

Unit Plan: Arc-Tic-Toc: Climate Change and the Ticking Clock

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Date: September 1, 2013

Description:

Students will explore climate change and the landscape of the Arctic, including the Arctic Ocean, ice sheets and the tundra. Students will gain an understanding of the Inuit way of life, the animals that inhabit the Arctic, and the valuable resources found in the circumpolar north. Students will create an iMovie on one aspect of the Arctic environment or people that includes ideas for reducing one's carbon footprint.

Grade Level(s):

Grade 6-8

Subject(s):

Earth Science or Life Science (adaptable for use in social studies classrooms, too)

Duration:

2-3 weeks. One week for introduction and research and one-to-two weeks for the production of an iMovie on a specific Arctic topic selected by student.

Goal:

Students will learn about the Arctic and specific challenges currently faced in that region of the world and produce individual iMovies that reflect their personal visions. In order for students to understand how they can personally respond to Earth's changing climate—and to feel empowered for positive change—they will first address questions about the future prospects for life in the Arctic if current levels of global consumption and pollution continue. Students will consider and determine concrete best-steps to shape a better future.

Objectives:

Students will:

- Be motivated to learn by viewing and responding to primary source images about the Inuit lifestyle;
- Articulate causes of global warming and become climate literate;
- Develop and improve questioning tools for historical inquiry and critical evaluation;
- Understand the role of atmospheric gasses in climate change;
- Review climate change models focusing on the Arctic region to cultivate a sense of social responsibility;
- Choose and present a focus topic that will be researched in-depth;
- Produce an iMovie that includes at least one primary source and three action items that will lead to a more sustainable future;
- Consider real world issues related to U.S. responsibilities for causing and improving climate change.

Standards:

This lesson meets the following Colorado State Standards:

- Life Science 1: Human activities can deliberately or inadvertently alter ecosystems and their resiliency;
- Earth Science 1: Weather is a result of complex interactions of Earth's atmosphere, land and water that are driven by energy from the sun, and can be predicted and described through complex models;

- Earth Science 2: Earth has a variety of climates defined by average temperature, precipitation, humidity, air pressure, and wind that have changed over time in a particular location;

and Climate Literacy Standards:

- understands the essential principles of Earth's climate system;
- knows how to assess scientifically credible information about climate;
- communicates about climate and climate change in a meaningful way, and is able to make informed and responsible decisions with regards to actions that may affect climate.

This lesson also meets National Middle School Earth Science Standards in K-12 Framework of the NGSS:

- **ESS3.D: Global Climate Change**
Human activities, such as the release of greenhouse gases from burning fossil fuels, are major factors in the current rise in Earth's mean surface temperature (global warming). Reducing the level of climate change and reducing human vulnerability to whatever climate changes do occur depend on the understanding of climate science, engineering capabilities, and other kinds of knowledge, such as understanding of human behavior and on applying that knowledge wisely in decisions and activities. (MS-ESS3-5)
- **ESS3.C: Human Impacts on Earth Systems**
 - Human activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing the extinction of other species. But changes to Earth's environments can have different impacts (negative and positive) for different living things. (MS-ESS3-3).
 - Typically as human populations and per-capita consumption of natural resources increase, so do the negative impacts on Earth unless the activities and technologies involved.

Background Information:

Teachers new to the topic may want to review Supplement 1 to this unit, "Global Warming Teacher Notes" backgrounder. Prior to beginning this unit, students will have completed study of an Arctic food web and have an understanding of ocean topics through a prior unit on ocean water. They will be introduced to climate change science through the www.nasa.org website and a NOAA-produced activity about climate literacy. Students will have begun an iPad initiative in the fall and will already be familiar with iMovie production methods and techniques. Many students will also be familiar with the 2007 family documentary, *Arctic Tale*. If not, a portion will be shown in class and it will be available for students to "borrow" overnight.

