any point in the lesson to check for understanding.

< Choice Board Strategy

The [Choice Board strategy](#) incorporates the principles of Universal Design Learning (UDL) by encouraging multiple means of expression. Students chose a mode from the

choice board (see sample below) to present their understanding of their learning.

Sample Choice Board

Poster Presentation	Act It Out	Rant
Draw a Comic	FREE CHOICE	PowerPoint
Write a Rap	Sing a Song	Use Recycled Materials to Make a Model



G. Take Action:

There are endless possibilities for Action Projects that would enable students to enact positive change or action in their local communities when it comes to addressing the physical and mental health effects of climate change. These are just a few examples to provide a starting point or inspiration:

Ideas for Taking Action :

- Talk to friends and family about your feelings. This may help you feel better and it may also help others identify that they feel the same way.
- Get involved: work with others or start your own climate campaign or project
- Start with changing just one thing: walk or bike to school, start a garden, reduce your waste, offer to walk younger children to school safely
- Address eco-anxiety in the student population and community through awareness-raising campaigns, safe spaces and discussion groups
- Raise awareness about the local threat of infectious or other kinds of risky diseases and how to protect yourself or community

- Encourage school leaders to create policies, make space and provide resources to support the many mental health challenges students are experiencing in a warming world

Action Project Examples

- Feeding Our Community - Ruth Betts Community School - Flin Flon, MB (2019)
 - Students at RBCS built a community garden to increase the availability of affordable fresh produce. Students acquired the knowledge to build, grow, and harvest their own fresh fruit and vegetables and how to utilize them in daily meals and snacks. The garden contains a plant medicine wheel, ceremonial plants, and a three sisters garden, incorporating traditional knowledge. [See their project here.](#)
- Positive Space Room - Duke of Connaught PS - Toronto, ON (2014)
 - Grade 8 students at Duke of Connaught Public School wanted to promote mental health and “to create a space in our school that is reflective of the diversity that comprises it.” To this end, they worked together to design the Positive Space Room, a space for students of all identities to feel supported, accepted, and safe. The class studied and discussed the experiences of many minority and at-risk groups to help inform the design of the room. They made conscious decorating choices, incorporating flags of the world and LGBTQ+ flags and engaging the rest of the student body in positive art projects. They stocked the room with resources for students in need. The group hopes to expand the role of the space by facilitating activities, talk time, and free time for their fellow students to explore issues of identity and mental health. [See their project here.](#)
- VegFest - E.L. Crossley Secondary School, Pelham, ON (2016)
 - E.A.R.T.H. club members at E.L. Crossley hoped to inform their fellow students about the positive impacts a plant-based diet can have on the future of our planet. Students organized a week of veggie-friendly events with the support of various local community partners. The week’s events included a vegan cooking class with a local natural chef, a screening of the documentary Cowspiracy, a smoothie day, vegan salad bar extravaganza, cafeteria games, and a vendor day. VegFest received an overwhelmingly positive response and high levels of student participation each day. [See their project here.](#)
- Psychological Benefits of Interacting with Nature - Westview Centennial Secondary School, Toronto, ON (2018)
 - Students from Westview Centennial school were really interested in the impact of nature on people’s psychological well-being. Student leaders educated their classmates on the positive effects that caring for plants and being in nature can have on stress and anxiety. To create this positive impact on their community, student leaders purchased planting material and engaged their peers in transplanting and beautifying their school grounds. Now, Westview has a space

where students can connect with nature in a meaningful way. [See their project here](#)

6. A Low Carbon Future: Economic Transitions, Risks and Impacts

This inquiry explores the connection between the economy and the environment. This relationship may be somewhat less intuitive for students than some of the other dimensions (environmental, social, and health). However, through research opportunities, case studies, current events and news, discussion and debate, students will come to grasp economic risks and opportunities for businesses to be leaders in addressing climate change, both locally and globally. Students will explore how personal consumption contributes to climate change, and what personal changes as well as changes in consumer culture must be made in order to mitigate climate effects.



Photo by James Anderson, World Research Institute

Before you Begin: Background Information for Educators

Economic activity and environmental changes are closely intertwined. Looking ahead, there are many ways in which Canadian citizens may pay a price for the effects of climate change. A recent report released by the Bank of Canada in May 2019 acknowledged that Climate Change poses a threat to Canada's economy and financial system. As one very clear example, the Canadian economy is heavily reliant on natural resources, comprising almost 50% of exports ([Natural Resources Canada, 2019](#)) and so the future of Canada's export economy is heavily defined by the natural environment. Canada's economy and job market will look very different

due to the changing climate and national efforts to mitigate it. Many jobs that are central to our economy now may be obsolete in 10 years, and new jobs and careers are emerging by the day. Therefore, it is important for educators to consider how best to prepare students to work and live in a world that has felt the effects of climate change and shifted in many ways because of it.

Regional Variation in Economic Impact: A recurring theme throughout this guide is the variation that exists across such a diverse country like Canada, and the same can be said for prediction of economic impact. Some of the differences that may emerge across the country are: large cities will feel the effects of poor air quality and rising temperatures more heavily due to the large population, leading to an increasing health care costs treating associated illnesses (Paying the Price, Economic Impacts of Climate Change for Canada); the timber supply in Western Canada will be impacted significantly by issues such as pests and forest fires, costing the Canadian economy upwards of \$2 billion dollars per year; and coastal regions will feel the impact most heavily in terms of rebuilding infrastructure to adapt to erosion, flooding and rising sea levels. Mitigating threats to these coastal communities will cost the country a huge amount in capital investment to prevent large scale damage. For instance, the estimated cost of setting up protective measures along the Vancouver coast is \$9.5 million (Global News). Alternatively, looking at projected losses for two distinct locations in Canada, according to the Insurance Bureau of Canada in 2015, Halifax's projected losses due to ice storms and extreme wind events is \$18 million by the year 2040, whereas Mississauga projects an annual loss of \$9 million because of ice storms.

Insurance: Infrastructure damage due to extreme weather events could contribute to an increase in insurance premiums. Over the past five years, insurance premiums have risen 20-25%, in large part due to flooding and water levels rising, according to the head of Intact Centre on Climate Change Adaptation at the University of Waterloo . According to Peter Janson a principal lecturer at the London School of Business and Finance and a specialist in sustainable business development, "The insurance industry is expected to be most affected, as they have to pay for the damage occurring in other sectors."

Food costs: In Canada, extreme weather events and unexpected weather changes are driving food costs higher. According to [Simon Somogyi, a lead researcher from the University of Guelph](#), "Canadian farmers will face challenges in the future dealing with unpredictable crop yields, heat-wave livestock threats, pasture availability, and pest and disease outbreaks". For instance, e-coli outbreaks in Romaine lettuce are likely connected to a warming climate. Many of these extreme weather events can be attributed directly to climate change.

Consumption: The earth's resources are being used and consumed at a faster rate than possible to replenish. In large part, this has to do with overconsumption but also the linear nature of our economy. A linear economy exists when the raw materials that were used to make a product are thrown out at the end of its use, and thus become waste. On the other hand, a circular economy recycles and re-introduces used materials back into production, and materials/services are produced with sustainability, longevity, and reparability in mind.

In Canada, goods and services are consumed without considering the environmental impact. For instance, according to a recent report by [Second Harvest](#), 58% of all food produced in Canada is thrown away. Additionally, according to [Elisa Tonda](#) (Head of the Consumption and Production Unit at the UN Environment Programme) fast fashion and irresponsible purchasing of clothing are a large contributor to the climate crisis; apparel and footwear industries account for more than 8% of global climate impacts.

The Future of Careers in Climate Change: The Green Economy & Climate Opportunities

The environmental impacts of climate change have a [direct effect on the working world](#). Many jobs that rely on ecosystem services, and therefore also on sustainable environmental management (e.g. farming, fishing, forestry, air and water purification, soil fertilization etc.) are immediately threatened by climate change as it deteriorates these natural ecosystems and processes. As well, the rising temperatures are increasing the risks and hazards associated with labour-intensive work. These risks being felt in many sectors of work can be contrasted with a progressive shift to a green economy in many other sectors around the world. Green industries have grown exponentially over the past decades, and according to an InfoDev report in 2014, green industries have evolved from “a niche 1970s environmental aspiration into a competitive force motivating many of the world’s most progressive business planners and boardroom strategists”.

According to National Geographic, the [top eleven growing green jobs](#) include: urban growers, water quality technicians, clean car engineers, recyclers, natural scientists (measuring and monitoring our impacts on the world around us), green builders (including those using ecologically friendly materials), solar cell technicians, green design professionals, wave energy production workers, wind energy workers, and biofuel jobs (increasing, constructing, and producing renewable fuel). In many ways, it is productive and beneficial for students to conceptualize economic changes in the context of the many emerging careers and climate opportunities that accompany these changes. Throughout the upcoming years, there will be an increasing demand for skilled professionals in not only the green jobs mentioned by National Geographic, but also in sectors like urban planning, health care, architecture and information technology just to name a few. By educating and informing students on the subject of green careers, green energy and the green economy, possibly sparking interest in these fields students will enter the workforce more prepared and more capable of being successful in an economy and workforce that will likely look very different from how it does now.

Climate change is a current reality, but the future remains to be determined by the actions that we take now to stop the impacts from intensifying. The current economic impacts exist and are a part of a much larger interconnected story involving the environment, health, cultural dimensions, infrastructure etc. There is an inevitable level of uncertainty that accompanies any climate forecasting; however, there are concrete adaptation measures that can help prevent job losses and negative effects on workers and income. Governments and citizens can contribute to economic protection measures against climate change by investing in infrastructure, the

conservation of treatment water, reforestation, moving to a new energy future (renewables) and skills development to help displaced workers transition to relevant, growing professions.



A. Provocations: Low Carbon Economic Impacts

To hook student interest, choose one or more of the provocation ideas to initiate student thinking.

Idea 1) Videos

[Climate change impact on business](#) [Blair Feltmate on Bloomberg]: 4:07 minutes
Feltmate (Head of the Intact Centre on Climate Adaptation at the University of Waterloo) talks about the possibilities for businesses to adapt planning to take extreme weather and climate change into consideration.

[Is Fighting Climate Change Bad for the Economy](#) [The Year's Project]: 1:44 minutes
Hal Harvey argues that fighting climate change is not bad for the economy.

[Interview with IKEA CEO on being a company that is 'carbon positive'](#) [CNBC]: 3:21 minutes
Ikea's CEO: Jesper Brodin discusses climate change as their largest concern, and speaks to the company's growth in Asia

[Moving to a low-carbon economy](#) [Bank of Canada] 0:47 seconds
This video provides a short explanation on how policies that increase the price of pollution and how changes in consumer habits will impact our economy.

[Why are banks thinking about climate change](#) [Bank of Canada]: 0:52 seconds
Economists considering how climate change will impact the economy in general

[Business case for a sustainable world](#) [Bob Willard] 10:49 minutes
Bob Willard discusses "the big three" justifications for a sustainable global society: do the right thing, capture opportunities, and mitigate risk.

Idea 2) Articles

[Investing in climate change adaptation will pay off big - report says](#) [CBC Article]

[America's 'Green Economy' Is Now Worth \\$1.3 Trillion](#) [Bloomberg News]



B. Question Generation

Below are some guiding questions with a few references to help frame inquiry questions into economic transitions, the economic risk of not transitioning to a low carbon future, and the economic costs of climate impacts. If students are interested in drafting their own questions, then [affinity mapping](#) or [QFT technique](#) or other question-generating methods will work here too

Guiding questions:

1) What are the costs of climate change-induced natural disasters? What is the costliest climate impact for Canadians?

- [Climate Change is making wildfires in Canada bigger, hotter, and more dangerous.](#) *Macleans.*
- [Climate Change and poor planning are fueling more floods. Here's what we can do about it.](#) *CBC.*
- [Climate Change, Floods, and Municipal Risk Sharing in Canada.](#) *Munk School of Global Affairs.*
- Working with data from the Insurance Bureau of Canada, look at the overview graph of Catastrophic losses on pg. 17 and the following tables (pp 18-26) which break down catastrophic losses per year. With this data determine, whether the cost of climate change impacts are increasing and what kind of impacts are the most costly. [Facts of the Property and Casualty Insurance Industry in Insurance.](#) Insurance Bureau of Canada

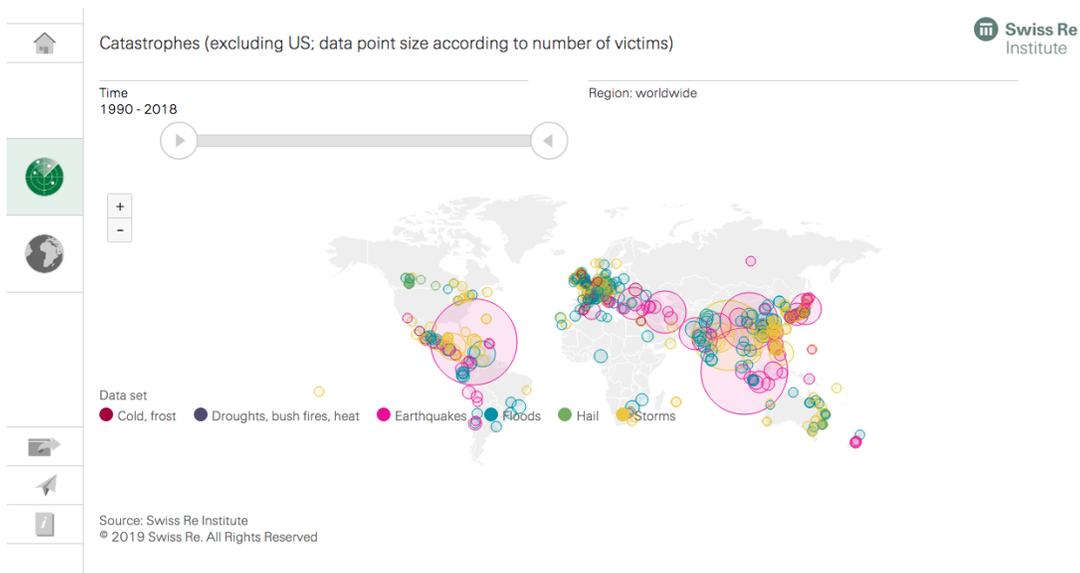
2a) What climate impacts has your community already experienced? What climate impacts should your community be planning for?

