CLIMATE CHANGE - IT'S NOT ALL DOOM AND GLOOM

75 MINUTES

SNC2D, SBI3U, SBI4U, SVN3M

A high school lesson plan provided by the University of Guelph

This lesson plan will introduce students to concepts pertaining to climate change, and allow them to explore the different affect climate change has on the earth and our society. Students will discover the differences between weather and climate, and learn about carbon and its role in climate change. The goal of these activities is to help students gain strategies to explain climate change and understand the things being done to address these challenges.

Curriculum Alignments and Expectations

- Analyse some of the effects of climate change around the world, and assess the effectiveness of initiatives that attempt to address the issue of climate change
- Demonstrate an understanding of natural and human factors, including the greenhouse effect, that influence Earth's climate and contribute to climate change
- Investigate various natural and human factors that influence Earth's climate and climate change
- Analyse ways in which societal needs or demands have influenced scientific endeavours related to the environment

Learning Objectives

- Build an understanding of climate change and the ways it can be observed globally
- Discover the differences between weather and climate
- Learn about carbon and its role in climate change
- Explore the different things that are being done to address climate change and the related careers and pathways
- Gain strategies to explain climate change to others

Assessment Strategies and Success Criteria

- Open-ended questions
- Class discussions and debrief
- Carbon footprint worksheet

Cross Curricular Links

- Biology - Sustainable Ecosystems
- Science - Scientific Investigation Skills and Career Exploration
- Chemistry - Gases and Atmospheric Chemistry
- Geography - Interactions in the Physical Environment
- Geography – Managing Canada's Resources and Industries
- Geography - Sustainability and Stewardship of Natural Resources

Materials

- Small pieces of paper and pencils
- Mini weather vs. climate quiz
- White boards or large paper
- Carbon footprint activity handout
- Calculators
- Scenario cards

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TEACHER NOTES

1. **Activity 1: Snowball - What is Climate Change?**

   Ask the students what they think climate change is. Hand each student a small piece of paper and give them no more than 2 minutes to write down their answer. Tell them to work individually and write down the first word or phrase that comes to mind, remind them it will be anonymous. Then pass a basket around and ask them to ball up their piece of paper and toss it in. Pull out random pieces of paper and read them and write down these words/phrases on the board, only pull out as many papers as time permits.

2. From the words/phrases in activity 1, recognize the breadth of the current knowledge or misconception of climate change of your students. Provide a proper definition and description of climate change.

   Climate Change: Most simply climate change is defined as a change in the global or regional climate patterns observed over a longer time period. When climate change is spoken of today it is most likely in reference to the global rise in temperatures over the last century or so.

3. Next, discuss "weather" vs. "climate".

   This a concept that can be easily confused. Make sure to relate this distinction to climate change while giving clear examples. If needed, show weather maps and climate maps to further solidify this point ensuring to point out the difference between time scales. People

   often assume that climate and weather are interchangeable, however while related and interconnected they are two very distinct concepts.

   Weather refers to the short-term; it is what we see reported on the news and changes from day to day & year to year, it is the condition of the atmosphere at a specific time. Weather is what it is like out today. For example, if it is cold and snowing right now; that is weather.

   Climate is measured over the long term; the climate in a region refers to things such as the seasonal temperature and precipitation averages of that area. It is important to note that different areas have different climates; there are generally 5 main climates: tropical, dry, temperate, cold and polar. Climate can subsequently be said to describe what the weather of an area is like over a long period of time.

   Climate change is, therefore, the long-term change of the temperature and a shift in the typical weather patterns of an area, it can be all encompassing of the entire globe or specific to a region.

4. **Activity 2: Is this an example of Weather or Climate?**

   Instructions: To check understanding of this distinction have students work in small groups of 3 or 4. Create slides or read each of the questions below (or your own). Using a set of small white boards or sheets of paper, have the students decide as a group and record if each is an example of weather or climate. Ask one or two groups why they chose their answer before revealing the correct response. This activity can become a competition where the group with most correct answers receives a prize

   EXAMPLES:

- Last year it rained on Halloween
  Weather: specific condition of the atmosphere on that day: short-term.

- Winters are historically colder in Winnipeg than they are in Toronto
  Climate: this is a long-term condition, overall it has been recorded that it is historically colder in Winnipeg than Toronto.
- The Sahara Desert is known for being hot and dry with average temperature of 30°C
  Climate: average is an automatic indicator that climate is being discussed, again this is long-term.
- If it is sunny tomorrow, I will go to the park
  Weather: this is the specific condition of the atmosphere at that time, a short-term condition.
- Jacks baseball game last night was rained out
  Weather: This was the weather at a specific time, the condition of the atmosphere "last night".
- The annual average snowfall in Winnipeg is 119cm
  Climate: again, average so climatic data over the long-term.

