

What's the Bigger Picture?

Using the Power of Art to Teach Science

Overview

In this lesson, students combine art and science to interpret and illustrate graphical art. In this way, students will build understand of the power of data-infused art to convey the “bigger picture” of climate change. “Hot issues, such as climate change, may not be subjects of contention within the scientific community, but it seems clear that the science is not being communicated in a way that has the necessary impact. Although art cannot directly communicate science or change minds, it can create a space for dialogue around difficult issues” (Kieniewicz).

The original version of this lesson was written in 2016 by Joanna Chierici, Kathleen Couchon, and Nancy FitzGerald for the Monterey Bay Aquarium Research Institute’s (MBARI) EARTH program. The original resources can be accessed at mbari.org/what-is-the-bigger-picture. This version was adapted by permission in 2020 by Shape of Life. The updated resources are found at shapeoflife.org/lesson-plan/sol/whats-the-bigger-picture.

Subjects

Science, Art, Writing, Reading

Grades 5–12

Time

60 minutes or more

Vocabulary

As needed during student research

Guiding Questions

- What issues are associated with climate change?
- What data do scientists collect that provide evidence of climate change?
- How and where is this data collected?
- How can this issue be brought to light in mainstream society through the use of art?

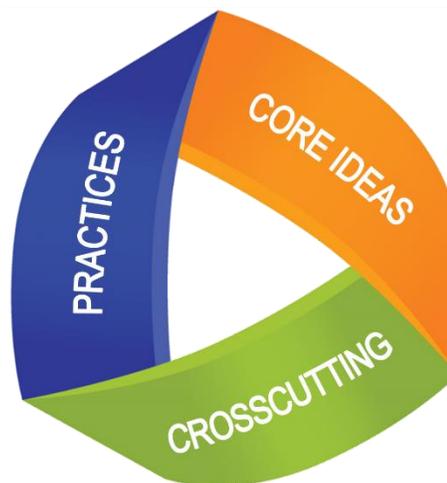


“Habitat Degradation: Ocean Acidification” by Jill Pelto:
jillpelto.com/ocean-acidification

Standards		Middle School / High School
<p>Next Generation Science Standards</p> 	Sample Disciplinary Core Ideas met	LS2: Ecosystems Interactions, Energy, Dynamics LS2.A: Interdependent Relationships in Ecosystems LS2.C: Ecosystem Dynamics, Functioning and Resilience ESS2: Earth Systems ESS2.C: The Roles of water in Earth Surface Processes ESS2.D: Climate and Weather ESS3: Earth and Human Activity ESS3.C: Human impacts on Earth Systems ESS3.D: Global Climate Change
	Sample Crosscutting Concepts (all can be incorporated)	<ul style="list-style-type: none"> • Patterns • Cause and Effect • Scale, Proportion, and Quantity • Systems and System Models
	Science & Engineering Practices (all can be incorporated in lesson)	<ul style="list-style-type: none"> • Asking Questions + Defining Problems • Developing and Using Models • Planning and Carrying Out Investigations • Analyzing and Interpreting Data • Using Math and Computational Thinking • Constructing Explanations and Designing Solutions • Engaging in Argument from Evidence • Obtaining, Evaluating, and Communicating Information

Teacher Background

Phenomena-Driven Inquiry refers to the process of using observable scientific phenomena to engage students and help guide the learning process. **Three-Dimensional Learning** refers to how the Next Generation Science Standards (NGSS) seeks to weave together the Science and Engineering Practices (SEPs), Crosscutting Concepts (CCs), and Disciplinary Core Ideas (DCIs) in student learning. Through the process of DOING science and engineering, students apply the Three Dimensions, helping them see the interconnections among disciplines as they develop their scientific, critical thinking, math, and English Language Arts (ELA) skills. This lesson provides a scaffolded exploration of the SEPs and CCs through the inclusion of graphic organizers that help students dig into the many important practices and concepts that scientists use in their investigations. This will help prepare students to conduct their own meaningful and reliable investigations and share their results with others in compelling ways.