- To investigate the climate impacts that your community has already experienced, first begin with students sharing what they know through a [Knowledge Building Circle](#), [think-pair-share](#), or other conversation methods.
- Review local newspaper articles for examples of extreme weather and climate-change-induced natural disasters.

- Then students can explore the historical weather data for your community through the [Climate Atlas of Canada](#). Students can also explore projected climate change impacts according to numerous variables by selecting two different emission pathways for your community on the Climate Atlas. Refer to Activity 1: Climate Atlas Open Exploration in the Monitoring for Change inquiry for instructions on using this tool.

2b) In terms of climate impacts, how much has your community been affected compared to other locations in the world?

- With students, explore the Swiss Re Institute's [Sigma explorer](#) to review where different climate-change-induced natural disaster events have occurred compared to other regions.



After reviewing, consider a discussion around climate justice (can include researching countries per capita emission rates). Refer to Ethical Dimensions inquiry.

3) What types of investments and businesses face the biggest opportunities for growth as economies shift to low carbon? What are the economic benefits of transitioning to a low-carbon economy? What are some risks? What are stranded assets?

- [Climate change poses risk to financial system](#), Bank of Canada
- [The heat is on: Insurability and Resilience in a Changing Climate. Emerging Risk Initiative - position paper](#). CRO Forum. (2019). Retrieved from: See section 1.4 & 1.5: pp. 13 & 14

4) How will different sectors transition or be impacted either positively or negatively by a low carbon economy?

- [Oil & gas](#)
- [Heavy industry](#)
- [Electricity sector](#)
- [Transportation](#)

5) How could your own personal choices or actions related to consumption either contribute positively (mitigate), or contribute negatively (worsen) to the effects of climate change?

- What choices can you make to contribute to a more sustainable future when it comes to food, goods, and services?
 - It is important to consider four aspects of a purchase: production, transport and retailing, usage, and end of life



C. Knowledge Building

- Students can form a [Learning Circle](#) – based on collective interest after exploring several provocations. For instance, groups could choose to focus on a certain industry or geographic region’s economic impacts, mitigation or adaptation strategies, opportunities for green careers, or any other relevant subject that has a collective interest. A good way to begin this process is for each group to agree on a focus question. This stage of inquiry invites the students to actively work to contribute to the collective knowledge of the group, rather than just learning on their own. Small groups of 3-4 students can help ensure that each student has a voice.

Time should be built aside for groups to continue to meet intermittently to build knowledge, refresh understanding with different perspectives, and work together.

- Groups can be formed using different strategies – knowing your students you will know how to make this process work best.
- **Invite a local community expert** to learn more about the future of the green economy and climate change.

Places to look for a local community expert:

- Environmental non-profit
- Faculty of Economics at a local university or college
- Faculty of Environment at a local university or college
- Economist

- Sustainable Enterprise entrepreneurs
- Sustainable Impact Departments at local businesses or companies
- Research Institutions focused on the Green Economy



D. Determining Understanding

De Bono's Plus Minus Interesting (PMI) Tool

A formative assessment is a useful way to get a sense of students' level of understanding of a subject, and then use the information to help shape the learning environment or process. At this point in the inquiry you may decide to use a tool such as 'Plus, Minus, Interesting.'

The **PMI strategy** is a critical thinking tool developed by Edward de Bono that allows teachers to determine student understanding of a concept. Students are instructed to write down the positives, negatives and interesting features of a topic, question or situation. This can be done in groups, individually and reviewed, or as a whole class approach to determine future directions of the learning process. For more information on the PMI strategy, check the strategy bank or check [here](#).



E. Pursuing Learning: Impacts and Green Opportunities

At this stage, students will undertake activities to investigate the following:

- Planning for flooding
- How much does carbon cost?
- Green sector careers
- Sustainability Products, Consumer Responsibility

Activity 1: Planning for Flooding

Flooding is the single most costly climate impact in communities across Canada. Being prepared is a proactive and cost-saving adaptation measure that all Canadians living in flood risk areas can do.

Review the Flood Ready guide to determine if your jurisdiction has flood maps available or information on how to access flood resources:

<https://www.canada.ca/en/campaign/flood-ready/first-steps.html>

Here are some provincial flood maps:

- [Ontario Flood Map](#)
- [New Brunswick Flood Map](#)
- [Alberta Flood Map](#)
- [Google Maps](#) may also help you

Many municipalities and conservation authorities are currently developing flood maps to help prepare communities. Check for the availability of these resources for your community

Consider these guiding questions:

1. Locate your school community on a flood map or use Google Maps. Is your school community in a flood risk area?
2. Are there any rivers or streams, and what course do they take? Would they have an effect on the watershed system?
3. Who or what is in the flood risk areas? Would this affect the economy? Using Google Maps as a comparison, see what is currently in the flood risk area.
4. Examine: Does the flood risk area have any artificial flood controls (e.g. dams, channels, sea walls)
5. Using the [IBC report](#)'s section on Catastrophic Losses (pp. 18-26) what has been the cost of flooding in your province since 2016?
6. What preventative measures can individuals take to flood-proof their homes? [Here](#) is a guide for how to flood-proof a home. In your view is it more cost effective to flood-proof a home or pay for damages after a flood?

Note: With flooding being the number one national economic cost of climate change, as well as a huge risk to the safety and health of many Canadians, a key preventative step is the existence of up-to-date, accurate flood maps. Currently, these do not exist for many areas of Canada. Flood maps provide a “cartographic depiction of an area likely to flood in certain situations.” ([Globe and Mail, 2019](#))

Activity 2: How much does carbon cost?

Through a cap & trade game simulation, students will compare two structural solutions aimed to reduce carbon emissions. Through this activity students will think critically about the benefits and drawbacks of several different types of environmental regulations. Specifically: which type of regulation will reduce carbon dioxide emissions most efficiently?

This resource provides clear instructions for the simulation, guiding discussion questions,

consideration of alternate perspectives, and encourages critical thinking.

You can access the full resource [here](#); refer to Chapter 7: pages 67-80, or **jump straight to the activity** [here](#).

Activity 3: Research Green Sector Careers

This research activity invites students to think practically about the job market in the face of climate change. We live in a time of constantly evolving mitigation and adaptation measures and a rapidly changing economic market. As the green sector economy grows and expands, both green skills and green jobs will continue to be embedded throughout the job market. So, we are asking today's students to consider the question: what do future careers look like in a more efficient, sustainable, and renewable world?

Consider these guiding questions as a starting point:

- Where in the economic market do you predict there are opportunities as the economy transitions?
- What careers will make a positive difference for the future of the environment?
- Are there careers now that are central to our economy but may be obsolete in 10 years in a more renewable, sustainable world?

Here are a few case studies of Canadian companies that are looking forward to a low carbon economy:

- [Carboncure](#)
- [Veriform](#) (carbon-neutral since 2015)
- [Sustane Technologies](#)
- [Carbon Engineering](#)

Activity 4: Sustainability Products, Consumer Responsibility

From: *R4R: [Lesson - Sustainability Products. Consumer Responsibility](#)* (Education World, 2012)

This resource focuses on responsible purchasing and sustainable consumption. The aim is for students to make connections between what they choose to purchase, and the various impacts the product is having on society, the economy and the environment.

Students have a chance to examine the life cycle of several products including: a soccer ball, a DVD, a cell phone and walk through the production, consumption and disposal of each item. The students share their findings in groups and examine these products' impacts on the economy, society and the environment. This lesson is intended to help students think critically about their consumption habits, and acknowledge the wide-reaching effects that consumption has. Specific statistics relevant to place and time may need to be updated by the educator.



F. Consolidation

This step is designed to encourage students to integrate and synthesize key ideas. When students make connections and see relationships within and across lessons, it helps them to solidify knowledge and deepen their understanding.

Student Created Questions

For this consolidation exercise, students will work in pairs. Each person will generate several thought-provoking consolidation questions for their partner. The questions should be based on the learning from this inquiry and could address their own personal gaps in understanding or aim to deepen understanding. Each partner will have an opportunity to write full responses to their questions, and then share their thinking with their partner.



Assessment Idea

Teachers will assess learning at different points throughout the inquiry using multiple methods. The following assessment provides an alternative evaluation method to standard quizzes and tests, that can be used after consolidation or at any point in the lesson to check for understanding.

< One-Minute Paper

The [One-minute paper](#) is a classroom assessment technique that uses a focused question that can be answered within a minute or two. The activity asks students to reflect on their understanding of a concept and provides the teacher with rapid feedback on students' perceptions on key learnings. Questions can probe different dimensions, such as interest, relevance, attitudes, or analysis. Check [here](#) for more information on this strategy.



G. Take Action:

Allowing time for students to take action is an essential part of the learning process on climate change, as it empowers students and eases their eco anxiety.

Ideas for Taking Action:

- Encourage innovation and creative use of technology to explore solutions to climate change challenges
- Research local adaptive measures in place to prepare for natural disasters and severe environmental effects and persuade improvements or expansion
- Educate the local community about the existing and future economic risks of climate change
- Reach out to a business climate leader for an informational interview to learn about what they do and opportunities they see in a low-carbon economy

Action Project Examples

- Mission Roots Cafe - Okanagan Mission Secondary High School – Kelowna, BC (2017)
 - Students came up with an innovative entrepreneurial project to promote sustainability: Mission Roots Cafe. This in-school cafe is run and staffed by a team of 25 volunteers from grades 7-12, and it combines sustainable operations with a social enterprise structure. All proceeds from the cafe are donated to charities selected by the students. The students raised over \$3,400 for their chosen charities in their first year! [See their project here.](#)
- Green Industries - Guelph Collegiate Vocational Institute - Guelph ON (2019)
 - In a multifaceted, large scale project students engaged in gaining hands-on experience for students to learn how to create their own sustainable future, and learn about the value of self-sustaining food systems. This project offered students opportunities to learn fundamental skills for a future, and career in a world with a rapidly changing climate. For instance, recirculating ecosystem education, importance of innovation and learning how to make technological innovations more productive and efficient. [See their project here.](#)
- Solar Energy - Saint Mary's Academy - Edmundston, NB (2019)
 - The high school Eco-Committee at St. Mary's Academy in Edmundston, NB is committed to educating their entire K-12 school about solar energy. They have a long-term goal of converting St. Mary's into a clean-energy school. Students began by educating their peers (and themselves!) about solar energy and the function of solar panels. They visited other schools that had already installed solar panels, interviewed their local power generation company, and toured local solar panel providers. They also partnered with The 3% Project to learn about cost-efficiency and cost-impact analysis to strengthen their case! This year they purchased and installed solar panels in their school greenhouse and designed a self-watering system using a rain barrel and a timer. [See their project here.](#)
- Hip Threads - Evergreen Heights Education Centre - Elmsdale, ON (2015)
 - Students started the Hip Threads used clothing store to tackle overconsumption in their community. They collected donations of used clothing, made their own eco-friendly laundry soap to wash the clothing, then held store hours every week

during lunch. They held a successful fashion show to promote the store and encourage more people to donate their old clothes instead of throwing them out. Clothing was sold by donation and proceeds were donated to charity. [See their project here.](#)

7. Climate action and decolonization: Indigenous perspectives

This inquiry takes a deeper look at how Indigenous peoples have been and are leaders of climate action as well as how climate change is exacerbating existing socio-economic inequities and impacting some cultural practices. The following resources, guiding questions and activities aim to encourage thoughtful consideration on how climate justice is inherently connected to decolonizing processes and truth and reconciliation. We invite students to consider the depth of knowledge that exists in the diversity across Canada and work to ensure that Indigenous ways of life are not at risk in Canada's future.



