Visualization: A Professional Development Exemplar

Alan Feldman

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NEIRTEC is a collaboration of Education Development Center (EDC), TERC, Learning Innovations at WestEd, and the Education Alliance at Brown University. NEIRTEC is one of the ten Regional Technology in Education Consortia funded by the U.S. Department of Education.

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The Knowledge Loom is a free, web-based professional development resource for educators maintained by The Education Alliance at Brown University.

For more information about The Knowledge Loom, contact The Education Alliance: loom@lab.brown.edu

NEIR TEC DTI

Instructional Design Template

Visualization: A Professional Development Exemplar

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Overview

Unit Focus

Geographic Visualization

Grade/Professional Development Level

K-12 (all subjects). See Description of Learners.

Duration of Unit/Professional Development Experience

60 to 90 minutes

Learners and Contexts

Description of Learners

Learners are teachers K-12 (any subject), leaders of professional development, technology integration specialists, or administrators. The content of this lesson was developed with upper elementary school and middle school students in mind, and this professional development version of the lesson has been tested with educators K-12.

Context Analysis

Context could be one activity in mult-day institute or as a single activity used in a school-based professional development day to stimulate extended discussion about appropriate pedagogy and use of technology (perhaps using the model of "lesson study").

Goals and Standards

Essential Question

This activity unfolds on two levels, and each has its own Essential Question:

1. (content level) How do the Earth's atmosphere, land, and water interact to create weather patterns?
2. (pedagogy level) How can the rich quantity of information that is encoded into visual representations be used to create opportunities for student learning?

Goals

1. Draw attention to the Earth as a system that includes atmosphere as well as land and water.
2. Develop skills using visual information, including sketch maps.
3. Use technology to support learning through inquiry.

Alignment with standards/frameworks

National Geography Standards (1994), grades 5-8:
a. the student knows and understands how to translate mental maps into appropriate graphics to display geog info and answer geog guestions;
b. the student knows and understands how to draw sketch maps of different regions and compare them with atlas maps to determine the accuracy of place location and knowledge.

Increasing access for all learners

By focusing on visualizations, this kind of lesson is accessible to students whose text literacy skills are weak. Typical learners for this professional development version --educational professionals --do not have this issue, but the value of visualizations for representing complex information is evident for this group as well.

Performance Objectives

1. Learners will routinely apply the terms "mental map" and sketch map" in their discussions of how students learn geography.
2. Working informally in groups, learners will identify at least 15 geographic features of the earth visible in photograph from space.
3. Working individually, learners will identify where (on a diagram of the earth) clouds are likely to be and state at least two reasons why they would be there.
4. Looking at photos of cloud cover from space, learners will identify at least 3 typical cloud patterns including the one caused by the Coriolus effect.
5. Learners will be able to describe and apply at least four different good practices for using visualizations as part of their lessons.

Instructional Activities and Assessments

Introduction/Pre-Instruction

Note: Powerpoint presentation is available for download. Specific slides are references in the description of activities.

1. Set the goal for the lesson as linking visualizations to student learning (slide 3).
2. Show real time image of earth from space (slide 4 --see URL for current image). Ask group to "read" the image and its surround to determine that this image is actually taken within the last six hours. Emphasize link to student learning (slide 5).
3. Link to standards (slides 6, 7), especially "mental maps" (http://www.ncge.org/publications/tutorial/standards/ee1/standard2.html) and "sketch maps" (National Geography Standards, 1994, p. 146-147). Show (very rough) sketch maps (slides 8, 9) to demonstrate the ability of the human brain to attribute specific references to very rough diagrams.

Introduction/Pre-Instruction Assessment

Observe the ability of the group to find information on the initial visualization activity (slide 4). Give them time and support as needed to locate date/time stamp and keys for temperatures.

Instructional Activities

Part I. Show image of earth from space (slide 10); ask participants to talk about what they see. Initially, emphasize *what* they see, eg, colors and shapes; and ask them to avoid inferences, eg, rain forest.