The Three Dimensions of the Next Generation Science Standards (NGSS)

Materials + Preparation

- Different pieces of graphical art for students to analyze, such as those found in:
 - “What’s the Bigger Picture” PowerPoint available at shapeoflife.org/lesson-plan/sol/whats-the-bigger-picture.
 - Artist images and exemplars: jillpelto.com/#intro

- Higher-resolution images (and prints available for purchase) on her “Glaciogenic Art” Etsy site: [etsy.com/shop/GlaciogenicArt](https://www.etsy.com/shop/GlaciogenicArt)
- Additional resources available at shapeoflife.org/lesson-plan/sol/whats-the-bigger-picture:
 - “Graph Analysis Worksheet”
 - “Summative Rubric”
- Computer access and/or books or other reference materials
- Art supplies, which may include drawing materials, paper, colored pencils, markers, watercolors, paint brushes, etc.

Teaching Suggestions in the 5E Model

Engage

1. “Hook” students and introduce the lesson. (3 – 5 min.)

- Have students view Jill Pelto’s images (found on both the PowerPoint and her website, jillpelto.com), and record observations about the images. Be sure to use images that have graphs incorporated in them.
- Once students have had sufficient time to make observations, discuss what they have observed, the trends or patterns that exist, and what the image is trying to convey. If students have not already identified that a graph exists in the artwork, be sure to point that out.



“Dwindling Migration” by Jill Pelto:
[etsy.com/listing/724268771/dwindling-migration](https://www.etsy.com/listing/724268771/dwindling-migration)

Explore

2. Have students analyze graphical artwork. (3 – 5 min.)

Give small groups a graph to analyze. There are many to choose from in the Gallery section of the website. All of the graphs have data relating to climate change. **Do not tell the students this at this time.** Choose a group of graphs that you feel are appropriate for your grade/ability level in your class. Have students identify the trends/topics of their graph. You may want to have students use the Graph Analysis Worksheet to lead them in the process.

Explain

3. Provide the students with information about the artist. (3 – 5 min.)

- See the PowerPoint or jillpelto.com for more information.
- Show the students the “artist statement” that accompanies each image (also available on the PowerPoint or website).
- Ask students to share their thoughts about the images orally and/or in writing.

4. Discuss the artists' statement with the class. (3 – 5 min.)

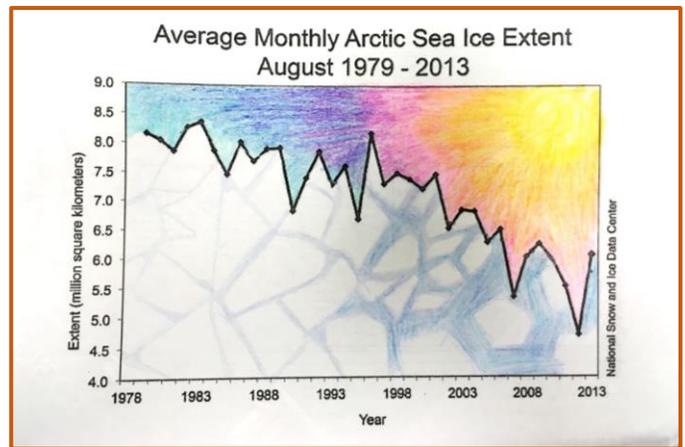
- You may want students to annotate the statements and find commonalities between them.
- Lead students into identifying that the statements include a concise, scientifically-based description of the issue with appropriate references cited.

5. Students research the topics of their graphs. (5 – 10 min.)

- Students should research the topics of the graphs they analyze to gain a better understanding of them.
- Guide students in choosing scientifically accurate and appropriate websites, books, and/or other sources for their research.

6. Have students create their own graphical image to convey the concept(s) in an imaginative way. (10 – 20 min.)

- Once students have accurately interpreted and analyzed their graphs and researched the concepts, tell students to decide upon an image (modeled after Jill Pelto), that would best communicate the issue in an imaginative and creative way.
- Encourage students to think of imagery that evokes an emotional connection. They may use markers, watercolors, colored pencils, or another artistic medium to create their imagery.
- Students can use the Summative Rubric available at shapeoflife.org/lesson-plan/sol/whats-the-bigger-picture to help guide them in the development of their projects.