Photo by: Hert Niks

Before you Begin: Background Information for Educators

The rapid and profound climate changes are putting lands and territories of many Indigenous communities (Metis, Inuit and First Nations) on the front lines of mitigation and adaptation efforts. According to Terry Teegee, regional chief of the BC Assembly of First Nations, Indigenous communities are often the first to experience the impacts of climate change. Indigenous communities have a strong dependence on and close relationship to the environment and its resources. Threats to Indigenous ways of life due to the changing climate

are complex and wide-reaching. Specific experiences vary considerably based on the area or region in which communities are located. One of the general impacts that climate change is having on Indigenous communities in Canada include an increased risk of physical harm associated with traditions or activities including hunting and fishing. Very experienced harvesters are being forced to alter hunting strategies and take into consideration the lack of rescue facilities available ([Canadian Geographic Indigenous Atlas of Canada](#)). Therefore many people are also experiencing a loss of food security in part due to altered animal migration patterns as well as human travel routes impacting people's ability to access [country foods](#). Indigenous people may be experiencing threatened sovereignty and a loss of communities and culturally significant locations due to rising sea levels, flooding, coastal erosion, and melting permafrost.

How does climate change disproportionately affect Indigenous communities?

Indigenous people in Northern communities have historically demonstrated an incredible ability to adapt to varied and changing circumstances. However, as the impacts of climate change intensify, successful adaptation becomes increasingly challenging. When considering climate change and its effect on Canadian citizens, it is imperative to acknowledge the social and cultural inequalities that exist when it comes to contribution, mitigation and adaptation. For instance, according to the [Government of Nunavut](#), despite the small contribution made by a territory like Nunavut to national greenhouse gas emissions, the effects of the global excess are felt heavily by the citizens.

Impacts and path forward in The Arctic - Inuit Peoples

According to the [IPCC \(2019\)](#), the [cryosphere](#) changes in the Canadian Arctic have negatively impacted human health in several key ways. There have been dramatic increases in food and waterborne diseases, malnutrition, injury and serious mental health challenges especially among Indigenous people. Additionally, Indigenous peoples and other Arctic residents have had to change the timing of various activities in response to seasonal changes and safety of travel on ice, land and snow. Some coastal communities have planned for relocation due to failures associated with flooding and thawing permafrost. According to the [IPCC](#), "limited funding, skills, capacity and institutional support to engage meaningfully in planning processes have challenged adaptation." Inuit people have used and occupied Arctic and Subarctic land, ice and water for thousands of years, documenting use and reliance on the land and waters for many generations. It is imperative to recognize the critical role that Inuit people must play in developing adaptation and mitigation strategies to address the many complex challenges that define the Canadian North.

Moving Away from indigenous stereotypes ('passive witnesses,' media portrayal)

First Nations people have been and continue to be leaders in the fight against climate change. Inuit leaders brought warnings about the impacts of climate change to the international stage as far back as the Earth Summit in 1992. There are many groups working towards reconciliation in Canada that recognize the leadership of Indigenous cultures when it comes to sustainability as a central tenet of their relationship with the environment ([Sustainable Canada Dialogues](#)).

Due to the unique context of Indigenous rights and impacts, (governance, economy, infrastructure and activities) many wide-spread solutions that policy makers have put forward do not acknowledge that Indigenous communities are already engaged in important climate change mitigation strategies that are deeply rooted in Indigenous customs and traditional practices (ICA, 2019). In many ways, Indigenous knowledge and practices can be an incredible resource for learning strategies to adapt to climate change. It is important to think critically about the sources from which we gather information on indigenous rights. In too many instances, a biased version of an event is told and shared widely through the media; stereotyping indigenous activists and protestors, misconstruing actions and portraying a radical, negative picture to the general public.

According to the 2018 [Indigenous Climate Action Report](#), the implications of culturally embedded perspectives are significant: National “Environmental” policies often ask relatively narrow questions about how to reduce emissions and mitigate or stall damage, whereas [Indigenous water walkers](#), for example, are asking us, “How do we get to a spiritually grounded and more fully integrated way of life where we can swim, eat and drink from uncontaminated lakes and rivers?” There is a great deal that we can learn from the way that Indigenous peoples have lived harmoniously and sustainably with the land for thousands of years. Indigenous perspectives should be a central voice for policymakers and citizens of Canada to hear as we are adapting and developing sustainable communities of the future.



A. Provocations: Indigenous Perspectives

To hook student interest, choose one or more of the provocation videos to initiate engagement.

[Autumn Peltier, water advocate](#) [Global News]: 2:29 minutes

Water advocate Autumn Peltier discusses her initiative to promote awareness about the sacredness and importance of clean drinking water.

[There's Something in the Water](#) directed by Ellen Page and Ian Daniel. A 2019 documentary examines environmental racism and the effect of environmental damage

on Nova Scotia First Nations and the role of Indigenous women to care for water and fight to preserve this basic right.

[Eriel Deranger - Indigenous Climate Action: Community-based solutions rooted in decolonization](#) [Climate Atlas Canada]: 3:42 minutes

“Real climate solutions are rooted in a return to the land - a return to and of the land - and are rooted in decolonization,” says Eriel Deranger, Executive Director of Indigenous Climate Action (ICA)

[Melina Laboucan-Massimo - Renewables in the heart of the Tar Sands](#) [Climate Atlas Canada]: 4:36 minutes

The Lubicon Cree Nation situated in Northern Alberta are leaders in the low-carbon energy transition. In response to the drastically changing landscape, community member Melina Laboucan-Massimo took charge of the construction of a 20KW energy system which she calls “a beacon of what is possible in our communities.”

[Adapting to Sea Level Rise: Indian Island, NB](#) [Climate Atlas Canada]: 7:58 minutes

Indian Island First Nation Chief Ken Barlow relied on science and traditional knowledge to predict that his nation will be underwater by 2100, the community is now making a big effort to prepare and protect their homes from this inevitable outcome.

[Back the Buffalo: Lethbridge Alberta](#) [Climate Atlas Canada]: 3:36 minutes

Dr. Leroy Little Bear of Kainai First Nation discusses the environmental change he’s witnessed over time and why buffalo restoration in Alberta is critical for restoring ecological balance.

[Meechim Project: Garden Hill First Nation](#) [Climate Atlas Canada]: 10:59 minutes

This video is about the Garden Hill First Nation community, a place that is only accessible by air or ice roads, and their effort to build a self-sustaining farm with the goal of attaining food sovereignty.

[Climate Change in Great Bear Lake:](#) [Produced for the Déline Renewable Resources Council in collaboration with the elders of Déline, NT] 14:47 minutes

This video looks at the ecological impacts from climate change on Great Bear Lake through the eyes of Déline NT Elders and their traditional ecological knowledge.

Change at the Top of the World [Explore Films]: 24:05 minutes

Click on the search icon at the top within the [site](#) and type in the title and then select ‘Films’ under Content Type

This beautifully filmed and produced video describes the changes that global warming is already bringing to Northern Canada and Greenland. Local people describe changes to ecosystems, impacts on culture and lifestyles, and the challenges of melting permafrost. Ship captains describe changes in navigational channels and fjords. Scientists describe

changes in albedo and permafrost, as well as increased pollution transported from outside the Arctic (the Grasshopper effect).



B. Question Generation

Critical Thinking Questions - created by Global Encounters,
adapted from [Let's Talk Science - Indigenous Perspectives on Climate Change](#).

1. *What are some steps that you can take to decarbonize and decolonize? What is meant by decolonization?*
2. *Are there measures being taken by governments or other groups that are creating a deeper impact of climate change on Indigenous populations? (i.e. Modern Colonialism: the policy or practice of acquiring full or partial political control over another country, occupying it with settlers, and exploiting it economically)?*
3. *Compare and contrast the impact of climate change on your physical region and Indigenous groups to that of international Indigenous groups. For example, a student in BC may talk about the impact of a warming climate and the decline of salmon available for fishing.*
4. *Identify ways that the media portrays indigenous rights. Find recent examples in the media to support your answer. Is the portrayal or description accurate?*
5. *How can you become a climate change hero? Share a brief outline for an action plan you could take to become a climate change hero. To help create a plan, consider the following questions:*
 - a. *What can I do to reduce my carbon footprint?*
 - b. *What are the effects of global climate change on today's world?*
 - c. *Why is it important to preserve the First Nation area, treaty area, provincial crown land and/or Federal Crown land?*
 - d. *How do we assist Indigenous groups to preserve their land?*

See the full resource to view these questions in context [here](#).

Note: These questions would also be a rich starting point for a dialogue in the classroom as the students pursue and consolidate their learning - either by assigning students various positions to stretch their thinking or allowing their own responses to guide the dialogue.



C. Knowledge Building

Use one or more of the following suggestions to help students build knowledge on Indigenous perspectives on climate change.

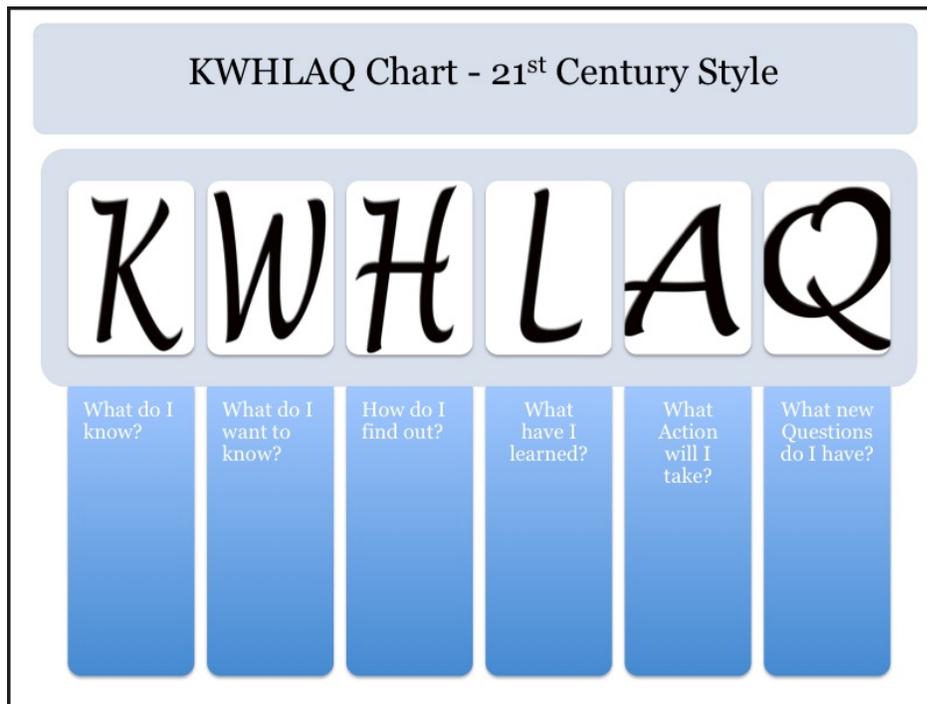
- **Invite local traditional knowledge keepers into your classroom** as a guest teacher or resource person. Identify sources of traditional knowledge keepers from local First Nations, Indigenous organizations in towns and cities, government sources.
- **Plan a field trip** for students to learn about Indigenous traditions and cultural values, explore similar or diverse experiences of climate change, and ensure students foster cultural sensitivity and respect.
- Students should have access to **quality Indigenous resources** (books, websites, oral stories and classroom activities).
 - Refer to the “additional resources” page of this Inquiry for some examples
 - Search on [R4R.ca](https://www.r4r.ca) and filter your search by: subject, grade, and theme: “Indigenous Knowledge”
 - Another starting point for quality Indigenous teaching resources is [The Deepening Knowledge Project](#).



D. Determining Understanding

In order to determine where students are in their learning process, create a [KWHLAQ Chart](#), which is an extended version of the [KWL Chart](#), for students to think critically about where they currently are in their learning journey and where they want to go. The class should return to this chart after completing some of the activities listed below, to evaluate what they have learned and decide on next steps.

Sample of a KWHLAQ chart



Source: [Flickr](#). Used with permission of Silvia Rosenthal Tolisano (@Langwitches) Creative Commons license, CC-BY-NC-SA-2.0



E. Pursuing Learning: Indigenous Perspectives

It is important to encourage students to reflect on their learning as they investigate impacts of climate change through diverse perspectives. Ultimately, we want to consider how to integrate different points of view when considering solutions to the problem.

Note: In order to authentically integrate traditional Indigenous perspectives into the classroom, activities like a talking circle should become a part of your teaching practice and the origin and importance to Indigenous people should be explored. You should become familiar with circle protocols or courtesies for instance: no hierarchy, talking sticks, speaking in turn, no cross talk and respect for the speaker. Additionally, [medicine wheels](#) could be introduced as graphic organizers.

[Sila Alangotok - Inuit Observations on Climate Change](#)

Retrieved from: [The Deepening Knowledge Project](#) at The Ontario Institute for Studies in Education.

This video explores the impacts of climate change on Banks island through an Inuvialuit perspective. The residents of Sachs Harbour have seen significant changes to their homes and have had to alter their way of life. For instance, foreign species of birds, insects and fish have invaded the land, ice is becoming dangerously thin, permafrost is melting which is moving the very foundations of this community, among many other changes.

The [Teacher's Guide](#) for the Video Sila Alangotok—Inuit Observations on Climate Change provides an extensive compilation of activities designed to extend learning, pose critical questions and support students in making connections after watching this video. There are nine separate activities included in the guide, each one able to stand alone. For the purpose of the current guide, we will highlight two excellent activities.