Next, ask them to identify geographic features: continents, oceans, deserts, etc. Pass out atlases or other resources. Participants sketch the image on a blank piece of paper and label specific geographic features. Start this as a group, then ask everyone to do their own sketch. Provide fewer resources than participants in order to encourage participants conferring w/ each other.

Review as a group.

Part II. Ask students if they notice anything unusual about the photo they have been working with. Typically, the class will comment on the absence of clouds. Establish that there is never a cloud-free day on earth (despite our personal experience). Refer to image used in Introductory activity which has cloudy scattered. Explain that this photo was a collage (composite) of many photos taken at different times.

Ask, Where would clouds be on a typical day? Pass out Activity Sheet (slide 12): participants draw in clouds and write why they put the clouds where they did. Circulate and encourage each participant to write the "why" statement.

Debrief participants' work.

Show photo of earth from space (slide 13) --this time, with clouds. Ask students if their predictions were correct. Ask about patterns that they see in the clouds, including swirling in counter-clockwise direction that is the result of Coriolus effect.

Show student work, if available. (I use work I've done with fifth grade students, included as slides 15 to 17.)

Part III. Debrief the activity. You can use slide 18 as summary of discussion. This slide is a very helpful handout, along with slide 19 (web sites).

Assessment

Part I. Notice the ability of the class to keep to the "what" in slide 10. Notice the class's increasing attention to details, e.g., continents on the periphery of the image and lakes/rivers in Africa.

Part II. Notice how participants represent clouds on the Activity Sheet. Notice students who are clear in their thinking or who are very hestitant (often their drawings will be very lightly sketched).

Part III. Participants' level of understanding will be evident in the summary discussion.

Assessible end product/activity

In Part III,
Ask, what teaching techniques were used in this lesson?
Ask, what role did technology play in this lesson?

End product/activity assessment

1. Participants should be able to anticipate many (if not all) of the six "guidelines" (see handout).
2. Notice ability of participants to see that role of technology is broader than students using computers; that teachers presenting authentic documents such as this visualization is a key use of technology.

Implementation and Reflection

The Big Picture

This lesson is often presented as part of our institutes, as one of several GMOTT (Good Models of Teaching with Technology) exemplars. This unit highlights the way that technology can be used for instruction in the very common situation where there may not be a computer in the classroom. The teacher needs access to a computer to download the images; when I lead this lesson, I use transparencies for most of the images to highlight the reality that a teacher may not have a computer in his/her classroom, ie, s/he may be using a computer in the library or at home.

Implementation Timetable

Implementation Reflection: Goals

This lesson is very successful in achieving the stated goals.
One area where I've added to the unit —I've downloaded Earthbrowser software (free for demo version) and show the power of this software to help students explore the earth. See earthbrowser.com.

Implementation Reflection: Performance Objectives

GMOTT: Visualization

PowerPoint Presentation Handouts

This PowerPoint presentation can be downloaded at

http://knowledgeloom.org/gmott/resources/visualization_lesson.ppt.

GMOTT: Visualization

Alan Feldman

TERC

Credits

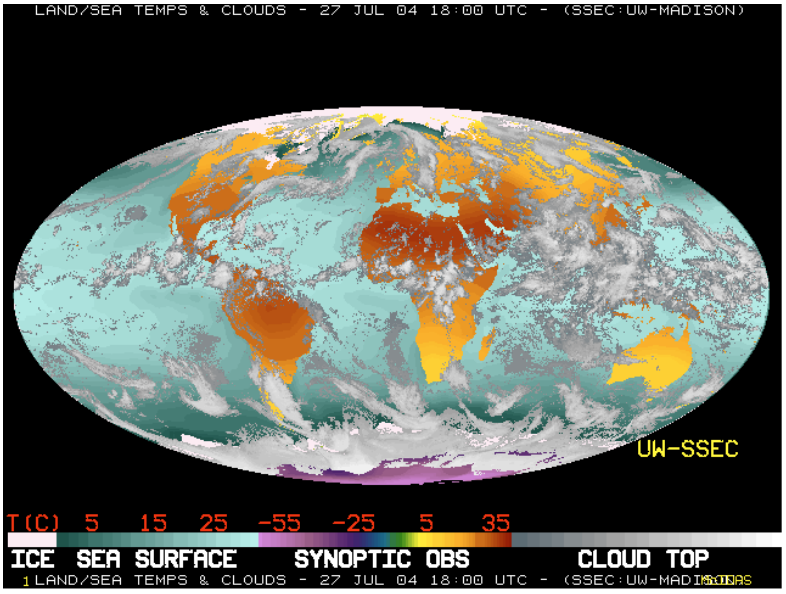
This lesson is adapted from materials developed by TERC staff as part of the "Visualizing Earth" project (http://visearth.ucsd.edu), under funding from the National Science Foundation.