5. Discuss how climate change is being observed across the globe with visuals and videos. Refer to the previously defined climate and weather, ensuring that students understand these events/occurrences are being observed over a longer period and are becoming more frequent. Therefore, we can point to climate, it is not just a single random unprecedented weather event

   Videos
   Causes and Effects of Climate Change | National Geographic: https://www.youtube.com/watch?v=G4H1N_yXBiA (3 mins)
   Climate Change Animation Shows Devastating Effects: https://www.youtube.com/watch?v=S7jpMG5DS4Q (3 mins)
   1 °C and its impacts: what does climate change mean for Canada? https://www.youtube.com/watch?v=9SvlT6z5nhc (2.5 mins)
   Canada warming at twice the global rate, leaked report finds https://www.youtube.com/watch?v=CJybe_uZiQI (2 mins)

6. Next, ask students about carbon: What is it? Where is it found?

   Carbon: is a chemical element found on the periodic table, in its purest form it is diamond or graphite (lead in pencils!). It is essentially everywhere; it is the building block of all living things. This means that carbon itself is not a bad thing, as the planet and everything on it would not exist without it. When carbon is discussed in relation to climate change and global warming, most often what is actually being discussed is the gas CO2, which only occurs when we have one atom of carbon joining with 2 atoms of oxygen. It can also be in reference to other gasses such as methane and hydrocarbon which are also made up of carbon-based molecules. These gasses, known as greenhouse gasses, are extremely harmful to the planet and are the leading contributor to global warming and the greenhouse effect. When we are discussing our carbon footprint, we are talking about the amount of greenhouse gas being released as a result of an activity.

7. **Activity 3: Carbon Footprint Quiz**

   Instructions: To allow students to reflect on their own contribution to climate change and usage of carbon have them complete a carbon footprint quiz. Hand each student a copy of the worksheet (page 5) and have some calculators available if needed. Allow students about 5 minutes to complete the quiz individually.

Once complete, ask if there was anything that surprised them or changes they could make to reduce their carbon footprint.

Warning: make sure students know that this activity is simply a self-awareness and personal reflection activity - it is meant to be judgement free. Often an individual's footprint is larger than they expect and through this activity they can identify the actions they might take to have a positive impact on their carbon footprint.

8. Next bring up the positive initiatives and actions that are being done globally by scientists, researchers and students like themselves. Explain the different careers and pathways related to this field of science. Show students what they can do now and in the future if they want to be involved.

What is being done in Canada

- Paris Agreement
- Carbon taxes - putting a price on pollution
- Single use plastic elimination
- Cleaner Energy initiative

What is being done Globally?

- International Summits & Agreements
- Global shift to more sustainable eating
- International climate movements
- Shift to greener energy (slow)
- Emerging technology and new research

What can you do?

- Video: The Best Ways to Reduce Your Carbon Footprint https://www.youtube.com/watch?v=KdiA12KeSL0
- Get involved and start conversations
- Future careers and education in Environmental Science

9. **Activity 4: Scenarios - How would you respond?**

   Instructions: Have students broken up into groups of 4-6. Give each group a scenario card (page 6) and ask them to discuss in detail what strategies they would use to respond to their assigned scenario. Ask students to ensure they are using solid evidence and reasoning to back up their response. Give them 5-10 minutes to come up with an appropriate response, and then have each group share with the class. Debrief by discussing different strategies that can be used to respond when they are faced by scenarios like this is real life (page 7). Responding positively, explain yourself rather than simply giving out an overwhelming amount of scientific data, trying to explain what is going on in a way that they can relate, trying to see things from their point of view.

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Carbon Footprint Worksheet

Instructions: Answer the questions below, then fill in the corresponding values on the far right. Tally the values to find your carbon footprint. Only fill in one value for each question, unless otherwise stated.