Note: If students gravitate to an alternate video or story, from the provocations or otherwise, the framework for the following activities could be adapted to suit alternative resources.

Activity 1: Placemat and Debate

Part A. Placemat

This activity will encourage students to make connections between key ideas and bigger themes explored in the video, guided by the question: “*Based on your knowledge of the factors that contribute to climate, how do you think climate change will affect northern Canada?*” Students are divided into groups to complete a placemat collectively. For more information on this strategy, click [here](#).

Placemat Activity

Socially?	Economically?
How do you think climate change will affect Northern Canada?	
Environmentally?	Other?

Part B. [U-Shaped Debate](#)

After the placemats have consolidated some of the information in the video, the class will engage in a u-shaped debate to explore the statement: **The observations of one community member complement and add to the understanding of climate change.**

Students are invited to rebut and respond to one another's arguments, and complete a reflection on the u-shaped debate in any format that seems appropriate to them: letter to action, persuasive essay, a video, a dramatic skit, etc.

Activity 2: The Impact of Climate Change on the Arctic (Adapted)

Part A. [Compare and Contrast](#)

There are many similarities between the observations that the Elders make, and predictions made by Western scientists. Students will use the higher order thinking strategy - Compare and Contrast - to deepen their understanding of these two different points of view. Encourage students to use a graphic organizer or chart of their choice to organize their thoughts.

Part B. Conduct a [Survey](#)

Students will design a survey to compile observations about the effect climate change is having in their own community. It is worthwhile to take a bit of time to review your expectations for survey form and length, and to also explain how to write effective survey questions, including open-ended and closed-ended questions.

Use the survey tools that students have created to find out about the impacts on local Indigenous communities as the community members observe them. Students have spent some time closely examining the effects that climate change is having on the Arctic and Inuit People, but not yet looking close to home. Foster existing connections with local communities or reach out to community members of your class or school that identify as Metis, Inuit or First Nations.

After obtaining the survey results from your local community, ask students to share: What did you learn that you didn't expect?

Additional Resources for Pursuing Learning

We have included a list of high-quality resources for students and educators to explore (see text box below). These could be provided to students to extend learning or search for answers to any remaining questions.

Resources for Additional Research

Cultural Survival Article: [Traditional Indigenous Knowledge on Climate Change](#)

[Indigenous Peoples Atlas of Canada](#)

Government of Canada: [Indigenous and Northern Affairs Canada](#)

Canadian Geographic Article: [It's time to listen to the Inuit on climate change](#)

Connected North Article: [Why is Land Important? Indigenous Perspectives on Climate Change](#)

Nunavut Climate Change Center: [Climate Change Impacts](#)

Truth and Reconciliation Commission: [Calls to Action](#)



F. Consolidation

1. One way for students to consolidate some of their learning would be to return to the initial questions provided at the beginning of this inquiry. These questions could initiate a small group discussion, written reflections, or a whole-class discussion and would be a good way for students to reflect on their learning process and synthesize some of the knowledge and skills that have been gathered throughout the inquiry.

This could occur through simply writing down notes or [doodling/sketching](#) a creative visual that depicts the key information that students have learned throughout this inquiry.

2. Rapid Feelings Check in:

This activity involves a brief check in, asking students to think about their emotions and perspectives related to climate and the environment. Ask students to get into pairs, each person takes a turn speaking for one minute at a time. Some prompting questions to provide students are:

- How have you been feeling about the climate, activism, the environment and the future?
- How has your thinking shifted throughout this process?
- What realizations have you had during this inquiry?
- Has anything you've learned surprised you? Why?

Assessment Idea



< Summarizing Learning with an [Infographic](#)

Have students create a one-page infographic either individually or with a partner of the most important learning from this inquiry – It can be from the survey data they gathered, or other knowledge gained during this unit. For more information on infographics, click on the [LINK](#).

< [Gallery Walk](#)

To add further engagement, the infographics should be shared with the rest of the class in some format, such as by conducting a gallery walk where the infographics are posted around the classroom and students rotate through them and are asked to write post-it-note comments on their observations or questions about other students' work. For more information on gallery walks, click [here](#).

Note: Students may choose to use any graphic organizer software tools available such as Word, PowerPoint, Canva, Lucidchart, Coggle, Piktochart, Procreate, Mindmup, MindMeister, etc.



G. Take Action:

Allowing time for students to take action is an essential part of the learning process on climate change, as it empowers students and eases their eco anxiety.

Ideas for Taking Action:

- Research and create a video to inform your community about Indigenous peoples' leadership and innovation in climate and sustainability action.
- Research and plant an Indigenous food and medicine garden.

Action Project Examples

- Story of the Salmon - W.D. Ferris - Richmond, BC (2013)
 - Students developed and performed a play called the "Story of the Salmon" to highlight the connection between Richmond, BC, the Musqueam First Nations people and their traditional fishing and hunting territory, and the salmon migration. The students raised Coho salmon in the classroom and released them at the Little Campbell River Fish Hatchery. [See their project here](#)
- Canada's North – A Balancing Act - David Livingstone Elementary School - Vancouver BC (2016/2017)
 - Students wanted to feel a greater connection to their land, while searching for answers to the question: "What could sustainable northern development look like?" They set out to learn the history of our country from different perspectives and learn how Northern communities could thrive in the world that we're living in today. Through an incredible, multi-dimensional field trip, they learned about nature, industry, culture and traditions in the Yukon. [See their project here.](#)
- United First Nation Youth Summit - Riverview High School Summit - Riverview, NB (2019)
 - Fifteen First Nation communities across New Brunswick were invited to participate in the Youth Summit at Riverview school. Each community or school was asked to select 2-5 youth delegates, each selecting one of Education,

Environment, Social Justice or Health & Wellness as a committee to participate in once they arrived. To prepare for participation in their respective committee discussions, delegates were asked to arrive ready to share/discuss a topic of interest or concern pertaining to their committee topic and relevant to their respective communities. [See their project here.](#)

- Walk for Water: A follow up from Strut for Shoal - Seven Oaks Met School - Winnipeg, MB (2019)
 - When senior students at Seven Oaks Met School learned that the local community of Shoal Lake 40 First Nation (the very community where most of Winnipeg's drinking water is sourced!) has been under a boil water advisory for over 20 years, they were inspired to take action. They used their passion for fashion and music to organize a benefit night at the local performing arts centre. They also organized speakers and elders, from both Winnipeg and Shoal Lake, to educate the audience about the water crisis. The event raised over \$7,000 for the Shoal Lake 40 First Nation community and spread awareness across the region. Later that year, Seven Oaks students participated in the local Walk for Water event, which drew over 1,000 participants. The students gathered over 900 signatures for their petitions in support of clean water for all Indigenous communities across Canada. As a result of the students' advocacy, Shoal Lake 40 First Nation will be getting a water treatment plant! [See their project here.](#)

8. Ethical Dimensions for children, youth, and liveable futures

Globally, children and youth (under 18 years of age) make up 29% of the world's population. In an [open letter](#) to The Guardian, the global organizing committee of the Climate Strike movement, wrote: "Our generation grew up with the climate crisis and we will have to deal with it for the rest of our lives. Despite that fact, most of us are not included in the local and global decision-making process. We are the voiceless future of humanity."

[According to Field](#), "If, as educators, we are to provide educational learning spaces that encourage young people to address issues in their local communities in meaningful and relevant ways, then we need to encourage them to use all the information, tools, and resources they have at their fingertips. It is through action that hopeful futures are created." Looking into future decision making, we need to allow students to be creative and authentically inspired to create change, be active citizens, and be critical thinkers and solutions-oriented to address problems in their communities.

Climate change will be impacting future generations and there will be difficult decisions ahead in terms of balancing mitigation and adaptation and for whom. Canada has a low vulnerability score and a high readiness to adapt to climate impacts. While adaptation challenges still exist for Canada, as a country we are well-positioned: Canada is the 6th least vulnerable country and the 18th most ready country according to the [Notre Dame Global Adaptation Initiative \(2019\)](#). Other countries will look to Canada for financial support due to the natural disasters related to climate change, climate migrants will see Canada as a destination, and Canadian resources, such as freshwater, will become increasingly significant. There is no straight answer on how to deal with these issues, but we can 1) discuss dimensions of ethics that pertain to foundational societal values of equity, diversity, and inclusion with students; and 2) envision hopeful futures that have transformed disparity.

This inquiry explores how children and young people are growing up with an understanding of the climate crisis, how it may affect their future, and what avenues they have for engaging in change making processes.



Photo by: Kompas/Hendra A. Setyawan

Before you Begin: Background Information for Educators

The ethical dimensions of climate change challenge the concept of fairness in every sense of the word. It is the people most vulnerable and least responsible that may be the ones to suffer the most serious impacts of climate change. In essence, “most of the victims are poorly placed to hold us to account — being very poor, not yet born, or nonhuman” ([Yale 360](#)). The history of environmental racism is well-evidenced with low socio-economic or racialized peoples experiencing a disproportionate burden of exposure to negative environmental impacts. Climate impacts align with this history of environmental injustice. Climate change is not a national problem but a global one; the air we breathe is a product of global emissions and the warming we feel is related to the actions and reactions of each country around the world. As the impacts of climate change worsen, the [ethical challenges](#) become a closer and more daunting reality.

Vulnerable Countries

Many developing countries are located in climate-sensitive regions around the world, and often these developing countries don't have the resources to prevent massive damage or to properly adapt to the changing climate. There is a stronger economic penalty for countries in warmer climates as their already-high temperatures make them more sensitive to any increases in heat. Coastal regions and small islands are especially vulnerable to flooding as sea levels rise and serious storms increase in intensity. The number of people that are at risk of flooding each year could increase exponentially and force inwards migration ([Islam and Winkel](#)).

Future Generations

The problems that we are creating now have the potential to seriously impact the quality of life for future generations. [Yale Environment 360](#) asks the question: “Why should people in the future pay to clean up our mess?” The carbon emissions that we are creating now could remain in the atmosphere for up to 100 years. All of the predicted negative environmental effects are worsening over time, more seriously affecting future generations. Some of the long-term effects include: increasing temperatures, precipitation pattern changes, more droughts and heat waves, more intense hurricanes and tropical storms, and rising sea levels among many others. ([IPCC](#))

Non-human species

Globally warming temperatures are having a serious negative effect on many different species, putting species at risk for endangerment or extinction. For instance, climate change is affecting natural migration patterns of animals and forcing many animals to search for cooler temperatures. It is increasing the prevalence of pests that have a detrimental effect on the health of many plants and trees, taking away crucial food supplies for various species. Humans are also destroying the habitats of plants and animals for agriculture and timber. Rising Arctic sea temperature is causing problems for many of the wildlife that live there. Loss of ice, in many cases, means loss of stability for breeding, feeding, resting, hunting etc. These examples only demonstrate a very small number of the detrimental effects on plants and animals, whose ability to survive is being compromised.

Addressing Difficult Discussions

The problem should not be recognizing whether or not we need to take action; it should be how. The scientific consensus is resounding and the message is clear. However, there remain large gaps in understanding and a post-truth narrative continues to inform policy makers and media coverage, and thus streams into general societal understanding. A problem exists with how to address these kinds of narratives with students. *If these viewpoints or conversations arise in the classroom, how can teachers acknowledge that a “controversy” exists and be careful not to silence any voices or conversations, while still staying true to the science and avoiding opportunities for skepticism or doubt?*

The sensitivity of climate change for children and teens should be a consideration as educators navigate through the various facets of this subject. Specifically, as ethical dimensions of climate change unfold in a classroom, it is important to acknowledge, respond, and reflect on students’ reaction to this information. To make the learning meaningful and productive, how can the conversation move from information sharing and knowledge building towards acting?

A powerful discussion tool that could be a useful framework for addressing climate change in each dimension is called deliberative dialogue. [Deliberative Dialogue](#) aims to find the most informed and promising course of action for a certain problem at hand, or an “intent to resolve.”

Exploring these ethical dimensions invites students to ponder some of the most difficult questions and look deeper into their own personal (as well as society's) ethical and moral standards in relation to climate change.



A. Provocations: Ethical Dimensions

To hook student interest, choose one or more of the provocation ideas to initiate engagement.

Idea 1) Quotes to Reflect On

Quotations can provoke deep thought. For this hook activity, put a number of climate change quotations on tables throughout the room. Have students wander and read them and then choose the one that resonates with them the most. Ask them to form pairs at their chosen tables and allow students to explain their thinking to a fellow classmate. Then have students rotate to a new partner at a different table and each explains their choice of quote.

A few suggested quotes are listed below, but an internet search will reveal many others to suit your needs.