Motivating Primary Source Documents:

- Image: Inuit killing salmon with spears, Canada (<http://www.loc.gov/pictures/resource/cph.3c12765>)
- Image: Mrs. Kleinschmidt a dinner guest in Eskimo igloo with dinner of frozen crab (<http://www.loc.gov/pictures/item/2005691857>)

NOAA Preassessment Activity:

Seven students argue about what they thought were major human causes of global warming. This is what they thought were causes that could be attributed to humans. Circle the name of the student or students that you agree with. Explain why you agree.

Maria: Acid Rain

Natalie: Burning coal

Tessa: the fuel we use in our cars

Anita: Toxic chemicals in air pollution

Blaine: Using leaded gasoline instead of unleaded

Raul: the thinning of the Earth's ozone layer

Van: Water pollution

Teacher Resources and Student Materials:

- “Global Warming Teacher Notes” backgrounder (see Supplement 1 pdf);
- NOAA Preassessment Activity (see Page 2 above);
- Teaching with Primary Sources Activity: Questioning Primary Sources (Supplement 2 pdf)
- Teaching with Primary Sources Photo Analysis Worksheet (Supplement 3 pdf)
- Post Unit Activity: Discover your Changing World with NOAA – Activity 8: Are you Climate Literate?” (Supplement 4 pdf);
- iPad with iMovie software;
- Internet and computer access for programs not compatible with iPad;
- Additional information to be developed by instructor and provided as handouts to students so that they have core information about the Inuit Circumpolar Council, Arctic Climate Impact Assessment (with rate of warming and accusation of human rights abuses by US as a result of climate change);
- Copy of National Geographic’s documentary film, *Arctic Tale* (2007).

Procedures:

1. Pre-assessment written assignment about causes of global warming will be completed by all students and discussed as a class.
2. Introduction to climate change in the Arctic by place students in table groups to view and respond to historical images, *Inuit Killing Salmon with Spears* using a *Photo Analysis Worksheet* (see Supplement 3 pdf). Groups will share their responses as a class upon completion of the activity.
3. Students will form different groups and carry out the *Questioning Primary Sources Activity* (see Supplement 2 pdf) with the primary source photograph Mrs. Kleinschmidt a dinner guest in Eskimo igloo with dinner of frozen crabs.
4. Students will be taken on a field trip to the world-renowned science institution NCAR to be more formally introduced to climate change through a special learning program offered in Boulder, Colorado.
5. Students will be provided with a brief history of the Inuit and their homelands in the circumpolar north. They will take guided notes regarding five possible effects of global warming in the Arctic. They will brainstorm predicted results and impacts related to: 1) melting of ice cap and ice sheets, 2) thawing of permafrost, 3) longer and warmer months, 4) more snow in winter and less sea ice in summer; 5) melting of summer sea ice using a provided table.
6. Students will watch the special features section, *Making of Arctic Tale*, from *Arctic Tale* and listen to the song from the movie, *Song of the North (Beneath the Sun)* before selecting a topic related to Arctic peoples, Arctic animals, or the environment of the Arctic for further research and eventual production of an iMovie on their chosen topic.
7. Students produce individual iMovies as per the rubric provided on Page 5 below.
8. View iMovies together as a class and have students review their earlier discussion at the outset of the unit (pre-assessment) about global warming.
9. Share with the class an interview that Sheila Watt-Cloutier, an Inuit activist, offered to *Ecokids* (see http://www.ecokids.ca/pub/eco_info/topics/canadas_north/people/swc.cfm). As a class, we will discuss the petition brought against the United States for human rights violations resulting from the impacts of global warming and climate change caused by acts and omissions by the United States. They will be considering real world issues and have a connection to the topic as it gains prominence in future years.
10. As a reward for learning so much on the topic, it is recommended that, as a class, students form teams to play “Discover Your Changing World”, a fun NOAA activity (Supplement 4 pdf).

Evaluation/Assessment:

The primary assignment for evaluation in this unit is the student-produced iMovie using the rubric provided on Page 4. The global warming knowledge test will also be used for evaluation.

Additional Notes:

This project would benefit from an expert guest lecture during the iMovie production phase to respond to student questions and ideas. This way students can also include first-person Q&As or add an authoritative voice to their iMovies.

