Lights, Camera, Action!
Lesson Plan

Overview

Photographs and other images are powerful and fascinating learning tools. But what is needed to *make* an image? In this lesson, children will explore various images and learn that in order to make a visible image using a camera or using our eye, light is required. Children will begin to learn the connection between light and color, and will explore how the human eye can let in more or less light, as needed. In addition, children learn that in order to make images of the Earth, a light source is required—sunlight by day, and light bulbs by night!

Suggested Lesson Sequence	Please see the Earth Systems Foundations: Maps and Images, and the Global Visions module descriptions.
Lesson Level	Entry/Intermediate
Science Connections	· Students will learn that **light** is required to make an image. · Students will learn that light is needed for **colors** to be seen. · Students will observe that some **information** (**details**) can be seen in images with more light, but other information can be "washed out" with too much light.
Human Connections	· Students will recognize that the human eye is an **imaging device** that can let in more or less light, as necessary. · Students will observe that **city lights** can be seen from **outer space** during the nighttime.
Technology Connections (optional)	· Students learn that in low light, a camera can use a flash in order to make an image. · Students learn that a camera lets in light through its **shutter**.
Lesson Assessment Tools	· Assessment and Standards Table (Word) · Assessment Activity Description · Authentic Assessments

Materials

- Powerpoint Reader (Windows / Mac), Quicktime Player, and Adobe Reader
- A computer with screen and/or computer projection device (audio speakers desired but not required)
- A flashlight
- A film camera without any film loaded
- Optional: a digital camera with flash capability
- Lights, Camera, Action! activity sheet (Word)
- Lights, Camera, Action! interactive slideshow (PowerPoint)
- Lights, Camera, Action! slideshow assessment (PowerPoint)
- Optional: "Meet Pixel the Satellite" movie (Quicktime)

About the slideshows: These slideshows are not meant for students to read through on their own. They are intended to be viewed together, to outline and illustrate a discussion of the lesson's themes, led by the teacher. You might have a different student read each slide's text.

Vocabulary

- Pupil: the part of the eye that serves to let light in to the eye. The pupil is black because the light that enters it gets absorbed by the back of the eye.
- Film: a thin material, placed inside some cameras, that is sensitive to light. When light strikes the film, an image is recorded.
- Illuminate: to brighten an object by shedding light on it.
- Iris: the part of the eye surrounding the pupil. The iris expands and contracts to allow more/less light in to the eye.
- Reflect: to bounce off of. Light *reflects* off of objects to illuminate them.
- Shutter: the portion of the camera that opens and closes to allow light in, so that a picture can be made.

Vocabulary Note: students will likely be unfamiliar with other vocabulary presented in this lesson. This is done intentionally, to spur additional conversations and discussion about these words and their meanings. Encourage your students to ask about words they may be unfamiliar with.

Procedure

I. Assessing Prior Knowledge

Introduce this lesson by beginning a short game of "I spy", where students mention that they "spy" things of various colors around the classroom. After a few "I spy" examples, ask the children about how they are "spying" these things. What are some of the other ways that we can "spy" things around us? Prompt students to begin talking about the human eye, as well as

other "spying" instruments like binoculars, telescopes, cameras, etc. After some discussion, ask the students an open-ended question about what allows these objects to actually be "spied" by anything. Allow for students to speculate, and listen for them to mention words relating to color, or lights in the room, or shadows, or perhaps sunlight coming through the windows. Draw this discussion to a temporary close by having all of the students close their eyes until you count to a certain number (long enough for you to turn out the lights in the room and draw the shades).

II. Contextual Preparation

As you count and darken the room, and with the students' eyes still closed, ask the children to quietly think about some of the colors of the things that had been mentioned during the "I spy" game. Ask: can they see those things now, with their eyes still closed? Of course, they cannot. Once the room is darkened, students may open their eyes again to continue the special game of "I spy". Return to several of the original "spied" objects, and this time ask the students to describe what they see. Depending on the darkness level of the room, and after their eyes have adjusted, they may use words like "darker", "shadowy", "hard to see", etc., or they may not even be able to see some of the objects at all. Ask what color these objects now appear. How do the colors differ, compared to when the lights were on? Can we learn as much about the objects (e.g. see shapes, patterns, or textures that appear on them) with the lights off?

