Using Google Earth to Explore and Evaluate the Aral Sea

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Overview

Google Earth® is a powerful instructional tool in the geography classroom. It also can be used by students in a lab setting to spatially explore and analyze. The Aral Sea disaster is one of the worst environmental disasters of our era. This lesson uses Google Earth® to approach this disaster spatially. This lesson compliments any curriculum dealing with environmental issues in a geography classroom. Students will be expected to explore this topic using Google Earth® and evaluate it for themselves in a guided group discussion.

Time Required

Two to three 50 minute class periods depending on how much Google Earth® tutorial is needed.

Preparation

For this lesson, teachers will need to install free Google Earth® 7 software (http://www.google.com/earth/index.html) and familiarize themselves with the lesson using the software. If the exploration is completed by students in a computer lab, the software will need to be installed in the lab.

Geography Standards

1. The World in Spatial Terms – How to use maps and other geographic representations, geospatial technologies, and spatial thinking to understand and communicate information
14. Environment and Society – How human actions modify the physical environment
18. The Uses of Geography – How to apply geography to interpret the present and plan for the future.

Geography Skills

1. Asking Geographic Questions
2. Acquiring Geographic Information
4. Analyzing Geographic Information
5. Answering Geographic Questions
Opening the Lesson

1. Using a map of the world show the class where the Aral Sea and surrounding countries of Uzbekistan and Kazakhstan are located. Tell them that the Aral Sea used to be the world’s fourth largest lake. Explain that it has been disappearing at an alarming rate and it will be their job to explore this for themselves and evaluate factors causing this and the overall impact on humans and the environment. If time, have students label the following on a blank outline map of Central Asia: Aral Sea, Amu Darya, Pamir Mountains, Syr Darya, Tian Shan Mountains, Uzbekistan, and Kazakhstan. An excellent outline map is available through Arizona Geographic Alliance at (http://alliance.la.asu.edu/maps/centralasia.pdf).

2. Use Google Earth® to locate the Aral Sea. This is best done in a lab setting where students can go find it themselves. Prior tutorial to students on Google Earth® would be useful. If a lab setting is unavailable, this can be completed as a class with a projector while students are partnered in groups of 3 or 4.

3. Have the students adjust the settings for exploration.
   - Under Layers on the side pane check: Borders and Labels
   - Under View click Toolbar to display it across the top
   - At the top Toolbar click which is Historical Imagery. This will allow you to use the toolbar to look at the Aral Sea over time.
   - Zoom the page so that the area of the Aral Sea takes up most of the screen

4. Have students explore the Aral Sea using the Historical Imagery slide bar to explore how this body of water changes from 1973 to 2012.

Students should record observations about what they are seeing as well as questions that this imagery provokes under the section of the handout subtitled “Asking Questions” (See Figure 1.). Require students to come up with at least 2 questions and 2 observations in groups of 3 or 4. Some typical questions and observations might be:

   a. The area seems dry because there is very little growing.
   b. Why is the Aral Sea disappearing?
   c. It is probably evaporating because it is so dry.
   d. Is this caused by climate change?
   e. Are humans or the environment causing this?
   f. What is all the white on the ground around the Sea?

5. At this point I like to present this case like a crime scene or mystery. We can observe what is happening, now we must determine the causes.
Developing the Lesson

Part 1. Exploration

During this portion of the lesson students will be working on the computer acquiring and exploring geographic data that will be later analyzed. The teachers’ role in this portion is to guide students through technology challenges that may arise. The lab sheet (Appendix A.) has questions and instructions that will guide students on the exploration.

6. Have students explore and record quantitative and qualitative physical characteristic data of the Aral Sea (climate data and nearby rivers are found using National Geographic Mapmaker Interactive, identifying the sea width for 4 years sampled and Panoramio pictures are found using Google Earth®). Panoramio is a layer on Google Earth® that allows photographs to be uploaded of a particular place on earth. The Aral Sea has dozens of photographs that students can explore to gain a greater perspective on what the Aral Sea looks like today, see Figure 2. for examples. Many of these pictures also give brief descriptions. Instructions for this and the next step are on the lab sheet (Appendix A.).

7. Next, students will explore the human characteristics of the Aral Sea using Panoramio pictures from Google Earth® (Figures 2), and an Aral Sea Drainage Basin map (Figure 3.).