- 1. We have the choice to use the gift of our life to make the world a better place – or not bother.** – Jane Goodall
- 2. Going back to a simpler life is not a step backward.** – Yvon Chouinard
- 3. The future will be green, or not at all.** – Jonathon Porritt
- 4. We are living on this planet as if we had another one to go to.** – Terri Swearingen
- 5. If it can't be reduced, repaired, rebuilt, refurbished, refinished, resold, recycled or composted, then it should be restricted, redesigned or removed from production.** – Peter Seeger
- 6. I'm often asked whether I believe in global warming. I now just reply with the question: Do you believe in gravity?** – Neil deGrasse Tyson
- 7. To do good, you actually have to do something.** – Yvon Chouinard
- 8. Everyone thinks of changing the world, but no one thinks of changing himself.** – Leo Tolstoy
- 9. There is no such thing as 'away'. When we throw anything away it must go somewhere.** – Annie Leonard
- 10. As consumers we have so much power to change the world by just being careful in what we buy."** – Emma Watson

Idea 2) Videos

[Climate Change: Take Action for Children Now](#) (UNICEF Canada): 2:21 minutes

This is the message from African youth who participated in UNICEF's digital mapping project, (documents the impact climate change is having on their communities).

[How we children save the world](#) [Plant for the Planet]: 5:21 minutes

The story behind Plant for the Planet - a youth perspective on how children can change the world and make a real impact in the climate crisis.

[How the climate strike travelled around the world](#) [Guardian] 2:15 minutes

A video showing the millions of people that joined in walking out of school/work to protest against the climate emergency and call people to action.

[How to feed the world in 2050](#) [Commission on Sustainable Agriculture and Climate Change] 6:00 minutes

This video highlights that to achieve food security in a changing climate, the global community must operate within three limits: the quantity of food that can be produced under a given climate, the quantity needed by a growing and changing population, and the effect of food production on the climate.

Idea 3) Articles

[Climate Change Reinforces Inequalities, even in developed countries](#) (Deutsche Welle News)

"Climate change exacerbates inequalities, not only in poor, developing countries, but also in industrialized, wealthy ones. The poor should be given special importance when planning, experts say."

[Canadian kids sue over climate legislation](#) [Nature]

Lawsuit alleges that the federal government has violated citizens' rights by promoting and enabling fossil-fuel development, filed by Canadian youth on October 25, 2019.



B. Question Generation

Using a topic that was generated from one of the above provocations, have students generate their own higher order questions using a [Q-chart](#). This question creation chart provides students with a framework for developing a range of personally meaningful questions, which can include both close-ended factual questions and open-ended, divergent questions. Questions of different levels of

complexity can be generated using different quadrants of the chart. For a downloadable pdf version of the chart click [here](#).

Higher-Order Questioning with Q-Charts

Both students and teachers can use this helpful tool to generate questions that range from factual to higher-level synthesis, application, and evaluation questions.

Question stems increase in complexity as you move from the top-left to the bottom-right of the grid.

	Is Are Was (Present)	Did Do Does (Past)	Can (Possibility)	Could Should (Probability)	Will Would (Predictability)	Might (Imagination)
What (Event)						
Where When (Situation)	Remembering & Understanding Lowest Order of Thinking Skills (LOTS)			Understanding & Applying		
Which (Choice)						
Who (Person)						
How (Means)	Applying & Analyzing			Evaluating & Creating Highest Order of Thinking Skills (HOTS)		
Why (Reason)						

IDRA 2017

Chart From: <http://www.idra.org/wp-content/uploads/2017/08/Q-Chart-and-New-Blooms-Quadrants.pdf>

If you prefer to use pre-generated questions, here are some sample questions on the ethical dimension of climate change:

- What role do you see for developed countries like Canada, in mitigating climate effects in countries more harshly impacted, more vulnerable to climate impacts, and less responsible?
- What are ways to empower youth to take action and have their voices heard on the climate change mitigation and adaptation strategies? Why is this so important?
- In the context of Climate Change effects, dissect the quote: “Most of the victims are poorly placed to hold us to account — being very poor, not yet born, or nonhuman.”
 - Who could “us” represent in this context?
 - What might “being held to account” look like?

- Research: Why will these specific groups (“very poor, not yet born, or nonhuman”) feel the most severe effects?
- Whose job is it to take responsibility?
- For all the negativity surrounding the climate emergency, there are millions of people, and youth worldwide doing incredible things to make a difference. How can these actions be harnessed into wider global action? How can the momentum from climate crusaders continue to impact wider, multi-level change and action?
- How can your class tell the story of how your community has responded to climate impacts, policy, action, or advocacy?



C. Knowledge Building

Use one or more of the following suggestions to help students build knowledge on the ethical dimensions for children, youth and others with regards to the impacts of climate change.

- Configure the class into a circular seating formation and facilitate a [Knowledge Building Circle](#). The sample questions in “Question Generation” can be asked as springboards into discussions of ethics, in terms of equity, diversity, and inclusion.
- **Invite a local [community expert](#)** to learn more about ethics and climate change.

Places to look for a local community expert:

- Environmental non-profit
- Local social service agencies
- Lawyer
- Equity Officer
- Human Rights Officer



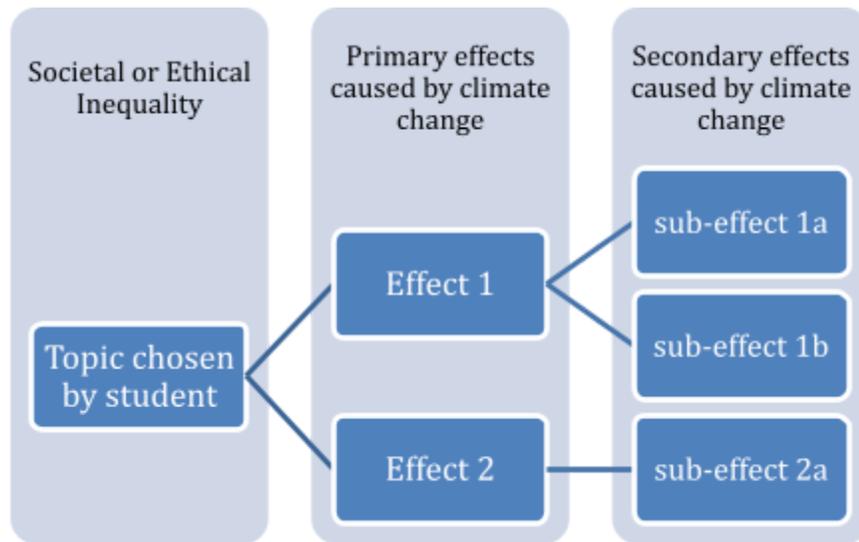
D. Determining Understanding

Ask students to choose two existing societal or ethical inequalities that are important to them, that they think are being exacerbated by climate change and why. Ask them to write down a short explanation of the relationship. If you wish, you could also use a [Cause and Effect](#) graphic organizer to modify the activity for some or all students. Have them go deeper by seeing if they can identify secondary effects as well.

Students can hand these papers in at the end of class for you to review and understand the diverse perspectives and assess student understanding. As a follow the next day, student work could be

sorted into categories (social, economic, cultural) and used to group ideas or focus a knowledge building circle.

Sample Cause and Effect chart – how climate change exacerbates inequality



E. Pursuing Learning: Ethical Impacts of Climate Change

Students may choose to take their own avenue to continue their exploration of ethics & climate change. Below we have included several focused activities for students to connect to global issues and explore the global and ethical impact of climate change on children and youth.

Activity 1: Climate Change Connections

Summarized from Climate Change Children and Youth: Local Connections to Global Issues (UNICEF)

The objective of this activity is to ask students to consider how climate change may intensify some of the many issues facing children around the world today. Included in this resource are three testimonials by Climate Ambassadors in different countries that the students are invited to read and think deeply about in relation to climate change. Ultimately, students should start thinking about climate change and children's rights as interconnected issues.

Handouts and additional resources are included.

Access the full Climate Change Children and Youth guide [here](#). Refer to this activity on page 19-21.

Activity 2: Climate Change and Child's Rights

Summarized from Climate Change Children and Youth: Local Connections to Global Issues (UNICEF)

This activity asks students to familiarize themselves with the Convention on the Rights of the Child and identify which rights are connected to the effects of climate change. In other words, how do the effects of climate change impact the articles such as a child's right to free education, right to health and health care, respect for the opinions of a child, and many more?

Encourage students to think outside the box, and acknowledge the significant loss of rights for children, especially in many other countries around the world.

Access the full Climate Change Children and Youth guide [here](#). Refer to this activity on page 22-23.



F. Consolidation

[U-Shaped Debate](#)

This activity is called a u-shape debate and it encourages students to see the merits of all sides of a debate and to think of positions along a continuum rather than binary options of “for” and “against.” It differs from a traditional debate where there are winners and losers and focuses on developing a position based on facts and different points of view and allowing for students to learn to shift their position and to reflect on the reasons that their thinking shifted. The Critical Thinking Consortium explains: “The goal is to encourage students to endorse positions provisionally while listening to others in an attempt to figure out the most defensible personal stance along a continuum of possibilities. Rather than trying to convince others, students explain why the position they are sitting or standing in is the most defensible one for them. There is no need to reach consensus on the issue.”

A U-Shaped Debate could be used as an instructional strategy for all of the different thematic inquiries in this guide. For this inquiry on ethics and children and young people's futures, here are some sample debate questions:

- What are the most effective ways for young people to participate in climate action?
- What should the global ceiling for emissions or temperature change be? Who should make this decision? And how should this decision be made?
- How should decision-makers balance short-term needs of society versus long-term insurance of a stable climate?
- What role do you see developed countries like Canada having in mitigating climate effects in countries more harshly impacted, more vulnerable to climate impacts, and less responsible?

Preparing for the U-shaped debate will require some class brainstorming on some of the positions and the ends of the continuum for the focus question. Students should also have the opportunity to do some independent research.

Facilitating the U-shaped debate:

- Ask students with polar views (i.e., either strongly agreeing or strongly disagreeing) to position themselves at the ends
- Ask students with mixed opinions to position themselves at appropriate spots along the rounded part.
- Ask students at each tip of the U to state their position and offer a few reasons only
- If there is an imbalance, as a teacher, position yourself on the weaker side to allow for discussion.
- Alternate from side to side, as students from all parts of the U offer their views.
- The most important take-away is to encourage students to physically move along the spectrum. When they do move, to indicate shifting their opinion, ask students if they feel like sharing what caused them to change their mind.

Full access to a U-Shaped Discussion and corresponding handouts (student reflection, self-assessment and teacher assessment) can be found [here](#).

Mental Health Check Activity: Being a Transformational Climate Leader

Climate Therapy Alliance - Pacific Northwest. [Emotional Resilience Toolkit for Climate Work](#) (Version 1.0). September 20, 2019.

After working through some of the big questions presented in this inquiry, we recommend allowing some time for students to point their focus inward and move their thinking towards personal agency and action.

Start by reading the following: Buckminster Fuller asked, *“If the success or failure of this planet and of human beings depended on how I am and what I do, how would I be? What would I do?”*

One of the qualities of being a transformational leader is: *“You stand for a sustainable, just and fulfilling future.”* Can you imagine three specific ways this Idea could be put into action in your school or personal life? Take a moment to write about it now.

Read the following questions and allow students some time to reflect.

- What symbol can you use as a reminder to reconnect you to this vision?
- What could support you in moving toward that vision? What barriers exist?
- Is there a step you are willing to commit to right now that would begin or enhance your movement towards this future?



Assessment Idea

Teachers will assess learning at different points throughout the inquiry using multiple methods. The following assessment provides an alternative evaluation method to standard quizzes and tests, that can be used after consolidation or at any point in the lesson to check for understanding.

< I Care Why? strategy

This activity suits this inquiry on the ethical dimensions of climate change. Pass out index cards or half a sheet of paper to encourage succinctness and so that students do not feel overwhelmed by a long assignment. Ask students to choose one key learning from the inquiry that resonated with them personally and explain the relevance of the concept to their life or how they might use it.



G. Take Action:

Allowing time for students to take action is an essential part of the learning process on climate change, as it empowers students and eases their eco anxiety.

Ideas for Taking Action:

- Develop a campaign around your exploration of the most effective ways for children and young people to take climate action.
- Consider the social inequalities associated with climate change that you have explored throughout this inquiry. Are there populations in your community that may be feeling the effects of climate change more harshly than others?
- Raise funds to support an organization focused on climate justice close to your community or far away.

Action Project Examples

- Bayridge Secondary School - Making a Difference (2013)
 - Grade 12 youth leaders at this high school researched and presented to their community about the negative effects of plastic water bottles (which never completely break down and will pollute our land and oceans for centuries). By educating and

inspiring other (younger) students at their high school, students are considering the active steps that themselves, and their entire community can take to protect future generations. [See their project here.](#)

- Wolseley School - Help the Homeless (2015)
 - Some of the people who will be most impacted by climate change are those who are not able to afford to adapt and lack resources and support. This school held a clothing and food drive that donated these items to local organizations who partnered with homeless citizens and those less fortunate. [See their project here.](#)
- Milk Bag Sleeping Mats - Bowmanville High School (2019)
 - On a local level, this project is upcycling materials to do something positive for a population that needs support. Students encouraged members of their community to donate used milk bags to the school to create sleeping mats for the local homeless population. [See their project here.](#)

Inquiry 9. Youth Agency

Climate change is a large-scale problem. Addressing the complexity of climate change requires all sectors of society to make radical changes including government, business, industry, and individuals.