III. Student Activities

1. Brighten the room as much is necessary to allow the students to write (but preferably not to full brightness), and distribute a copy of the Lights, Camera, Action activity sheet to each student. Gather the children into a close area if possible.
2. Choose a student to volunteer for an "eye exploration", and bring the student near you. Prepare your flashlight for action. (The objective of this activity is to have students explore how the eye changes when there is more or less light available to it, and the students will draw the size of the volunteer's eye pupil on their sheet.)
3. The class should now, in small groups, take their activity sheet and pencils close enough so that they may draw the size of the volunteer's pupil under the given lighting conditions. After all of these drawings have been made, use the flashlight to shine onto the student's forehead from 2-3 feet away. Take care not to shine the light directly into the student's eyes. Again, have the rest of the class draw the size of the student's pupil. Allow the volunteer to make her or his drawing by selecting a second volunteer, and repeat the process.
4. Discuss with the students what change occurred between the two levels of lighting. The reason that the pupil is large under low light is because the eye's colored iris has pulled away from it so that it can let more light into the eye. When the flashlight provides additional light, however, the iris covers more of the pupil because not as much light is necessary.

5. Use an unloaded film-type camera to demonstrate how a camera lets in light so that it can take a picture. Open the back of the camera and press the shutter release button, allowing students to see how the shutter opens for a short time to allow light into the camera. Remember to "advance" the camera between shots if the camera is not an auto-advance model. Show students where the film would be located if it were loaded. When the camera is loaded with film and the camera back is shut, this light makes an image on the light-sensitive film. Ask students to think about the following: In bright areas, would a camera shutter need to stay open longer or shorter than in dark areas? Why? (Answer: The shutter stays open shorter in bright areas because more light is available.)
6. The class has now seen that in order to make an image in a dark area, more light needs to be let in to the eye or the camera. Another way to allow for images or pictures to be made in dark areas is to **add more** light to the environment. You removed light from the classroom environment when you darkened it, and can add more light just as easily. Similarly, the sun "adds" and "subtracts" light from the outside environment so that objects can be seen over the course of the day. This light **reflects** off of objects so that they become lit, or **illuminated**. How does a camera add light to an environment? Discuss these topics with the class; they will be revisited during Step 8 below.
7. (Optional) Using a digital camera that has flash capability, and with the room lights off, take two photos of a classroom object (perhaps one of the "I spy" objects). For the first photo, allow the flash to brighten the object. For the second photo, have a student cover the flash with their hand. Display both photos on the back of the camera, showing the difference that the added flash light makes when taking a picture in a dark area.
8. Display the "Lights, Camera, Action!" interactive slideshow, using a large computer screen or projector, reading the various questions from the screen. Students should answer the questions in an open discussion fashion. Take time to move back and forth among the slides to allow comparisons and additional explorations of the photos. Answers to the questions are self-explanatory. Many of the concepts shown in this slideshow will reinforce the previous discussions in this lesson. To add context to the satellite image slides, you may wish to show the "Meet Pixel the Satellite" Movie as an option.

IV. Assessment

Display the Lights, Camera, Action! Slideshow Assessment on a computer screen or projector, reading the various assessment questions from the screen. Students may answer orally or in written form on the bottom of their activity sheet distributed in step 1, above. Answers to the questions are self-explanatory. Students should recognize that in the first satellite image, the Sun is providing light that shines onto the surface and is reflected back to the satellite. They may recognize that the ice and snow (white parts) in the image reflect the most light, which is why they are brighter than other areas, and that the deep ocean reflects very little light, which is why they are dark. In the nighttime image, they should recognize that the brightest areas are cities, which have the most lights that can be seen all the way up in space. The land masses can be seen faintly, most likely due to slight illumination from sun reflecting off of the

moon. The order of the increasing elephant photo brightnesses in the last slide are: 5, 6, 1, 4, 3, 2.

Lesson Extensions for Authentic Assessment

- Use a laser pointer (a laser is a light beam which emits one narrow color of light only) to shine on objects around the darkened classroom. What color are these objects where the laser hits them? It is always the same color, because the laser only contains that one color (technically called a *wavelength*) of light. Why is it that objects appear all colors when illuminated by the sun or a white light? This is because white light contains all (in the case of sunlight) or many (in the case of lightbulbs) colors of the spectrum. Use a prism to hold up to the sunlight to show that a rainbow of many colors can be produced from the white light. What happens when the laser light is shined into the prism? IMPORTANT: light coming from laser pointers can be very damaging to the eye. Take care NOT to shine the laser near students' eyes.
- Take students to a place with no windows. Plug in a small nightlight. Then, turn off the main lights suddenly. At first, it is difficult to see any surrounding details, but as students' eyes adjust to the darkness, they can begin to see more detail all around them. The light level from the nightlight does not change, but things appear differently through time! Have students speculate about what happens when their eyes "adjust" to turning out the lights. They will learn that it takes some time for the eye's iris to widen sufficiently for enough light to enter the eye so that they can begin to make an image in their own brain.
- Use the vocabulary list and other words from this lesson to have the students write a story. Possible topics: have them imagine that they had no iris in their eye, have them imagine that they were riding on Pixel the Satellite to look at the Earth day and night, or have them make an imaginary trip to the inside of a camera as it takes a photo.