The lesson has been presented by TERC staff as a Good Model of Teaching with Technology (GMOTT) Exemplar within projects MEET and NEIRTEC. Contact Alan Feldman at TERC for more information.

Goals

- Draw attention to the Earth as a system that includes atmosphere as well as land and water
- Develop skills at using visual information, including sketch maps
- Use technology resources to support learning through inquiry

http://www.ssec.wisc.edu/data/comp/latest_cmoll.gif



National Geography Standards
Grades 5-8 (1994)

C. Draw sketch maps from memory and analyze them, as exemplified by being able to

Translate a mental map into sketch form to illustrate relative location of, size of, and distances between places (e.g., major urban centers in the United States)

Prepare a sketch map of the student's local community to demonstrate knowledge of the transportation infrastructure that links the community with other places (e.g., approximate locations of major highways, rivers, airports, railroads)

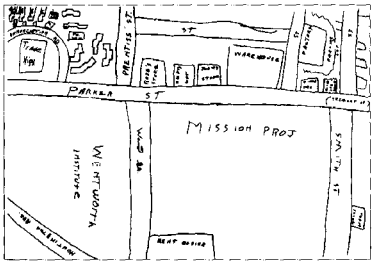
Draw a world map from memory and explain why some countries are included (and others not), why some countries are too large (and others too small)

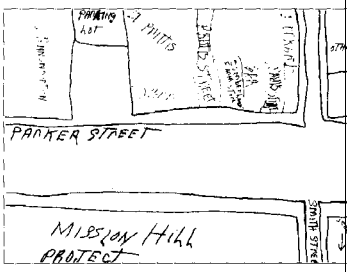
D. Analyze ways in which people's mental maps reflect an individual's attitudes toward places, as exemplified by being able to

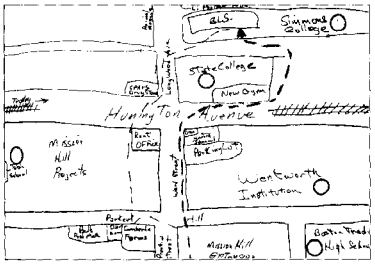
Identify and compare the different criteria that people use for rating places (e.g., environmental amenities, economic opportunity, crime rate)

Analyze sketch maps produced by different people on the basis of their mental maps and draw inferences about the factors (e.g., culture, education, age, sex, occupation, experience) that influence those people's perceptions of places

Compare passages from fiction to reach conclusions about the human perception of places (e.g., Las Vegas as exciting, Paris as romantic, Calcutta as densely settled)

