BRAIN-COMPATIBLE SCIENCE LESSON PLAN

Optics

Teacher: *Warren Phillips, Science K–12*

Lesson Objective(s): *What will you be teaching?*

Optics: behavior of light and how we perceive it

Assessment (Traditional/Authentic): *How will you know students have learned the content?*

Students will learn "The Optics Song." They will analyze the information in the song and incorporate the vocabulary into their experiments. They will be able to explain the experiments they've seen and other experiments involving optics that they have not seen. They will be able to explain why colors appear. They will complete online explorations. They will be involved in a review game that emphasizes important information.

Ways to Gain/Maintain Attention (Primacy): *How will you gain and maintain students' attention? Consider need, novelty, meaning, or emotion.*

Students will need to learn the properties of light to help them with their understanding. The novelty of singing a song and accessing interactive Web lessons will add excitement to the lesson. As they experience several demos, they will find meaning through other examples in the world around them. They will eventually become emotionally involved as they sing and gain meaning from the lessons.

Content Chunks: *How will you divide and teach the content to engage students' brains?*

(This lesson will probably take two or three class periods.)

Lesson Segment 1: Sing "The Optics Song" (Copy the song in Strategy 11 as a handout.)

Activities

Students will sing "The Optics Song" and look at the visual representation of optics properties on the handout. The students will also identify and emphasize the vocabulary associated with the song.

Lesson Segment 2: Optic Demonstrations

Activities

1. *Use pin art to create a 3-D image: Place a student's hand on the pins. A representation of the hand will appear as the pins move. Use this analogy as how the eye's rods and cones pick up light and transfer the energy along the optic nerve to the brain.*
2. *Place a prism in the sunlight or in front of a slit of light emerging from an overhead projector. Analyze the colors of the rainbow and describe them in order as they appear on the wall.*
3. *Obtain a 4" x 8" mirror, or one about that size. Place black electrical tape in strips of varying sizes across the mirror, so it resembles a bar code. Move a laser across the mirror so that it reflects on the ceiling. Note the pattern created and liken it to a computer reading a bar code.*
4. *Find various illusions from books or even 3-D science toys (Mirage from Arbor Scientific at www.arborsci.com is a favorite!) that display illusions. Explain the illusions in terms of light properties and how the eye works.*
5. *Spray some deodorant in the air; then, use a laser to show off the light hitting the particles. Alternate placing a mirror, a concave lens, and a convex lens in front of the laser. Examine the behavior of the light as the mirror and the lenses are swapped.*
6. *Get a fiber-optic strand and watch the laser light as it travels from one end of the strand to the other. Explain how fiber-optic communication works by using several strands and by turning the laser on and off.*
7. *Drill a one-half-inch hole about one-third of the way up a two-liter clear plastic soda bottle. Cover the hole with adhesive tape so that it will not leak when filled. Add a teaspoon of milk to the two-liter bottle filled with water. Place a laser so that it shines on the hole where the tape is. Remove the tape and the light will shine inside the water spout as it spills into a tray below. This simulates a fiber-optic cable and demonstrates total internal reflection.*

Lesson Segment 3: Vocabulary and Interactive Technology Demonstrations

Activities

1. *Students form pairs and research on computers about convex and concave lenses, mirrors, properties of light, and total internal reflection. They can research light, illusions, and information about the demos they've seen—maybe even other demos! They should also research other information that was mentioned in "The Optics Song" and the mnemonic device* laser. *This can be done as a matrix, with each group learning different materials and then teaching each other.*
2. *Using sites such as brainpop.com and explorelearning.com, students should play the short video movies and interact with the online experiments that demonstrate the properties of light and how the eye works.*

3. *Students will sing "The Optics Song" and look at the visual representation of each light on the handout. The teacher will also ask students to explain the vocabulary associated with the song and how the song relates to the other activities they have done.*

Lesson Segment 4: Review Game

Activities

Have students create questions from the material learned. Arrange the students in teams, and review the materials while playing a game of Jeopardy or Wheel of Fortune. Use Eggspert or Quizzillion Build Your Own Quiz Game to create a game-show atmosphere.

Brain-Compatible Strategies: *Which will you use to deliver content?*

- ☑ Brainstorming and discussion
- ☐ Drawing and artwork
- ☐ Field trips
- ☑ Games
- ☐ Graphic organizers, semantic maps, and word webs
- ☐ Humor
- ☑ Manipulatives, experiments, labs, and models
- ☑ Metaphors, analogies, and similes
- ☑ Mnemonic devices
- ☑ Movement
- ☑ Music, rhythm, rhyme, and rap
- ☑ Project-based and problem-based instruction
- ☑ Reciprocal teaching and cooperative learning
- ☐ Role plays, drama, pantomimes, and charades
- ☐ Storytelling
- ☑ Technology
- ☐ Visualization and guided imagery
- ☑ Visuals
- ☐ Work study and apprenticeships
- ☑ Writing and journals