

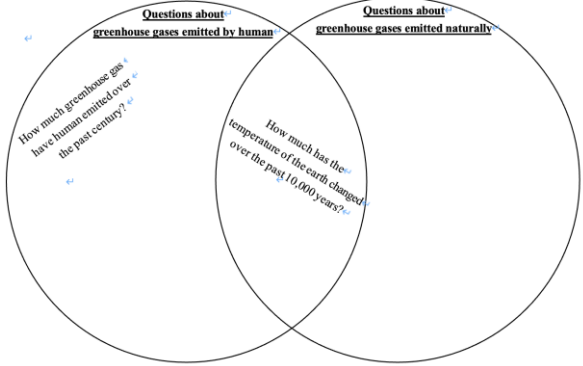
Gifted Education School Network 2023/24

STEAM Education

Key Learning Area: Integrated Science

Acknowledgements: This lesson example was adapted/ adopted from the try-out by Mr Chapman KONG of HKAGE College

Level	Secondary 2
Topic	Unit 7: Living Things and Air - Global warming
Lesson Duration	50 minutes
Learning Objectives	<p>Knowledge</p> <ul style="list-style-type: none">- To investigate whether humans or natural factors are the main cause of increases in global temperatures over the past century- To analyse whether the evidence supports claims about the causes of increases in global temperatures- To construct an argument for whether humans or natural factors are the main cause of increases in global temperatures over the past century <p>Skills</p> <ul style="list-style-type: none">- Forming and categorizing questions- Giving reasons- Weighting/ evaluating the quality of evidence and reasons <p>Values and Attitude</p> <ul style="list-style-type: none">- To be aware of impacts of human activities on global warming
Prior knowledge of students	N/A
Highlights of this exemplar	The goal of this activity is to build a deeper understanding of the evidence for the causes of the average increase in global temperatures over the past century. The lesson starts with a reading activity of how greenhouse gases cause global warming. An argumentation activity then provides two opposing claims about the causes of global warming, and student will write scientific questions to clarify which claim is better. Then students will examine eight pieces of evidence and identify which claim is supported. Finally, students will construct an argument for one of the claims and critique the alternative claim. The lesson help nurture creativity and higher-order thinking skills of scientifically gifted/more able students.
Differentiation Strategies employed	<ul style="list-style-type: none">● Flexible grouping● Higher-order questioning

Activities	Rationales for Implementation
<p>(A) Introduction</p> <p>Students are reminded of ground rule during the lessons that included listening to others attentively and showing respect for others' viewpoints.</p> <p>The teacher then introduce the objective of the lesson that is for students to use evidence and knowledge of the greenhouse effect to make an argument about the cause of the increase in the temperature of the Earth over the past 100 years.</p>	<ul style="list-style-type: none"> By establishing the ground rules, the teacher sets the tone of a class, provides clear guidelines on how to behave, decreases instances of incivility, and enables students to feel safe expressing their ideas or points of views. It helps create an open environment which is beneficial for developing higher-order thinking.
<p>(B) Stimulus - Reading to learn</p> <p>The teacher asks students to read the article about global warming and complete the diagram accordingly. Alternatively, the reading task can be assigned to students in the previous lesson.</p>	<ul style="list-style-type: none"> The reading activity can elicit students' prior knowledge of the greenhouse effect by having students label and interpret the diagram of greenhouse effect. The teacher then invites a few students to share their answers before displaying the suggested answer with PPT to align everyone's understanding.
<p>(C) Main activity 1 - Asking Questions</p> <p>The teacher presents the following scenario in the PPT to students:</p> <div style="border: 1px solid black; padding: 10px;"> <p>The Earth has warmed about 1.09 °C over the past century (100 years). Two students are discussing what has caused this change.</p> <p>Mary: I think greenhouse gas emissions from <u>human activities are the main cause</u> of the increase in temperature in the past century.</p> <p>Peter: I think greenhouse gas emission from <u>nature is the main cause</u> of the increase in temperature in the past century.</p> <p>Help Mary and Peter by completing the following Venn diagram. What questions would you ask to determine if Mary or Peter is correct?</p>  </div>	<ul style="list-style-type: none"> The teacher can provide some models for students and elicit possible questions. Students are then be asked to place their question into the Venn diagram (two Hula Hoops with the title cards). Two sample question cards should be placed in the Venn diagram. The teacher can also invite students to explain why they would ask these questions and how these questions help them determine if Mary or Peter is correct. Examples of the questions: <ul style="list-style-type: none"> How do human activities emit greenhouse gases? How fast does temperature change in the past century? What are some ways that nature emits greenhouse gases? How much greenhouse gas emitted naturally over the past century?

Students are divided into groups of 3-4. Each group will form and write a question on a piece of paper.

(D) Main activity 2 - Identifying evidence

An evidence card will be given to each group of students to examine the evidence and identify which claim is supported.

Humans emit over 10 times the amount of greenhouse gases they did a century ago.
Earth's hottest periods occurred before humans existed.
The temperature of the Earth in the past century has increased more than at any other time in the past 10,000 years.
Volcanos release greenhouse gases.
In 2010, humans released over 100 times the amount of greenhouse gases than all the volcanoes in the world.
Ninety-seven percent of papers in scientific journals support the idea that changes in the climate are caused by humans.
Methane and nitrous oxide are stronger greenhouse gases than carbon dioxide.
In the United States, from 1990 to 2020, there has been a 62% increase in the emissions of methane and nitrous oxide from livestock.

- The teacher can facilitate students' identification of evidence to which claim is supported by presenting an argumentation grid for students to complete.

Evidence ¹⁾	Whom does the evidence support? ²⁾		
	Mary ³⁾	Peter ⁴⁾	Neither ⁵⁾
Humans emit over 10 times the amount of greenhouse gases than they did a century ago. ¹⁾	☐	☐	☐
Earth's hottest periods occurred before humans existed. ²⁾	☐	☐	☐
The temperature of the Earth in the past century has increased more than any other time in the past 10,000 years. ³⁾	☐	☐	☐
Volcanos release greenhouse gases. ⁴⁾	☐	☐	☐
In 2010, humans released over 100 times the amount of greenhouse gases than all the volcanoes in the world. ⁵⁾	☐	☐	☐
Ninety-seven percent of papers in scientific journals support the idea that changes in the climate are caused by humans. ⁶⁾	☐	☐	☐
Methane and nitrous oxide are stronger greenhouse gases than carbon dioxide. ⁷⁾	☐	☐	☐
In the United States, from 1990 to 2020, there has been a 62% increase in the emissions of methane and nitrous oxide from the livestock. ⁸⁾	☐	☐	☐

(E) Main activity 3 – Evaluating whose claim is better

After examining the evidence, the teacher ask students to construct an argument for which claim is better using evidence and reasoning to support the claims.

- The teacher can facilitate students for developing arguments between the claims from Peter and Mary by asking the following tiered questions:
 - What is the evidence that support your claim that which idea is better?
 - What is a problem with (Peter/ Mary's) idea?
 - Prompt students to respond to each other's claim by restating/ agreeing or disagreeing other students' idea/ pressing for reasoning.
- In case the class discussion is mainly agreeing Peter's claim (i.e. nature is the

	main cause), the teacher can play devil's advocate for the scientific accepted idea (i.e. Mary's claim).
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