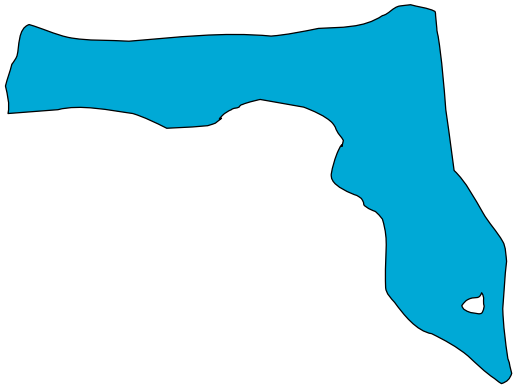




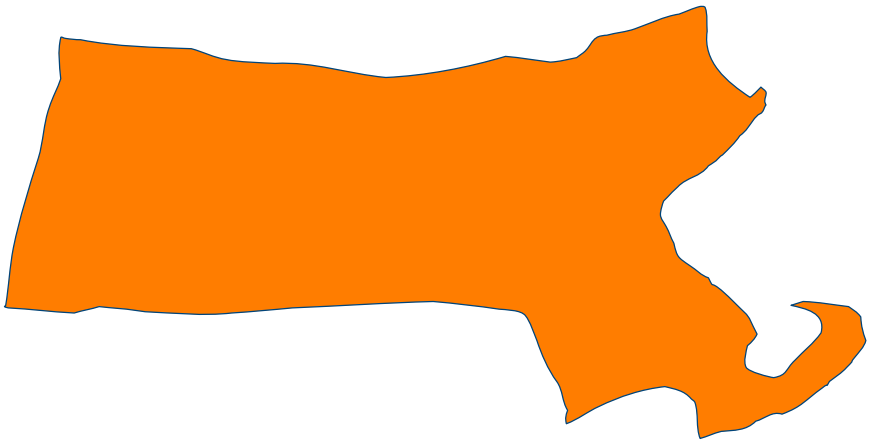


Three African-American students drew mental ma of their neighborhood in Boston: one (top left) kn only that the Mission Hill project is where white children live; he has never gone near it. The seco (top right) has reduced the size of the project but increased the width of Parker Street, the division between the black and white neighborhoods. Both attend neighborhood schools; the third attends th well-known Boston Latin School. He has reduced the scale of the project but located five education institutions, indicating the importance of education for him. SOURCE: *MENTAL MAPS*

Sketch map #1



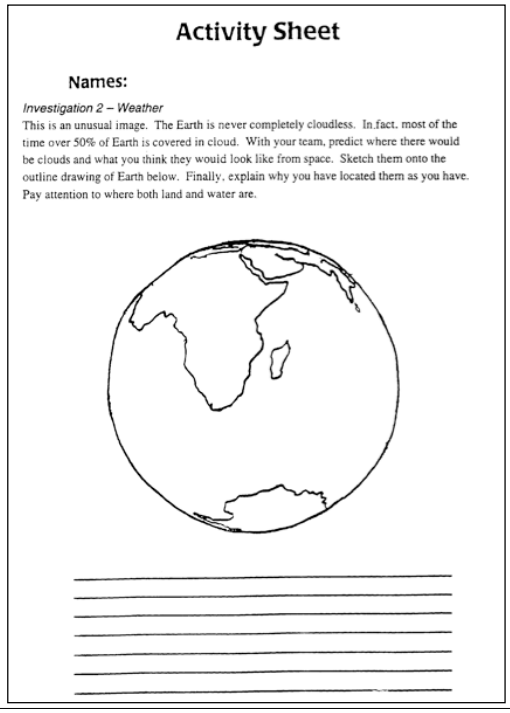
Sketch map #2



Note on photograph

Face of the Earth™

This classic image was created in 1995 by ARC Science Simulations, using modeling technology. It is based on the view of the earth from space shown in the earlier photograph. See http://www.arcscience.com/face.htm for more information.



Activity Sheet

Names:

Investigation 2 – Weather

This is an unusual image. The Earth is never completely cloudless. In fact, most of the time over 50% of Earth is covered in cloud. With your team, predict where there would be clouds and what you think they would look like from space. Sketch them onto the outline drawing of Earth below. Finally, explain why you have located them as you have. Pay attention to where both land and water are.

Note on photograph

This photograph was taken on December 7, 1972 by the Apollo 17 crew traveling toward the moon. (Photograph AS17-148-22721 courtesy NASA-JSC Gateway to Astronaut Photography of Earth.)

To download this image – go to:
http://eol.jsc.nasa.gov/scripts/sseop/photo.pl?mission=AS17&roll=148&frame=22721

"Image courtesy of Earth Sciences and Image Analysis Laboratory, NASA Johnson Space Center."

Names: Jonathan, Peter

Investigation 1—Getting Oriented

This is an unusual image. The Earth is never completely cloudless. In fact, most of the time over 50% of Earth is covered in cloud. With your team, predict where there would be clouds and what you think they would look like from space. Sketch them onto the outline drawing of Earth below. Finally, explain why you have located them as you have. Pay attention to where both land and water are.

