

BASIS Lesson Plan

Lesson Name: Eye See It! Understanding How Eyes See

Grade Level Connection(s)

NGSS Standards: Grade 1, Life Science; Grade 1, Physical Science

FOSS CA Edition: Grade 3, Physical Science, Light & Vision

**Note to teachers: Detailed standards connections can be found at the end of this lesson plan.*

Teaser/Overview

We rely on our sense of vision every day - eyes are incredibly important! Eyes come in all shapes and sizes and have different properties depending on the needs of each particular animal. In this hands-on lesson, students will learn about why we depend on our eyes, explore how they work, and evaluate the similarities and differences between the eyes of different animals.

Lesson Objectives

- Students will discover how all eyes have the same basic function, but they also have differences that reflect the needs of different animals
- Students will learn the importance of light to form an image
- Students will discover how much we rely on sight and how difficult it is to identify objects without it

Vocabulary Words

- Pupil
- Iris
- Retina
- Lens
- Vision
- Blindness
- Visual impairment



- Environment
- Diurnal
- Nocturnal
- Reflective
- Refraction
- Opaque
- Clear
- Predator
- Prey

Materials

Scientist Volunteers will bring:

Laminated cards with each of the five senses
Laminated cards with different types of animals and their eyes
Animal eye goggles (chameleon, insect)
Blindfolds (10 eye masks, 1 for each student)
Paper bags with several objects (10 bags, 1 for each student, with 3-5 objects in each bag)
Magnifying lens (an assortment of educational lenses/prisms)
Rough/opaque lens
Flashlight (2)
Poster of the human eye
Diagram showing different pupil sizes in different light conditions

Materials teachers should provide:

Sheets of paper and crayons to draw with.

Classroom Set-Up

Students should be seated at the central classroom carpet for the introduction to the lesson. Students should then be divided into three groups and each group will rotate through three stations, so please have desks grouped into at least three stations where one third of the class and a BASIS volunteer can comfortably fit. At the end of the lesson, students should then go back to the carpeted area. It would be helpful if students wear name tags during the lesson.



Classroom Visit

1. Introduction (10 minutes)

Role Model Introduction:

Being a role model for students is an important part of being a BASIS volunteer. Begin your lesson by introducing yourselves! Every team member should take a moment to explain who they are and what they study/do as a scientist. A bonus will be to tell your “story,” as if giving an elevator pitch to 8-year-olds: Why did you become a scientist? What made you interested in your topic? Why should students relate to you, or be interested in you? Feel free to draft a script of what you will say, here. And remember, you can also weave your story throughout your lesson through examples from your own life, and/or return to it with Q&A at the end.

Hi! We are graduate students from UC Berkeley studying Vision Science. This means that we study eyes, how we see and try to help people with visual impairment, or difficulty seeing. (Each person will then introduce themselves and explain what they specifically study)

Topic Introduction:

After you introduce yourselves as role models, take some time to introduce the topic of this lesson: eyes and vision. It may be helpful to keep the suggested take-away in the back of your mind throughout the lesson: **the structure and function of our eyes are essential to vision and helping us understand the world around us.**

Your topic introduction should follow the outline below. As much as possible, try to frame this information as questions posed to the class, rather than as a lecture. This helps activate students’ prior knowledge and facilitate student-guided conversation.

- Today we are going to talk about one of our senses. Who can help us name the five senses? [Hearing, Touching, Taste, Smell, and Vision=Seeing] What parts of the body do we use for each of these senses? [Ears, Hands/Skin, Mouth/Tongue, Nose, and Eyes]
- Our senses help us understand what is going on around us in the world and help us to know what is good for us and what is bad for us. Can anyone give us examples?
 - E.g. If something is delicious we can eat it, poisons tend to be bitter. Same for touch, if something’s sharp or hot, it hurts if you touch it.
- As humans, which one of these senses do you think we use the most? [Vision!]
- Why do you think our eyes are important? [We need to see to find shelter and food in order to live.]
- We’re going to do some science activities to help us understand the different parts of our eyes and why they are so important for helping us to stay safe and understand the world around us!