Our individual actions to personally reduce our individual carbon footprint contribute to reducing greenhouse gas emissions. In addition, when we share what we are doing and why, our actions start to shift culture and practices.

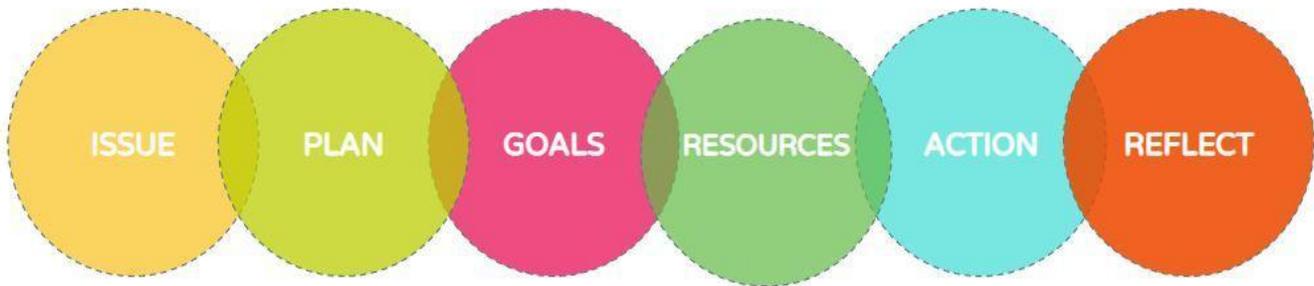
Taking action gives youth agency, promotes hope and addresses eco-anxiety and fear

We are at a critical point in our planet's history and there are many people working across sectors to make change happen. It is exciting and scary at the same time. In this inquiry, we draw on Learning for a Sustainable Future's [Engaging Students in Sustainable Action Projects Facilitator's Guide](#) (ESSAP) to provide a framework for developing an Action Project.



There are important steps that go into a classroom enacting change in the form of an Action Project. The ESSAP developed twelve steps to guide educators in planning, launching, and measuring the success of a student-led Action Project. These can be simplified to the following Six Steps to Taking on an Action Project: 1. Choose an Issue, 2. Make a Plan, 3. Identify your Goals, 4. Gather the necessary Resources, 5. Take Action, and 6. Reflect and celebrate.

A simplified visualization of the steps to taking on an Action Project:



Six Steps to Taking on an Action Project

STEP 1. Choose an ISSUE

Ideas to get students thinking about choosing an issue:

[Four things you can do about the climate crisis](#) [The Years Project]

[Surprising Solutions to the Climate Crisis](#) - Project Drawdown [The Years Project]

[The Solution to Climate Change is All Around Us](#) [The Years Project]

[How We Children Save the World](#) [Plant for the Planet]

Research is an essential step in the process to produce a meaningful action plan, students need to work to understand the complexity of the issue. Sample questions include: What has already been done on this issue? Are there people in your community taking action on this issue? Would they be a meaningful contact to make? Who is it impacting?

Based on your research, decide on an action that is a high-impact climate action.

Students may all have different ideas about what is important to them and what they want to take on in this project. By giving every student in the class a voice and choosing an issue in a democratic manner (vote, value line, ranking issues) the issue will be most representative and the likelihood of student engagement is much higher.

Activity: Value Line

Adapted from LSF's ESSAP Guide: Page 21

Give students examples of things that “bug” you and then ask the students to write down things that really bug them on a sticky note. For instance: “it really bugs me that students in the school do not know how to properly recycle, so even when I do the right thing it doesn’t make a difference.” In order to expand student’s ideas, you could start by asking students to reflect on something that bugs them at their home, then to their school, and finally in their community, and colour code these ideas on different coloured sticky notes.

All of the students’ ideas should be put into a central bin and move into an open space where there is room for students to move around. Let the class know that one side of the space represents “really really care” and one side represents “don’t care.” Ideas are chosen at random from the bin, and students choose a space on the line that represents how much they care about the issue. The results from each issue should be recorded visually to review afterwards and see which of the issues captures most students.

2. Make a PLAN

Action Projects have potential to be the most effective at making a real impact when they are strategic, so making a plan is essential.

To get started, students can brainstorm ideas of things/actions that they want to do to help reduce climate impacts based on the provocations.

To help students think through what actions are more effective than others, students can:

- Calculate their carbon footprint *
- Visit Project Drawdown to review which greenhouse gas emission reduction strategies are more effective than others (ranked from 1-100)
- Research the carbon footprint of an average person in your province/territory

Note: When it comes to carbon footprint calculators, there is variation in energy production systems from region to region which means that energy conservation actions in some provinces/territories are higher-impact climate actions than in others.

At this stage, we encourage students to think about people who might be involved in this issue, and identify any active stakeholders that may create barriers for students to accomplish their goals. On the other hand, it is important to consider existing supports as well. There are likely people or organizations that will be able to help support your class in some way. Encouraging students to use all available resources, inside and outside the school, is a useful skill to learn.

3. Identify your GOALS

There are many reasons why students want to take on an action project. The overarching goal is to make a positive change for the environment. In addition to the main goal, students should decide on specific, attainable outcomes and decide on what type of action best helps them to achieve their goals:

The ESSAP guide highlights eight different types of eco action that can help students achieve their goals:

1. Educate and Inform
2. Make Consumer Choices
3. Persuade Others to...
4. Raise Funds
5. Engage in Political Action
6. Initiate Legislative Action
7. Eco-Management Projects
8. Make Lifestyle Choices
9. Peaceful Dissent
10. Other...

4. Gather the necessary RESOURCES

At this stage, encourage students to think about people who might be involved in this issue, and identify any active stakeholders that may create barriers for students to accomplish their goals. On the other hand, it is important to consider existing supports as well. There are likely people or organizations that will be able to help support your class in some way. Encouraging students to use all available resources, inside and outside the school, is a useful skill to learn.

The type of resources required depends on specific projects. Most fall under the following categories:

People resources

- Who needs to be involved/informed?
- How can you recruit volunteers to help?

Monetary resources

- Community businesses are often willing to support student causes. Reach out to them.
- For fundraising and grant opportunities check [here](#)

Material resources

- Use newsletters or social media to ask your community for items you might need.

5. Take ACTION

Choose an Action: Project Planning Template

ESSAP Guide p. 41-48

This activity offers a thorough process for a class to determine the best action to target the issue that's been chosen. It starts off with a project planning workshop that encourages students to consider the root causes vs. symptoms of their issue and asks them to start thinking about remedies for both the symptoms and root causes.

Simple example:

ISSUE	SYMPTOM	SOLUTION	ROOT CAUSE	SOLUTION
You're sick	Runny nose, sore throat	<ul style="list-style-type: none">● A tissue● Soup	Bacteria	<ul style="list-style-type: none">● Antibiotics● Hand washing
Litter in the schoolyard	Garbage on the ground, overflowing cans	<ul style="list-style-type: none">● Litter pickup● More garbage cans	Too many packaged snacks brought to school	<ul style="list-style-type: none">● Litterless lunch campaign● Provide reusable options

The activity then refers to the examples of different types of action (mentioned in step 4) that could be taken to combat an issue. Students are asked to determine a set of criteria for landing on the best action. Students are asked to choose three potential actions and determine whether each does or does not address the specific criteria that they have come up with. A series of graphic organizers take a closer look at who or what is directly or indirectly affected by this issue (person, plant, group, place etc.) and whether any concerns arise in relation to these populations.

The final step is determining measurables for the success of the project. What evidence are you looking for that would signify progress? What tools can you use to measure this?

These plans and organizers can be a work in progress that can always be returned to and adjusted as the project progresses, or used to refer back to to stay on track. But they are a useful, succinct starting point for conceptualizing and planning a successful project. See full planning activity and template [here](#).

Take Action (Do it!)



Depending on the project that you have chosen to tackle, different skills may come in handy. Here are a few examples of skills, and activities that are described in [ESSAP](#) to use in your classroom to help students develop them:

- A. Developing Telephone Skills (p. 52)
- B. Lobbying (p. 55)
- C. Letter Writing (p. 58)

6. REFLECT and Celebrate!

Reflect on the positives, negatives, frustrations, accomplishments and challenges. Reflection can and should happen throughout the entire Action Project process. Taking stock of how the project is going, what can or should be changed, and how each member of the class is doing/feeling in relation to the project is important to staying on track, and ensuring the best results!

Share and Celebrate Success

Sharing your project is a critical and often-overlooked phase that is essential to creating widespread change. When we share what we are doing and why, we attract others to our cause and get them interested in following suit. This way we can multiply our efforts and start to shift culture and practices.

Schools are an excellent example of this. Each teacher influences dozens to hundreds of students per year (depending on class size & schedule). If students can spread messaging to their parents, peers, and other fellow Canadians, they can be a huge catalyst for creating large-scale and lasting change. This is a proven method! For example, anti-smoking, anti-impaired-driving, recycling and other major social and environmental campaigns have leveraged the education system to great effect in the past.

The more your Action Projects are shared with parents, your community, the media, etc. the greater your impact!

One way to share your project is on LSF's [Our Canada Project](#) sharing platform, where students across the country share their visions for a more sustainable Canada and the actions they are taking to achieve those visions. Add your Action Project to inspire other Canadians to follow your lead (and for the chance to [win great prizes!](#)).

Further Ideas for Taking Action:

It is important to keep in mind that not all actions listed below will have the same impact. Some actions have a much larger influence on climate change compared to others on the list. In order to make the list approachable for students we have chosen to include both large scale and small scale actions. Depending on where you are located, certain actions will matter more or less so it is important to keep this in mind as well. The following five actions are the most impactful choices and changes students can make, according to [Drawdown](#):

- 1. Reduce the amount of food waste you produce - food waste is responsible for approximately 8% of global greenhouse gas emissions.**
- 2. Try to eat a plant-rich diet (reduce meat consumption) - Western, meat rich diets account for 1/5 of global emissions.**
- 3. Take alternative transport: walk, ride your bike, take public transport or carpool to reduce your carbon dioxide emissions.**
- 4. Switch to LED lights wherever you can - they use 90% less energy than incandescent bulbs**
- 5. Buy less - Manufacturing and creating new items such as: toys, clothing, and electronics uses a huge amount of energy. If you make your existing things last longer, and buy second hand.**

Below are some specific ideas for Personal Actions, listed under seven main themes: food, transport, energy, in your yard, water, materials and general activism.

Theme 1. Food

Reduce the amount of meat that you consume (specifically beef). Raising livestock such as cows accounts for a large portion of Earth's heat-trapping gas emissions. Cutting beef from your diet is one of the quickest ways to lower your carbon footprint. According to the [World Resources Institute \(WRI\)](#), [producing a portion of beef emits 20 times more greenhouse gases](#) than producing an equal-size portion of plant-based protein, such as chickpeas or lentils.

If your community does not have a green bin program, encourage your parents to **buy or build a backyard composter or build a vermi-composter**.

Try to eat mostly **in season and locally grown** fruits and vegetables. This cuts down on the energy used to grow, transport and store food, which reduces the release of heat trapping gases. Flying, trucking, and shipping foods around the world use excessive amounts of oil.

Avoid drinking bottled water! Drink tap or filtered water & carry your drinking water in a reusable bottle. Plastic water bottles contribute to carbon dioxide per year. It is estimated that the carbon dioxide footprint of bottled water consumed globally is between 31 billion pounds of carbon dioxide per year (equivalent of 5 million cars per year) to 446 billion pounds of carbon dioxide per year (equivalent of 74 million cars per year).

Eat more fruits, grains, and vegetables - You may have heard people talking about switching to a plant-based diet. Not only are there health reasons to make this switch but you will also save carbon dioxide too. It takes a lot more energy to produce animal products (like meat and dairy) and processed foods (like fruit juice, soda, candy, and chips) than to grow fruits and vegetables.

Help **start a garden** at home, at school or in your community to grow some of your own food! Tending to a garden is not only great for the environment, but it gets you outside, enjoying and appreciating the natural environment you live in!

Ask your parents to buy **reusable grocery bags or advocate for plant-based plastics**. Help them to remember to get them out of the car and take them into the store.

Theme 2. Transport

Walk or ride your bike instead of taking a car everywhere. A 3 km car trip puts 2 pounds of carbon dioxide into the atmosphere! Biking or walking just one mile a day for a year could save 330 pounds of carbon dioxide—that's the same as planting four trees and letting them grow for 10 years!

Stay out of the drive thru! When you go to a fast-food place, ask your parents or guardian to park the car and let you walk inside, rather than sitting in a line of cars with the engine running and polluting.

If you must ride, **carpool** & consider driving an **electric vehicle**.

If you are in a car with family or friends, encourage **windows down** instead of air conditioning!

Holiday locally! Explore your own beautiful province during the holidays, so that an airplane flight with a large carbon footprint is not necessary.

Theme 3. Energy

Turn down the thermostat on the heating when it's cold. Try using sweaters, blankets, and socks to stay warm and use less heat!

Turn up the thermostat on the air conditioning when it's hot. If you are still too hot, fans are a good alternative to air conditioning because they use much less power.