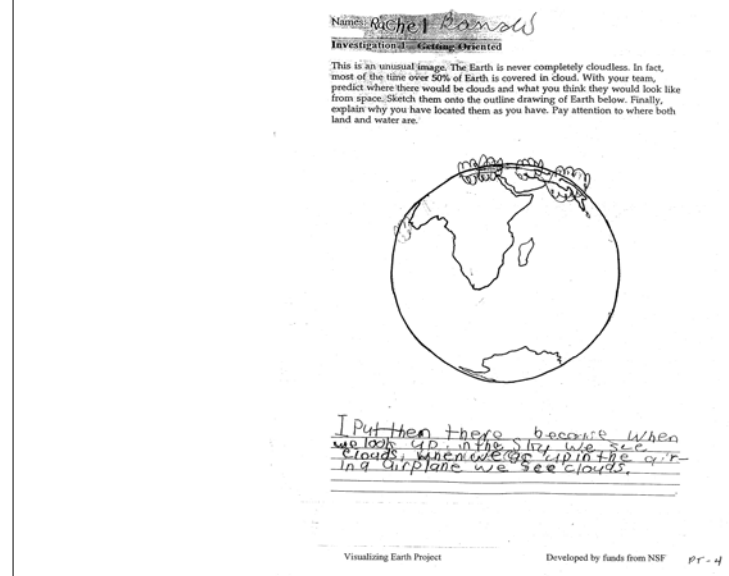
Clouds are made out of rain and cool air. In Deserts there wont be that much clouds because it is so warm and they would evaporate quicker. Where their is lots of snow melt there will be more clouds because more water evaporating.
By Jonathan Lord

Names: Becka Blocker, Gillian Gallagher

Investigation 1—Getting Oriented

This is an unusual image. The Earth is never completely cloudless. In fact, most of the time over 50% of Earth is covered in cloud. With your team, predict where there would be clouds and what you think they would look like from space. Sketch them onto the outline drawing of Earth below. Finally, explain why you have located them as you have. Pay attention to where both land and water are.

the clouds go over the green parts of the earth because that's where the most vegetation so it needs water to grow, but there isn't clouds around antarctica because you need warmth to make evaporation and you need evaporation to make a cloud, but there isn't heat near poles so there can't be evaporation and there can't be clouds. BUT THERE IS!



Name: Rachel Ronald

Investigation 1 – Getting Oriented

This is an unusual image. The Earth is never completely cloudless. In fact, most of the time over 50% of Earth is covered in cloud. With your team, predict where there would be clouds and what you think they would look like from space. Sketch them onto the outline drawing of Earth below. Finally, explain why you have located them as you have. Pay attention to where both land and water are.

I Put them there because when we look up in the sky we see clouds, when we go up in the air in a airplane we see clouds.

Visualizing Earth Project Developed by funds from NSF pg - 4

Guidelines for Teaching and Learning with Geographic Visualizations

- Start with what students know; build on both their curiosity and intuition
- Provide opportunities for students to construct ideas individually collaboratively
- Allow time for students to explore and become oriented to the form and content of visualizations
- Provide resources for students to connect the contents of visualizations to alternative representations
- Focus on images and visualizations as a source of questions as well as evidence for conjectures
- Explore questions of what? And where ? Before addressing questions of how? And why?

Geographic Visualization Web Sites

Earth and Moon Viewer
http://www.fourmilab.ch/earthview/vplanet.html

Global Montage Latest Image of Current Weather
http://www.ssec.wisc.edu/data/comp/latest_cmoll.gif

Global Montage Animation of Current Weather
http://www.ssec.wisc.edu/data/comp/cmoll/cmoll.html

GLOBE Program
http://www.globe.gov

Spacelink
http://spacelink.nasa.gov

SSEC Realtime Data
http://www.ssec.wisc.edu/data/

Visualizing Earth
http://visualizingearth.ucsd.edu/toc.html