1. How do you get to school?		
a) walk	a) 0	_____
b) bike	b) 0	_____
c) car	c) 1115	_____
d) bus	d) 131	_____
e) carpool	e) 459	_____
2. Do you eat mostly....		
a) fast food	a) 4818	_____
b) home cooked food	b) 629	_____
3. Do you eat mostly....		
a) vegetables/fruits	a) 153	_____
b) meat	b) 644	_____
c) bread	c) 364	_____
4. Do you unplug appliances/chargers when not in use?		
a) yes	a) 9	_____
b) no	b) 18	_____
5. Do you turn off lights when you leave a room?		
a) yes	a) 133	_____
b) no	b) 268	_____
6. How do you dry clothes?		
a) hang to dry	a) 0	_____
b) dryer	b) 750	_____
c) both	c) 375	_____
7. Do you turn off the water when brushing your teeth?		
a) yes	a) 34	_____
b) no	b) 274	_____
8. Do you turn off the TV when you're not watching it?		
a) yes	a) 47	_____
b) no	b) 140	_____
9. Do you turn off your video game system when you're not using it?		
a) yes	a) 29	_____
b) no	b) 90	_____
c) don't have/use one	c) 0	_____
10. Do you recycle? (for this question, select all that apply)		
a) magazines	a) -15	_____
b) newspaper	b) -90	_____
c) glass	c) -7	_____
d) plastic	d) -19	_____
e) aluminum and steel cans	e) -86	_____
Add together all the values in the far right column and report your total here		_____

This total is your "carbon footprint" in the number of pounds of carbon dioxide per year. The lower the number, the fewer greenhouse gases are emitted into the atmosphere.

CLIMATE CHANGE - IT'S NOT ALL DOOM AND GLOOM: Scenario Cards

Scenario 1: You are watching TV and a politician is discussing Climate Change, they do not believe it is a reality. Their reasoning is that it has been very cold out lately, and records have been broken on multiple occasions this winter for how cold it is outside, so how can global warming possibly be a real thing?

How would you respond? What evidence and reasoning would you give this individual to explain why they are incorrect?
Hint: Think about weather vs. climate!

Scenario 2: You are reading an article online about climate change in Canada and notice a comment at the end stating: it has been warmer in the past, i.e. 55 million years ago and the medieval warming period, so what's the big deal?

How would you respond? What evidence and reasoning would you give this individual to explain why they are incorrect?
Hint: Think about what the planet would have looked like 50 million years ago.

Scenario 3: You are a part of an environmental club at your school and are hosting an informational event. A student approaches you and tells you that they do not believe that their actions are contributing to climate change and they don't understand therefore, how them making any change is actually important.

How would you respond? What evidence and reasoning would you give this individual to explain why they are incorrect?
Hint: Think about the many ways an individual makes an impact.

Scenario 4: You are at the grocery store and overhear an older couple discussing how they do not care about climate change because by the time the real effects will be felt they will no longer be alive. They state that this is the younger generations problem anyways, they are the ones who caused it, so they must come up with the solutions.

How would you respond? What evidence and reasoning would you give this individual to explain why they are incorrect?
Hint: Think about what has been done in the past and the effects we are already feeling today.

Scenario: You are learning about climate change in class and when you go home you tell your older sibling about what you learned and the different things you can do. They respond by telling you that it is too late now and that we are all doomed anyways, so what is the point?

How would you respond? What evidence and reasoning would you give this individual to explain why they are incorrect?
Hint: Think about all the progress that is being made worldwide.

Scenario Answer Key: Solutions

Scenario 1:
- Weather is short term vs. climate is a long-term change in the waether
- Look at the different areas of the weather that are seeing more frequent and extreme weather events as the climate is changes (i.e. Australian bush fires)
- If we look at climate trends there has been an overall global warming

Scenario 2:
- 55 million years ago humans did not exist
- The planet was a completely different place, many of the species we see now did not exist
- There was a massive extinction at that time, sea levels may have risen as much as 30m. We may not survive these changes today
- It is also important to note that 55 million year ago this temperature increase is believed to have taken place over an extremely long time period
- We know that this current temperature increase is for a fact caused by humans

Scenario 3:
- Individuals contribute alone many tons of carbon in the atmosphere themselves every year
- This carbon directly contributes to the greenhouse effect
- Changes such as not driving a car, using an electric car, eating a plant-based diet and not using air travel can cut these amounts by many tons every year

Warning: Ensure when communicating about "plant-based diets" there is no application of judgement about whether students eat vegetarian, vegan or an omnivorous diet. Encouraging more "plant-based" is to reduce consumptions of animal products.

Scenario 4:
- Climate change has been a large issue for the past 100 years; however, it is just more recently that we are beginning to see the largest effects
- Coal burning, the use of oil and other fossil fuels has been directly contributing to the problem of climate change since the 1800s by leading to an increasing buildup of greenhouse gasses in our atmosphere (greenhouse effect)
- We are already seeing the effects as of now in increased flooding, forest fires etc.

Scenario 5:
- We still have about 30 years to truly make a change according the UN's IPCC report
- We need to move towards net zero carbon emissions, but it is possible
- Look at the new policies in Canada for climate change