Turn off lights, TVs, computers, when you do not need them.

Unplug! Any electronic gadget you can turn on with a remote (TV, DVD player, Nintendo, Xbox) uses power even when it is "off." Appliances with a digital clock (like a coffee maker) or a power adapter (like a laptop computer) also suck power like a sneaky vampire. Plug these kinds of things into a surge protector or power strip that has an on/off switch. Then you can shut off all the power without unplugging each gadget.

Switch to "Energy Star" products - from light bulbs to refrigerators, your family can look for products with an Energy Star label. It tells you how much energy an item uses and saves.

Theme 4. In your Yard

Plant trees! Roughly 15 billion trees in the world are cut down each year, so help offset that loss by planting a tree of your own. Trees are great for the environment in so many ways: they absorb carbon dioxide and release oxygen for people to breathe. They also provide shelter and food for

animals such as [squirrels](#) and [owls](#). Depending on where trees are planted, their shade can even reduce the need for air-conditioning in hotter months.

Tired of cutting the grass? Ask your parents to **replace grass with a perennial ground cover**. It doesn't need to be cut or watered!!

To avoid flooding in a basement, **remove leaves and garbage from the nearest storm drains and eaves troughs, extend the downspouts** so that the water discharges at least 2m from the house, make sure there are **covers on basement window wells**

Plant **native plants** for your garden that provide food and habitat for local birds, butterflies and bees. Native plants will thrive in your local soil, requiring little fertilization or care.

Change the way you do yard work - Leaf and snow blowers use gas or electricity. Raking and shoveling emit no carbon dioxide – they are the healthier alternative for you and the earth.

Theme 5. **Water**

Conserve water by turning off the faucet when you brush your teeth, and taking shorter showers. This could help conserve up to eight gallons of water per day, which means a reduction in the pumping and distribution of water and also a reduction of carbon dioxide emissions (for more information see Project Drawdown: [Water Distribution Efficiency](#)).

The cooler the water, the better for the environment - **turn down the temperature on the hot water tank** a few degrees. This will save energy and reduce carbon dioxide emissions.

Wash differently- try to only run dishwashers and washing machines when they are completely full. Wash clothes using cold or warm water instead of hot water, saving on water usage and energy, and reducing carbon dioxide emissions.

Theme 6. **Materials**

You can REFUSE items when they're offered to you. You can buy items made from RECYCLED materials. You can REFILL empties. You can REPURPOSE things. You can RECLAIM parts of things once they're no longer useful. You can RETURN or REGIFT things instead of throwing them out. You can REPAIR things when they break instead of buying new ones

Recycle properly! Make sure that your recyclables are cleaned properly (no food/liquids/other contents, before putting them in the recycling). For more information on the impact of recycling on carbon emissions go to Project Drawdown: [Recycling](#))

Buy less - Manufacturing and creating new items such as: toys, clothing, and electronics uses a huge amount of energy. If you make your existing things last longer and buy second hand - this would save a lot of energy over time!

Hang up your freshly washed clothes to dry. You'll be saving energy by not using the dryer.

Go paperless! - if something doesn't need to be printed out, read it on a screen or use GOOS (good on one side) paper.

Try **carrying a reusable bag** with you - so that you're prepared if you need to buy something.

Buy vintage! The textile industry's fast fashion messages encourage us to be a throw-away society. Go to your local thrift store to find your own fashion style.

Host a swap shop or re-gift it day at your school. Students can bring in their donations of gently worn or used items, and someone's cast offs can become someone's new treasure!

Theme 7. **General Activism**

Write a letter to the editor about climate change in your local or school newspaper. The more people talk about the issue, the better!

Not everyone understands climate change - even experts can know everything about climate change. For instance someone who studies ice cores may not understand food security. Be curious and **learn and then tell your friends and family about what you are learning. 47% of people in Canada learn about climate change through talking to friends and family (Field, Schwartzberg, Berger, 2019).** If everyone has an open mindedness to learn, we can work together to find solutions.

Send a letter, postcard, or drawing to your mayor, premier, government representative, or even the Prime Minister asking them to do something about climate change.

Fall in love with nature. Enjoy **spending time outdoors** as much as you possibly can! It is so important when doing climate activism to find ways to destress and being in nature can help you do this.

At school: encourage your classmates to take-action, start or join your school's eco-club. **Be a champion** - normalize and support classmates' efforts to be sustainable.

Use your social media platforms to educate and inform others on issues related to climate change and actions that people can take. Through this channel, many of you have access to a large number of other students and young people which gives your voice a platform to make a real difference.

What's Next?

Knowledge + Action = Hope

This resource was intended to help you spark an inquiry for your students, help them gather knowledge and encourage them to act and implement positive change.

Continue to ask your students: What do you control in your own life? What do you have influence over? What are ways that you can make a positive difference in the environment?

We hope that you continue to seek out transformative, active learning strategies and use them in many aspects of your teaching to help students develop 21st Century Learning skills such as problem solving and critical thinking. As educators, it is our role to give young people the tools they need to face the future.

"The moment we decide to fulfil something, we can do anything." *Greta Thunberg, Houses of Parliament, UK, 23 April 2019*

APPENDIX A. Active Learning Strategies Resource Bank

The following is a list of strategies that were referenced in this document: *Empowering Learners in a Warming World*. Although specific examples for their use were illustrated in different sections of this guide, active learning strategies are highly versatile and their use is encouraged at any stage of the inquiry process: provocations, question generation, knowledge building, determining understanding, pursuing learning, and consolidation.

Summary Chart of Active Learning Strategies used in this Resource

	STRATEGY	DESCRIPTION	LINK
1	3-2-1 Strategy	A method for students to summarize their learning: 3 things they learned; 2 things they would like to learn more about; 1 question they still have.	The Teacher Toolkit: 3-2-1
2	Affinity Mapping (also referred to as: Affinity Diagram)	<p>A method for collecting a large sample of data (in a classroom it is often each student's response) and mapping it to see themes based on the relationships with one another.</p> <p>Could occur after a brainstorming session, analyzing verbal data collected from students.</p> <p>Have each student write their response(s) on sticky notes. They can share with a partner. Once everyone has had a chance to share their ideas, return attention to the whole class and invite one student to begin by reading their issue aloud and then sticking it anywhere up on the wall. Ask students who think that their issue is similar to cluster their sticky notes around the original. Continue this process one issue at a time until everyone has found a spot on the wall. This will create a visual cluster analysis. Students are free to move theirs at any point throughout this process if they hear</p>	Affinity Diagram: Definition and Examples

		<p>another one that fits with theirs better. After all the issues have been placed on the wall, place labels to characterize the issues/themes. This affinity map can be photographed to revisit later. This is a great starting off point to lead to question generation, individual or group research projects.</p>	
3	Alternate Perspectives Activity	<p>Alternative perspectives can be incorporated into climate change teaching and learning through different subjects and disciplines, uncovering those among students, cultural differences, temporal perspectives, identifying minority views</p>	<p>Neighbourhood survey (Kozak & Elliott p. 14).</p> <p>De Bono's Six Hats (Dots, p. 55)</p> <p>Four Corners (Dots, p. 55).</p> <p>Using media</p> <p>Using literature</p> <p>Council of All Beings - Communicating on Behalf of Another (Kozak & Elliott, p. 56)</p> <p>Business Plan Preparation</p>
4	Bloom's Taxonomy – Question Starters	<p>As a group or individually, students generate their own higher order questions using the prompts for each of the six Bloom's Taxonomy levels.</p>	<p>A taxonomy for learning, teaching and assessing: A revision of Bloom's Taxonomy of educational outcomes: Question Starters</p>
5	Book	<p>Literature can be a powerful way to connect learners to an issue or idea. Choosing the right book is imperative to the quality of engagement and learning that takes place</p>	
6	Carousel Brainstorming	<p>A structured brainstorming technique that includes movement, discussion and reflection.</p>	<p>Professional Learning Board: What is Carousel Brainstorming Technique</p>
7	Cause and Effect	<p>A tool used to help students become empowered, analytic thinkers, capable of thinking through complex processes to make important decisions.</p>	<p>Teacher Vision: Cause and Effect Lesson</p>

8	Choice Board	Encourages multiple means of expression, as students chose a mode from a number of ideas to present their understanding of their learning.	Professional Learning Board: <u>How to use choice boards in the classroom?</u>
9	Community Expert	<p>Find an expert in the field of learning that you are discussing in the classroom - whether it is the science behind climate change, sustainable investing, indigenous leadership on combating climate change etc. to speak to your class about their expertise, and engage students in learning, considering alternative perspectives, and thinking critically.</p> <p>Inviting a community expert into the classroom is a really effective way of deepening the learning experience for students, and a starting point for expanding the subject matter from classroom learning into 'real world' applied learning. Teachers can't always be experts on every subject, especially with such a complex and challenging subject like climate change.</p>	<p><u>Bringing the Community Into the Classroom</u> (Edutopia)</p> <p><u>Experts in the Classroom</u> (Scholastic)</p>
10	Compare and Contrast	A higher order thinking strategy where students can use a graphic organizer to analyze the differences between two concepts or ideas.	<u>ASCD: Why Compare and Contrast?</u>
11	Concept Mapping	<p>A concept map can be created to explore an issue. The concepts are linked with a proposition which shows the relationship between the two concepts. This is more directed than a mind map which is a brainstorming tool.</p> <p>Students are able to explore many different reasons to care about an issue. They are able to draw upon emotional and rational dimensions of their response to an issue and further develop their understanding of the interconnectedness of the diverse dimensions of the issue</p>	<u>Active Learning – Concept Maps</u> (Kent State University)

		(health, environment, economics, well-being). (ESSAP, p. 25).	
12	Consequence Map	A graphic organizer that requires students to think about the potential long-term impacts of a real or imaginary event, issue, or problem.	Let's Talk Science: <u>Consequence Mapping</u>
13	Critical Thinking Question	<p>Pose an interesting, thought provoking question to invoke students' critical thinking about an issue or topic</p> <p>For example: What does () mean to you?</p> <p>How do you interact with () in your life?</p>	Centre for Teaching Innovation: <u>Using Effective Questions</u>
14	Doodling/ Sketching	<p>Solitary or group mapping of what is known to date, to be started at the beginning and revisited several times over the course of a project</p> <p>Visual reminders to connect the importance of what is learned to real world issues</p>	
	Essential Agreement	<p>Working collaboratively with students to create a class 'constitution' or ruleset that everyone must respect and abide by. These agreements are meant to help develop a community in which respect, and trust guide students' interactions with one another.</p> <p>Student involvement and co-development of these guidelines are essential to the buy-in, feeling of ownership and management of this agreement. Teachers should take time to reflect on what values and rules they view as non-negotiable before this process.</p>	
15	Five-Whys	An iterative interrogative technique used to explore the cause for a particular issue.	<u>Peachy Publications: Five Whys Encouraging Inquiry in the Classroom</u>

16	Gallery Walk	Questions, student work, etc. are posted around the classroom and students rotate through them and write comments on their observations to further their understanding.	Edutopia: Gallery Walks
17	“I Wonders”	<p>I wonders are used to describe the questions that students ask to themselves or others throughout their learning</p> <p>As a provocation: Pose an interesting “I Wonder...” and invite students to have one on one conversations about it</p> <p>Throughout the learning process/question generation: By listening to students dialogue and questions that come up as they are discovering and learning, future lessons and inquiries can be focused to address these curiosities.</p> <p>Teachers should also encourage students to write these questions down so that they are available to come back to later.</p>	"I Wonder" Questions: Harnessing the Power of Inquiry (Edutopia)
18	Infographic	A visual representation of knowledge and information, designed to make complex ideas and data easy to understand.	Creative Educator: Infographics
19	Issue ID/post-it/sort/discuss	<p>Helps to identify ‘What is important to you’ and ‘Why’ Write down in point form. Talk in a pair. Categorize your concerns as: Economic, Environmental, Social, Cultural</p> <p>For example: What Concerns You? What issue keeps you up at night? What worries you most about _____?</p>	
20	Journaling	Journaling is an effective way for students to record ongoing learning and questioning. It is also an effective tool for teachers to have a record of each	Connecting the Dots (Kozak & Elliott) p. 81

		<p>student's learning process in order to effectively guide the inquiry and determine where students are at in their understanding. Journals have the potential to tap deeper into students' learning, they can include not only words but also be a great place to keep photos and drawings.</p> <p>Helps to enhance reflection, facilitate critical thought, express feelings, and write focused arguments (Walker, 2006).</p> <p>Journaling can also have immense benefits for students' mental health. It can help students have a safe outlet to record and track feelings of anxiety or stress that arise throughout the learning process. As well it can help navigate through often difficult subject matter.</p>	<p><u>Education World: Journal Writing</u></p> <p><u>Hamilton Education: Journal Writing</u></p>
21	Knowledge Building Circle	<p>A circular seated configuration of learners as they engage in a 'knowledge building discourse'</p> <p>A circle is used as an intentional physical configuration that is conducive to knowledge building. A KBC involves respectful dialogue in which students share ideas, negotiate topics and work together to evolve the group learning. The principle "all ideas can be improved" is central to a knowledge building circle. The teacher acts as a facilitator, allowing the students to drive the conversation, but getting involved to ask for clarification, pose thought-provoking questions, observe for appropriate participation. (Kozak & Elliott, p. 91)</p>	<p><u>Watch a grade 5 KBC here.</u></p>
22	KWL Chart	<p>A graphic organizer designed to help students organize their learning.</p> <p>There are 3 columns: "What I Know, "What I Want to Know," and "What I Learned"</p> <p>Know and Want are completed before</p>	<p>ReadWriteThink: <u>KWL chart</u></p>

