I See the Light

Summary

The students will be able to explore, classify, and describe properties of light.

Materials

For each group of students a kit that includes:

several mirrors with a hole punched in the center
mirror clips
several flashlights
a kaleidoscope,
transparent deli container lid
a translucent deli container lid
a prism
a laser pen
a mirror
an empty CD case
rainbow glasses
an empty glass baby food jar
a thick acrylic block
a slit card, etc.

- *Assessment Card Sort* handout (pdf)

For activity:

Small cardboard box with lid
Scissors
Box cutter
Pencil
Ruler
One lens from a pair of rainbow glasses
Tape
Rubber bands

Media:

- Bill Nye: Light
  on ITV website
- Bill Nye: Sound
  on ITV website

The Magic School Bus Makes a Rainbow, Scholastic, can be downloaded free at ITV website

Background for Teachers

Light is a form of energy made of electromagnetic waves. Some of the waves we can see and some we cannot. The entire range of light is called the electromagnetic spectrum. The light we see is referred to as "visible light" and travels at a constant speed of 186,000 miles per second, or 300,000 meters per second. Light can be reflected, refracted, absorbed, or pass through an object. If light passes through a transparent object, it can also be reflected (bounce back) or refracted, which means to slow down a little, so that it seems to bend. A good example of refraction is placing a pencil in a glass of water. The part of the pencil above the water appears broken from the part of the pencil below the water. Light can be reflected off water particles in air, which allows us to see a rainbow, or light on a foggy day.

All objects reflect some light, which allows us to see them. Hard, smooth surfaces are better at reflecting light, though. Mirrors are excellent reflectors because the surface is smooth and the light is able to bounce back. When light hits a surface, it is always reflected at the same angle it strikes the surface. The Law of Reflection states that the angle of incidence equals the angle of reflection. A good model of this is bouncing a ball off a smooth surface.

Intended Learning Outcomes

1 a. Observe simple objects, patterns, and events, and report their observations.
1 b. Sort and sequence data according to criteria given.
4b. Describe or explain observations carefully and report with pictures, sentences, and models.

Instructional Procedures

Invitation to Learn:
Place an object in a 3D Miroscope, and walk around having students explain what they see. Open up the Miroscope so that students can see what it is like inside. Have them offer up explanations about how it works. Say, "Today we will begin to explore the properties of light."
Instructional Procedures:
Activity #1: Do You See What I See?
This first activity can be used as an introduction to light. Have a kit of materials set out for each group of four students. They are to work together and come up with at least four observations about light. Turn off the lights and let students explore. After about ten minutes, stop them, turn on the lights, and have each group discuss at least one observation they made about light. What did they see? What did they do to cause that to happen? What did they learn about one of the properties of light? As you discuss this with the class, use some of the light vocabulary words to help them describe properties of light. (Vocabulary words would include *reflection, refraction, absorption, prism*.) Ask some of them to share what they have written in their journals, and encourage them to add drawings and details in their journals.
Turn off the lights again and allow ten to fifteen more minutes (or whatever time you have) to make more observations. Check with them to see that they are using their time wisely to find at least four observations about light. Have student share other things that they observed about light.
Have students make a "Claims/Evidence" chart in their journals. Under the "Claims" column, they would write a property of light that they observed. Under the "Evidence" column, they will write down what evidence they have to make that claim, or what they saw. saw.
Activity #2: Reflection or Refraction, Transparent or Translucent
Students often get confused when trying to differentiate between reflection and refraction. Use the same materials from the first lab, and have students sort items by reflection and refraction, with a justification in their journal as to why it is what they said it is. This could include a "Claims/Evidence" chart, or a "Reflection and Refraction" chart. Students should be able to justify why they classified an object as one that reflects light or bends light. On the same day or another day, also have them use the same materials to compare transparent items, translucent items, and opaque items.
Lesson and Activity Time Schedule:

The lessons are 70 minutes.
"Make a Reflection Spectroscope" is 20 minutes.
Total lesson and activity time is 90 minutes.

Activity Connected to Lesson:
Make a Reflection Spectroscope
To make a reflection spectroscope, you will need the lens from a pair of rainbow glasses, an index card, and a small box with lid (small shoe box or even checkbook size).
Draw a rectangle that is about the size of your rainbow lens on one end of the box and then carefully

cut out the inside of the rectangle. Once the rectangle has been cut out, you will need to tape the lens to the outside of the hole.
Next, draw another rectangle of the same size on the other side of the box and carefully cut it out. You should be able to look straight through this hole and out through the rainbow lens. This hole will become your slit. Cut an index card in half and place each half over the hole, leaving a narrow vertical slit uncovered in the center of the hole. Tape the cards into place.
Wrap rubber bands around the box so it won't come open. Hold the box so that the end with the slit in it is facing your light source and look through the other end. You will be able to see all of the different colors that were hiding in the light. Don't look directly at the sun, though, because the sun's rays are so bright that they can damage your vision or even blind you.

Extensions

The subject of light offers many students the chance to do further research on the Internet, as well as projects at home. Students may search for "webquest -- light" to find webquests to complete for further research. Students may also create PowerPoints or brochures to integrate technology with science.

Several Core Academy lessons have been presented that will provide further lessons and ideas on how to teach light. These would be found at http://usu.edu/coreacademy/Materials/2004/Handbooks/index.php, # in 2004, 2006, 2008. Look for the Participant Handbooks, Grade 6, and the light lessons are at the end of the manual.

Family Connections:

There are many webquests available on light, which will allow the student to do further research while completing projects. These are great family activities as well as individual projects.

To show their understanding about many of the properties of light, students should work at home with their families to create a demonstration or experiment with light. This could then be brought to class to share with the other students.

Rainbow glasses provide fun for the whole family, especially at fireworks celebrations and with holiday lights.

Explore how we need light to see color. Send one person at a time in a dark closet to try to choose what to wear for the next day. After clothes are brought out in the room, see who came up with the best, or craziest, color combinations.

Assessment Plan

Journal entries would be part of your formative assessment, as you check for student understanding. Look for student use of vocabulary words, and check for misconceptions.

The reflection assessment card sort is also a great way to check for student understanding. Provide a set of cards for each student, then have them sort whether the item is reflective or not. (All items on the cards are reflective because all are visible, and it is important for students to realize that though some items are more reflective than others, all things that are visible are reflective, and will reflect light back to our eyes to enable them to see color.)

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