Part 2. Evaluation

During this portion of the lesson, students will be analyzing their findings from the human and physical characteristic exploration. They should work together using the lab sheet (Appendix A.) as a guide to draw conclusions about their findings about how this disaster has occurred. It is critical that they discuss and draw conclusions together in groups of 3 to 4. During part 2, the teachers’ primary role is to facilitate and help groups stay focused on discussion.

8. In this portion, students should speculate based on their findings about the cause of the Shrinking Aral Sea as well as the overall human and environmental impact of this disaster.

9. Students now will use Google Earth Global Awareness layer to see if their own findings regarding the causes of this disaster as well as the human/environmental impact are correct. They will then use the T-chart in the handout to note the parts of this disaster that they were able to correctly deduce as well as those that learned new from the Global Awareness briefing.

10. Students should work together formulating a brief answer to the Decision Thinking Question.

Closure

11. Reflect on pictures with class. Of the pictures, which do you think most clearly communicates this environmental disaster? Why?
12. As a class, go over the Evaluation portion of the lab.
13. Have groups share their different answers to their Decision Thinking Question.

References


Appendix A. Exploring and Evaluating the Aral Sea Lab Sheet

Asking Questions and Observations: After viewing the change in the Aral Sea from 1973 to 2012, fill in the following:

<table>
<thead>
<tr>
<th>Your own observations (at least 2)</th>
<th>Your own questions (at least 2)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Exploration (Physical Characteristics): Use National Geographic Interactive Mapmaker (http://education.nationalgeographic.com/education/mapping/interactive-map/) as well as Google Earth® photos to complete the questions.

1. How much precipitation does the Aral Sea region receive a year?_____________
2. What climate type is it classified as?___________________________
3. Type in Syr Darya in the search. Use the elevation at the bottom to determine whether the river flows into the Aral Sea or from it. (Hint: does water always flow downhill or uphill?)___________________________
4. Where does this river originate and get its water from?___________________________________________

5. Using the Google Earth® tool bar, use the Ruler and the Historical Imagery to measure the width of the Aral Sea from 1973 to 2012 with 4 samples. Record your findings:

<table>
<thead>
<tr>
<th>Aral Sea Sample Year</th>
<th>Miles Wide</th>
<th>Difference from Widest</th>
</tr>
</thead>
<tbody>
<tr>
<td>Widest in 1970s_______</td>
<td>N/A</td>
<td></td>
</tr>
<tr>
<td>1980s (any year)______</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1990s (any year)______</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Narrowest since 2000__</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

5. What is the pattern that you observe?___________________________________________
6. Using the *Layers* on the sidebar, check *Photos*. Explore some photographs of the Aral Sea region and describe the physical characteristics of the landscape that you are seeing.

__________________________________________________________

__________________________________________________________

__________________________________________________________

**Exploration (Human Characteristics):** Use photos from Google Earth® to complete the questions

7. Examine the photos on Google Earth® again. This time, record observations about how humans have been impacted by the change in the environment.

__________________________________________________________

__________________________________________________________

__________________________________________________________

__________________________________________________________

8. Follow the Syr Darya River away from the Aral Sea. Zoom into the land near the river at several locations on the river. What color is the land closest to the river?________  9. As you move farther away from the river what color is the land?___________

10. How is the land used differently next the river?__________________________________

11. Describe what you think is happening near the river that is different from surrounding land use__________________________________________________________

12. How do you think this impacts the Aral Sea?__________________________________

13. Explain why you think you are seeing increases in salt and decreases in water? How is this occurring?__________________________________________________________
**Evaluation:** Complete in discussion groups of 3 or 4 based on everything learned so far

<table>
<thead>
<tr>
<th>What do you think are negative impacts on the <strong>environment</strong> that this disaster has caused?</th>
<th>What do you think are negative impacts on <strong>humans</strong> that this disaster has caused?</th>
</tr>
</thead>
</table>

In Google Earth® uncheck *Photos*. Check *Global Awareness*. This will place two icons next to the Aral Sea. Click on these icons to explore the impact this disaster has had on humans and the environment. Use this information to complete the table as a group.

**Newly discovered environmental and human impacts**
**Decision Thinking Question:** As a group come up with a decision to the following scenario.

14. Assume you are the head of the department of environmental affairs in Uzbekistan which is a less developed country. You need the water from the rivers for your most important crop, cotton, but are painfully aware of the tragedy of the Aral Sea caused partly by your country, but especially the Soviet Union when they were in charge of Uzbekistan. The world community is demanding that something be done to save the Aral Sea.

   a. What should you do? Justify your decision.
   b. Come up with possible negative consequences of your decision.