Possible Extension:

Students could share their movies in the theater, rather than the classroom, so that their learning can be shared as a grade-level activity. Each of the four science classes could vote for their favorite films and awards could be offered to the top 3 winners. Whether or not this competitive aspect will motivate or intimidate students should be considered by the teacher regarding each individual group of students. Perhaps only those who choose to compete (decision made from the outset) will be eligible for the grade-level showing and potential prize (which should be significant enough to motivate most students).

Additional Resources:

Websites of additional interest to teachers and students are:

- <http://eo.ucar.edu/educators/ClimateDiscovery/ESS.htm>
- http://cleanet.org/clean/literacy/climate_lit.html
- <http://www.ncdc.noaa.gov/indicators/>
- <http://www.windows2universe.org/earth/climate/climate.html>
- <http://oceanservice.noaa.gov/education/discoverclimate/>
- http://oceanservice.noaa.gov/education/discoverclimate/NOAA_Activity%208_Are-You-ClimateLiterate.pdf
- <https://spark.ucar.edu/shortcontent/what-impacts-climate-earth>
- <https://spark.ucar.edu/longcontent/climate-and-ice>
- <https://spark.ucar.edu/simple-climate-model>
- <http://globalchange.gov>

Movie Evaluation Rubric for Arc-Tic-Toc Project

NB: Points will be doubled/tripled as needed.	Outstanding Effort 5 Points	Good Effort 4 Points	Improvement Needed 3 Points	Inadequate Effort 0-3 Points
Purpose and Content (10 Points)	Clearly relates to the learning objective or illustrates a concept.	Relates to the learning objective or illustrates a concept.	Some relation to the learning objective or a concept.	Does not relate to the learning objective or does not adequately illustrate a concept.
Storyboard Planning (15 Points)	Completed <u>detailed</u> storyboard with all of the following: 1) statement of purpose, 2) script, and 3) story-board of video "clips".	Completed storyboard with all of the following: 1) statement of purpose, 2) script, and 3) story-board of video "clips".	Completed storyboard with at least two of the following: 1) statement of purpose, 2) script, and 3) story-board of video "clips".	Storyboard not completed.
Titles, Transitions, And Effects (5 Points)	Titles and/or transitions <u>enhance</u> the video.	Titles and/or transitions do not detract from the video.	Attempts to use titles and/or transitions but they detract from the video.	No titles or transitions exist.
Video / Photos (10 Points)	Video and photos <u>relate well</u> to the subject.	Videos and photos mostly relate to the subject.	Videos and photos are few and some are off topic.	No videos or photos are included that relate to the subject.
Audio (10 Points)	Movie includes voice and music. Audio levels are <u>just right</u> .	Movie includes voice and music. Audio levels are too low or too loud.	Movie has only music. Audio levels are too low or too loud.	Movie has no sound.
Use of Technology (10 Points)	Skilled operation of computer and program <u>enhances</u> presentation.	Satisfactory operation of computer and program during presentation.	Minimal operation of computer and program during presentation.	Incorrect operation of computer and program detracts from presentation.
Presentation (20 Points)	Shared final product with audience, answered all questions knowledgeably and <u>clearly</u> explained the steps to production.	Shared final product with audience, answered some questions knowledgeably and explained the steps to production.	Shared final product with audience and attempted to answer questions and explain steps to production.	Incomplete or no final product to share.
Mechanics (5 Points)	Presentation has <u>no</u> misspellings or grammatical errors.	Presentation has fewer than two misspellings and/or grammatical errors.	Presentation has three or more misspellings and/or grammatical errors.	Presentation has four or more misspellings and/or grammatical errors.
Design (15 Points)	Clips and photos are <u>very appropriate</u> to the content and they communicate the information at a <u>high level</u> . Clips are long enough to convey meaning <u>without</u> being too lengthy.	Clips and photos communicate the content information effectively. Some clips are either too long or too short to be meaningful.	Clips and photos do not communicate the information well. Many clips are too long or too short and may even confuse the content.	The clips and photos interfere with Communication of the content. The clips do not make sense and seem randomly placed.