Decrease in Monthly Arctic Sea Ice Extent from August 1979-2013. Interpreted by Samantha, Age 14

Extend / Enrich

7. Students develop an artist's statement (modeled after the exemplars) to accompany their images. (5 – 15 min.)

- Remind students to include references.
- Students can use the Summative Rubric to help them craft quality statements.

8. Conduct a "Gallery Walk" of student work. (5 – 7 min.)

- As students are progressing through the gallery, they should make observations, note patterns, and define problems.
- Encourage students to ask questions and clarify the concepts as they take notes.
- Learn more about Gallery Walks:
theteachertoolkit.com/index.php/tool/gallery-walk

9. Invite the wider community to view and celebrate the art. (Will vary)

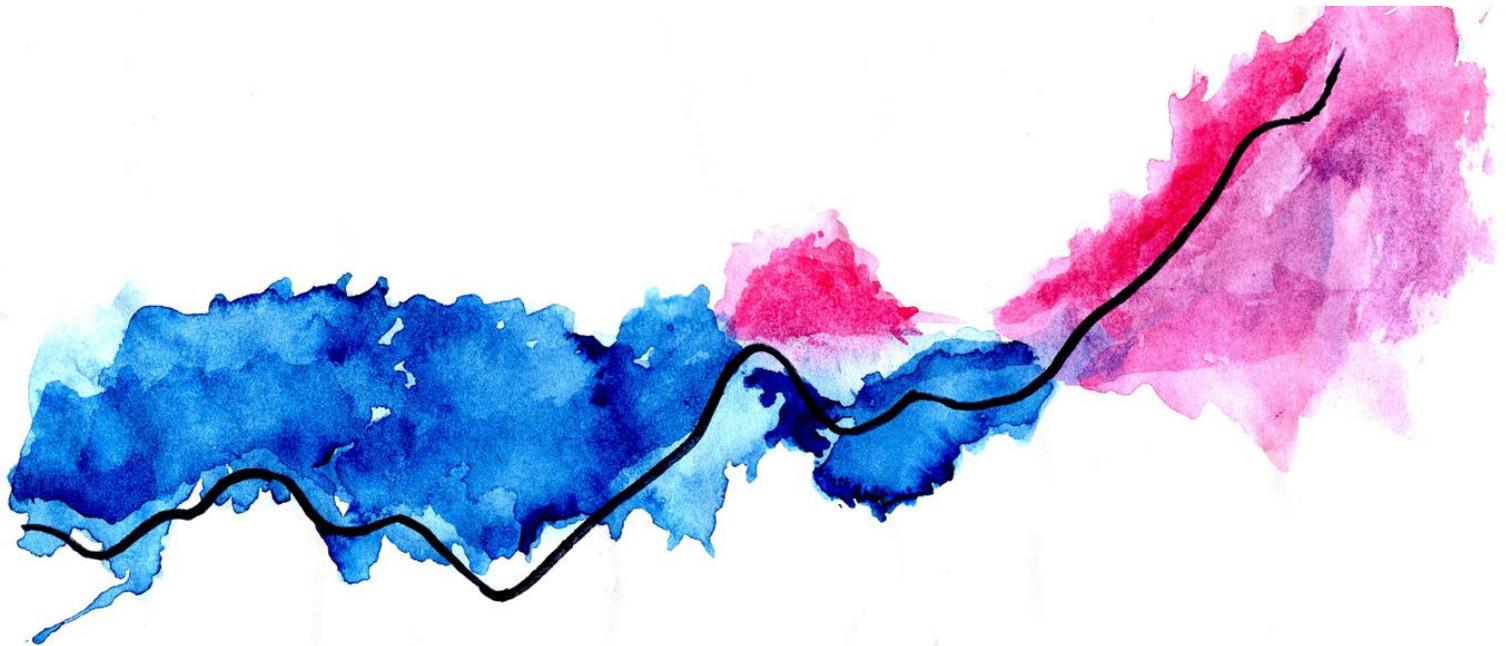
- Display the student art publicly in community centers, school spaces, partner businesses, etc.
- Invite families and community leaders to attend a “Graphical Art” opening celebration.
- Invite groups such as local environmental nonprofits to participate and share information about how the community can take action to address the issues raised by the art.