		<p>beginning research. Learned is completed after or as the research is completed.</p> <p>This type of organizer facilitates student's engagement in their learning process by critically thinking about what they already know or have learned, what they would like to learn in their own learning journey, as well as engage in a reflective process. This allows for personal clarification of an opinion or issue.</p> <p>The responses will help inform and guide the learning process. They can provide insight into which concepts need clarity, what many students are already well informed about, and a general direction that many students want to pursue.</p>	
23	KWHLAQ Chart	An extended version of the KWL Chart, for students to think critically about where they currently are in their learning journey and where they want to go.	Genius Hour: <u>The KWHLAQ Chart helps students organize 21st Century Learning</u>
24	Learning Circles (Building Knowledge through Collaborative Projects).	<p>Highly interactive, participatory structure for organizing group work.</p> <p>Can take place face to face or online. Online can be a good way to overcome distance and still work collaboratively.</p>	Taking 'Study Groups' to new heights
25	Neighbourhood Walk	<p>Take your class outside on a walk to observe the local environment. This could include both the natural and built environment. You could ask your students to look for anything from flora and fauna to evidence of adaptations to climate change.</p> <p>The focus on local helps conceptualize broader issues at a scale in which local actions can be both considered and implemented.</p> <p>Schoolyards and neighbourhoods have a lot to offer in terms of learning</p>	<p>Jane's Walk was developed by Jane Jacobs as a way of connecting neighbours with one-another and learning about the history and society of the place that they live.</p> <p><u>Social Mapping</u></p> <p>Doable in any neighbourhood</p>

		<p>opportunities - they can provide a diverse landscape to explore and expand classroom learning.</p> <p>Walking trips can serve many purposes (including having a positive health impact on students!)</p> <p>During and after the walk, students can document their observations through photos, sketches and notes.</p>	
26	One-minute paper	A focused question that can be answered quickly, asking students to reflect on their understanding of a concept. This provides the teacher with feedback on students' perceptions on key learnings.	ON Course: One Minute Paper
27	Placemat	Allows students to think about, record, and share their ideas individually or in groups on a graphic organizer divided into quadrants.	Government of Ontario: Online Teaching Resource: Placemat
28	PMI (Plus, Minus, Interesting)	A critical thinking tool that determines student understanding of a concept. Students are instructed to write down the positives, negatives and interesting features of a topic, question or situation.	Professional Learning Board: How Can Plus Minus Interesting Strategy be Used in The Classroom?
29	Q-Chart	This question creation chart provides students with a framework for developing a range of questions, of different levels of complexity (higher order thinking).	IDRA: Higher Order Questioning with Q-Charts
30	RAFT	Students undertake a role and learn how to effectively communicate their ideas clearly to their chosen audience. An activity incorporating UDL by including choice and student voice.	Professional Learning Board: How to use the RAFT strategy in the classroom to develop reading and writing skills
31	Reverse Mind Map	Reverse mind mapping is a tool to use when you have an 'information overload.' It is called reverse mind mapping	Reverse Mind Mapping Introduction & Brainstorming (Zoom Thinking)

		<p>because rather than brainstorming connections and ideas stemming from one big idea, you start with many seemingly separate ideas/information and try to narrow them down into one big idea.</p> <p>In order to create a reverse mind map, you begin with a large amount of information on a topic, and use this information to narrow in and determine the key concepts or 'big ideas'</p> <p>Four main steps to creating a reverse mind map involve:</p> <ol style="list-style-type: none"> 1) "Tell me everything" 2) Categorize 3) Sequence 4) Big Idea 	
32	Survey	An investigative tool used to gather further data from stakeholders on a topic or an issue.	<u>Science Buddies: How to Design a Survey</u>
33	Think Pair Share	<p>Students think about a question or idea posed by an educator on their own first, and then turn to a partner and discuss their responses with one another.</p> <p>TPS is a learning tool designed to encourage active learning and cooperation between a pair of students.</p> <p>This learning technique is effective because it invites individual reflection on a topic, and then the opportunity to share on a smaller scale with a minimum of one partner.</p>	<p>University of Toronto: Active Learning Pedagogies: <u>#5 Think Pair Share</u></p> <p>Learning Sciences International: Helping Students Practice and Deepen their Understanding of New Knowledge (2012)</p>
34	Think Pair Square	<p>This technique is very similar to TPS, but the sharing is taken one step further, to a group of four students.</p> <p>This technique allows students to have exposure to a greater number of</p>	

		perspectives, but still in an intimate group setting. Students get to hear from multiple learners, and every student has a chance to share their own thoughts.	
35	Thirty-Second Sound Bite	Students understanding of and passion behind a specific topic is summarized in a sound bite designed to get listeners' attention about an issue.	http://samples.jbpub.com/9780763749453/49451_CH09_FINAL.pdf
36	U-Shaped Debate	Unlike a formal debate structure, in a u-shaped debate students arrange themselves along a continuum of opinions ranging from one polarized opinion to the other side.	<u>The Critical Thinking Consortium : U-Shaped Discussion</u>
37	Umbrella Questions	<p>Umbrella questions are overarching questions to help guide the learning process by connecting to big ideas and themes. Big ideas “go beyond discrete facts or skills to focus on larger concepts, principles, or processes” (Wiggins & McTighe, 1998, p.10)</p> <p>It may take several drafts to develop umbrella questions that meet both student and teacher expectations. An umbrella question is developed to help ground the inquiry. The question should be focused - it's not aiming to answer all aspects of an issue. The question should be of interest to the students and also connect to the big ideas of the unit or subject.</p>	
38	Question Formulation Technique (QFT) “The Right Question”	<p>A step by step process that was designed to help students produce, improve and strategize how to use their questions.</p> <p>Ask students in groups to generate as many questions around a topic/issue as they can in the allotted time (suggested 5 min).</p> <p>To generate questions, follow QFT rules</p>	<p><u>Step by Step Guide</u> (introducing QFT into class)</p> <p><u>Question Formulation Technique Resources</u></p>

		<p>for producing questions:</p> <ul style="list-style-type: none"> • Ask as many questions as you can • Do not stop to answer, judge or to discuss the questions • Write down every question exactly as it is stated • Change any statement into a question <p>Review the difference between open-ended and closed-ended questions and ask students in groups to identify open questions with an “O” and closed questions with a “C”. Ask students to rewrite three closed-ended questions into open-ended questions and three open-ended questions into closed-ended questions.</p> <p>Next ask students to review their questions and prioritize them according to which ones they believe will help the class better understand the issue.</p>	
39	Q-Chart	<p>A grid that helps the learner understand the types of questions they are asking</p> <p>Provides opportunities for learners to learn to ask HOT (higher order thinking) questions</p>	<u>Higher Order Questioning with Q-Charts</u>
40	Value Line	<p>This exercise allows students to become more conscious of their own perspectives or understanding of a topic, as well as observe and appreciate their classmates perspectives.</p> <p>With a physical or imaginary line drawn on the ground, identifying one side of the line as one extreme (i.e. strongly agree) and the other side of the line the opposite (i.e. strongly disagree) a question is posed to the students and they are asked to determine how they feel in response, and line up accordingly.</p>	<u>University of Toronto: Active Learning Pedagogies – Line of Agreement (Value Line)</u>
41	V-Heuristics	A V-heuristic requires students to think	Connecting the Dots

		<p>about their values throughout the learning process (beginning, middle and end) (Ahlberg, 2005).</p> <p>A concept mapping tool that helps learners evolve in their decision making skills, reflection and problem solving by helping students work on their metacognitive abilities and tune into their internal thoughts.</p>	
42	Video	<p>Informational, engaging videos can be a useful tool to use at different stages throughout the inquiry process. In the age of technology, videos are captivating for students, and almost immediately draw the classes attention which makes them an engaging initial provocation to spark interest and generate initial questions.</p> <p>Listening to an expert speak and share information is often more effective than speaking about the topic yourself. There are many techniques for making this use of videos more effective for instance: watching a video more than once, and prompting critical questions to consider while watching.</p>	
43	Visual Processing Cards	<p>Visual processing cards are an effective tool for conceptualizing learning in a creative, visual way. Often the cards represent visuals for students to express what they learned, or how they feel about what was learned.</p> <p>Cards are spread out on the floor or on a table. Ask students to pick a card that reflects something that they have learned today. This is ideally facilitated in a circle and can be a go-around, popcorn-style, or a jigsaw.</p>	<p>Climer Cards</p> <p>Chiji Cards</p>

APPENDIX B. Mapping the Active Learning Strategies throughout this guide

	Inquiry 1. What is Climate Change and Why Care?	Inquiry 2. Climate Change: Where are we now?	Inquiry 3. Monitoring Change: Using the Climate Atlas of Canada	Inquiry 4. Environmental Impacts and Restoration	Inquiry 5: Human Health: Addressing Climate Change Makes us Healthier	Inquiry 6. A Low Carbon Future: Economic Transitions, Risks and Impacts	Inquiry 7. Climate action and decolonization: Indigenous perspectives	Inquiry 8. Ethical Dimensions for children, youth, and liveable futures
3-2-1 Strategy				X				
Affinity Mapping (also referred to as: Affinity Diagram)	X				X			
Alternate Perspectives Activity						X		
Bloom's Taxonomy – Question Starters			X					
Book								
Carousel Brainstorming			X					
Cause and Effect					X			X
Choice Board					X			
Community Expert				X		X		X

Compare and Contrast					x		x	
Concept Mapping		x						
Consequence Map					x			
Critical Thinking Question							x	
Doodling/ Sketching							x	
De Bono's Six Thinking Hats	x					x		
Essential Agreement								
Five-Whys					x			
Gallery Walk							x	
"I Wonders"		x						
Infographic							x	
Issue ID/post-it/sort/discussion								
Journaling	x				x			
Knowledge Building Circle		x			x			
KWL Chart	x							
KWHLAQ Chart							x	
Learning Circles (Building Knowledge through Collaborative Projects).						x		
Neighbourhood Walk	x			x				
One Minute Paper						x		
Placemat							x	
PMI (Plus, Minus, Interesting)					x			
RAFT					x			
Reverse Mind Map				x				

Survey							x	
Think Pair Share								
Think Pair Square			x					
Thirty-Second Sound Bite								
U-Shaped Debate								x
Umbrella Questions								
Question Formulation Technique (QFT) "The Right Question"	x			x				
Q-Chart								x
Value Line								
V-Heuristics				x				
Video	x	x		x		x	x	x
Visual Processing Cards	x							

APPENDIX C. Subject Alignment Chart

	Science	Social Science	Business/Economics	Canadian World Studies	Guidance and Careers	Mathematics	Language Arts	Technology	Health and Physical Education
Inquiry 1. What is Climate Change and Why Care?	x					x	x		
What's the difference between weather and climate?	x								
Natural Greenhouse Effect: Life Giving vs. Life Threatening	x								
Carbon Dioxide Trends	x					x			
Inquiry 2. Climate Change: Where are we now?	x	x		x					
Scientific Consensus on Human-caused Climate Change	x								
Who's in Control?		x	x						
Policy investigation		x							
Inquiry 3. Monitoring Change: Using the Climate Atlas of Canada	x	x							
Climate Atlas Open Exploration		x				x			
Mapping and graphing local data	x					x			

Inquiry 4. Environmental Impacts and Restoration	x								
Individual or Group Research	x	x		x					
Inquiry 5. Human Health: Addressing Climate Change makes us Healthier	x				x				x
Vector-Borne Diseases and Climate Change	x					x			x
Student Exploration of the Global Impacts of Climate Change on Human Health	x								x
Climate Change & Health: Media investigation	x						x		x
Inquiry 6. A low carbon future: Economic Transitions, Risks and Impacts	x		x		x				
Planning for Flooding	x	x	x						
How much does carbon cost?	x	x	x			x			
Research Green Sector Careers			x		x				
Sustainability Products, Consumer Responsibility	x								
Inquiry 7. Climate Action and Decolonization: Indigenous Perspectives	x	x		x			x		
Sila Alangotok - Inuit Observations on Climate Change	x	x							
Placemat and Debate	x	x	x				x		
The Impact of Climate Change on the Arctic						x			

Inquiry 8. Ethical dimensions for children, youth and livable futures	x	x		x					
Climate Change Connections	x	x							
Climate Change and Child's Rights	x	x							

Find inspiration to help support your students taking action here:

- <https://promiseofplace.org/stories-from-the-field/stories-from-the-field>
- ESSAP guide page 37
- <http://ourcanadaproject.ca/>

Action Project Planning Guides:

- ESSAP guide page 41