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Activity, Curriculum, and Technology

Lesson Title: Introduction to Aerial Photography
Curriculum Area: Science and Technology
Technology Strand: Remote Sensing and Geographic Information Science
Grade Level: 7

Essential Question: What is the benefit of the birds eye view?

Activity Summary (Give a brief description of the activity.)

Part 1 Engage- Students are shown a photo taken from the seat of an airplane. Immediately involve them in the lesson by asking how many have flown and of those that have, how many sat in a window seat. Try to get them to describe the perspective shift- cars and houses look tiny, but entire lakes, mountains, highways, forests and many other objects or phenomena that they can't see normally become visible from this vantage point.

Part 2 Explore-The slides examine many things that appear unique when seen from above: Center pivot irrigation fields, a meandering stream, neighborhood and street view, and a link to the Guilford County North Carolina GIS website that shows a series of historic photos before and after the establishment of the Lake Jeanette reservoir. All photos leading up to the animated series can be used to introduce the concept of environmental change, both naturally occurring and that initiated by people. The animated series will introduce the time sensitive nature of aerial photography and its potential benefit to science as a record of change.

Part 3 Explain- This portion of the lesson examines the history of aerial photography, how and why this technology developed.

This section starts with a question: Which came first- the airplane or aerial photography? The question begins a discussion on why the earliest practitioners wanted to see the world from a bird's eye view and how this was achieved historically. Hot air balloons were first used to take pictures from above, but other methods were also explored, including kites, rockets, and maybe even pigeons, although the existence of the Bavarian Pigeon corps is difficult to verify. This section ends with the airplane and the satellite, which remain the two primary methods of collecting imagery from above.

The difference in altitude between planes and satellites is demonstrated by using the different layers of the earth's atmosphere previously drawn the week before by the students. In order to show where the satellites orbit, extra lengths were added to one of their drawings of the atmosphere and pictures of Landsat 5, 7, the Terra satellite, and

newer, low orbit commercial satellites were added. This demonstrated how far away the satellites were from the surface of the earth as compared to aerial photos taken from a plane.

Part 4 Extend- The difference in altitude and its effect on image resolution is demonstrated by showing an image of High Point captured by the Landsat 5 satellite (5/4/2011) It is important to let the students identify as many features as they can, and to encourage them to try and identify what High Point might look like from Space. The slide that follows is the same area with the county boundaries superimposed. The 3rd image is of the High Point city limit. The last is a polygon drawn over Welborn Middle school that appears as a tiny red dot with a yellow circle around it. Following the satellite image are digital orthophotos of Welborn Middle School and Andrews High School taken in the winter of 2010, at two different scales. The first ortophoto includes Welborn only and is a class discussion piece. Ask the students to identify familiar things, such as the soccer goals, the rain gauge, the Little Gym, the flagpole, the approximate location of their classroom. Let them approach the screen and point to the feature that is being discussed.

Part5 Evaluate- This portion is a hands on activity in which the students are given a set of instructions and questions to answer, along with a printed high resolution black and white aerial photograph of Andrews and Welborn. The questions ask the student to either draw a boundary around or color in objects or phenomena in the photo and identify them as naturally occurring or manmade. Also included are questions about the relative position of objects according to cardinal directions, and a simple measurement task. This evaluate segment sets the stage for follow up- Covered under cognitive teaching strategies.

Curriculum Objective
2.01, 2.02, 2.03

Technology Objective
This lesson is designed to lead up to the use of satellite imagery to categorize objects and phenomena using their spectral signatures, and how this approach is used by scientists to investigate the urban sprawl phenomena that is part of the 8th grade curriculum. It does not directly meet any technology requirements for the 7th grade year other than those met in the curriculum objective section.

Activating Strategies
In order to explain the difference between imagery captured by a Satellite and photos taken form an airplane, use their previous class work pertaining to the layers of the earth's atmosphere and extend this familiar model into the exosphere, using the same millimeter scale to represent satellite orbits above the earth.

Cognitive Teaching Strategies
Step by step questions guiding the discussion are included above. The fact that many students are already spatially aware will get them interested and engaged in the lesson. Thank Google Earth, Google Maps, Bing Maps and iPhone for that. In order to keep them interested, keep the lecture sections short, letting them answer questions as a class

whenever possible. The most engaging part is the activity section at the end in which the students practice identifying features together, then work independently with an image and worksheet.

The worksheet is designed to get the students to think about how the objects that they see in the orthophoto could be classified into categories, which is a fundamental task of remote sensing scientists. By coloring or drawing a boundary around certain objects students are defining where one phenomena or object stops and another begins. Some items on the list are easy, (Welborn Middle School) others harder to draw a line around (The Greenway) This task leads the students to ask "What is the Greenway? Where does it stop and the forest start?" This is even harder to do when trying to categorize surface phenomena from a satellite image, at a smaller scale with less detail.

The satellite image included with the lecture also has a companion image captured 25 years earlier by the same sensor, Landsat 5. A future lesson could involve the actual classification of Pixels in both images and a comparison of how the classes have changed over time.

As a follow up, it may help at the beginning of the next lesson to discuss land cover change, and change detection as practiced by the Federal Government via satellite images
http://www.usgs.gov/science/science.php?term=629
http://www.usgs.gov/climate_landuse/

Summarizing Strategies
Promote the retention of knowledge through the use of engaging strategies designed to rehearse and practice skills for the purpose of moving knowledge into long term memory.

Once the lesson is over, it is suggested that a copy of the image of Welborn is kept in the room for students to look at whenever they are curious or have more questions. Further, the 2010 orthophoto is used in conjunction with every lesson that I teach. This same image cam be overlaid with a Lat Long grid for future lessons on co ordinate systems, and will be used as a base layer for the Maple syrup production project.