Evaluate

10. **Formative assessment:** As students are working with the graphs, ask probing questions to be sure students understand the graph, the trends, and the information being presented.

11. **Summative assessment:** Using the information the students gathered in their gallery walks, students should answer the following question orally and in writing:

- “What is the Bigger Picture” that is being presented in all the data?
 - Tell students they should support their claim with logical reasoning, relevant and accurate data, and evidence that demonstrates their understanding of the topic.
 - They should include the broader issue the data is illustrating, as well as the trends that support their claim(s).



Rising Global Temperatures
Alysza, Age 15

Expand Knowledge + Skills

Sources/Copyright Links

Links for graphs that could be used in this lesson, as well as some background information about the data:

- “Ice Shelf Melting Around Antarctic”: science.sciencemag.org/content/341/6143/266.figures-only
Explanation: science.sciencemag.org/content/341/6143/266
- Penguins population graph: pal.lternet.edu/images/sci-research/transformational_science/3.4.png
Explanations:
 - Dehnert, E. (2014). “Gentoo Penguins Thrive, While Adelies and Chinstraps Falter in a Climate-Changed World.” *Scientific American*: scientificamerican.com/article/gentoo-penguins-thrive-while-adelies-and-chinstraps-falter-in-a-climate-changed-world
 - Sidder, A. (2016). “Antarctica Could Lose Most of Its Penguins to Climate Change.” *National Geographic*: news.nationalgeographic.com/2016/06/adelie-penguins-antarctica-climate-change-population-decline-refugia
- “Keeling Curve Lessons.” Includes graphs from the Scripps CO₂ Program: scrippsco2.ucsd.edu/history_legacy/keeling_curve_lessons
- “Trends in Atmospheric Carbon Dioxide.” NOAA: esrl.noaa.gov/gmd/ccgg/trends/graph.html
Explanation: pmel.noaa.gov/co2/story/Ocean+Carbon+Uptake
- “Ice Sheets.” Graphs and explanation from NOAA: climate.nasa.gov/vital-signs/land-ice
Additional information: “Arctic Sea Ice 101.” National Snow and Ice Data Center (NSIDC): nsidc.org/cryosphere/icelights/arctic-sea-ice-101
- “Sea Level” Satellite Data and Ground Data graphs and explanation. NASA: climate.nasa.gov/vital-signs/sea-level
- “Arctic Sea Ice Extent Standardized Anomalies” graph and explanation. NSIDC: nsidc.org/cryosphere/sotc/sea_ice.html
- “Arctic Sea Ice Blog,” graphs, and explanation: neven1.typepad.com/blog/2016/02/piomas-february-2016.html
- “Arctic Sea Ice News & Analysis.” Includes graphs from the NSIDC: <http://nsidc.org/arcticseaicenews>

Standards and Three-Dimensional Learning

- Next Generation Science Standards, including a link to the *Framework for K-12 Science Education* to which this lesson was aligned: nextgenscience.org/framework-k%E2%80%9312-science-education
- Examples of what NGSS looks like for California students can be found in the 2016 Science Framework for California Public Schools: cde.ca.gov/ci/sc/cf/documents/scifwchapter4.pdf
- “Three Dimensional Learning.” Next Generation Science Standards: nextgenscience.org/three-dimensions
- “NGSS EQulP Rubric: 3-Dimensional Learning.” Video. TeachingChannel: nextgenscience.org/sites/default/files/EQulPRubricforScienceev3.pdf
- NGSS EQulP Rubric for Lessons & Units: Science. Ver. 3.0: nextgenscience.org/sites/default/files/EQulPRubricforScienceev3.pdf
- Common Core State Standards and links to the complete documents: corestandards.org