2. Learning Experience (40 minutes)

Students will be split into three groups. Each group will start at one of three stations set up around the room, and rotate every 10 minutes. At each station, a BASIS volunteer will lead an activity to explore one aspect of vision and eyes. An additional BASIS volunteer will keep time and offer support to the other stations as needed. Remember that all three of these stations are designed to address the take-away in a particular way: **the structure and function of our eyes are essential to vision and helping us understand the world around us.**

Station 1: Eye Matching

We are going to look at different eyes and match them to the correct animal. Does anyone have a pet? What do their eyes look like? Do they look like ours?

After you have matched the eyes, please tell me how this eye you are looking at differs from that of a person. We will discuss different functions that are gained by these differences.

Engage students in a conversation about how we use the sense of sight and why we have two eyes, and a pupil forming iris.

- a. Students may think about colors, brightness, darkness, patterns, etc. Prompt students with some guiding questions “How do we see?” “Why do we need two eyes to do this?” “How does light influence color?”
- b. Introduce the idea that sight is a sense that we use to help us function and survive the world around us.

When students match an eye to the correct animal we will talk about something that is unique about that animal’s eyes:

- all the animals we see have a pupil, and its shape is formed by a special colorful muscular tissue called the iris. This gives each one of us a unique eye color. As you can see, animals have eye colors that are more elaborate than those that people have. The size of the pupil- the hole that light comes through is determined by the movement of the iris muscle and it depends on light- when it’s dark the pupil is wide open, like a big window trying to capture all the light around, and it allows us to see better in the dark. In bright light the pupil is small- because we need less light to enter our eye in order for us to see. I’m sure some of you can recall that in bright light we squint our eyelids to let less light in- well your pupil also squints in light, getting smaller.
- cats have a tissue in their eye, called tapetum, that reflect light so they can see better at night. Cats eyes, as many predators are forward facing, which helps them to focus on prey and catch it. Cats also have a vertical pupil when it constricts, to maintain this forward facing visual acuity.



- Horses have a horizontal shaped pupil, and laterally placed eyes that provides them with a wide visual field, allowing them to notice predators from a distance, and escape them.

- Raptors have 2 eyes that together are larger than their brain, the visual acuity of raptors is much better than ours so that they can spot and catch a mouse in a field when flying high in the sky. They also have a third eyelid, which is a transparent tissue that acts as a windshield wiper, and allows them to blink/clear their eye while flying, without compromising their visual field. Woodpeckers their third eyelid to prevent wood chips from flying into their eyes while pecking on a tree.

- Some animals that live in the ocean go between very dark depths, to very bright surfaces in the sea. They're eyes are very sensitive to light for this reason, since they need to be able to function in the pitch-black ocean floor. You may have noticed that these animals don't have eyelids. What do you do when it is very bright outside? (squint, go into shade, wear a hat)

When they surface, they deal with abundance of light in 2 ways- they can close their pupil entirely, allowing nearly no light to enter their eye, and some of them have a special organ (operculum) that acts like a visor/baseball cap, and prevents too much light from coming in from the direction of the sun.

Key learning outcome: All eyes have the same basic function, but they can vary based on the environment/needs of the animals.

Station 2: Light & Anatomy of the Eye

1. Engage students in a conversation about how our eyes work
 - a. Prompt students with some guiding questions: "If you're in a dark place, can you see anything?" [No!] "How do our eyes work?"
 - b. Introduce the idea that our eyes need light in order to see. Light enters our eye through the dark spot called the **pupil**. Turn to the person next to you and look at their eyes. What's the same? What's different? See if you can locate the **pupils** of their eyes. Light enters the eye through the pupil and the lens of the eye focuses that light onto the back of our eye, the **retina**. The retina then sends this information to the brain and helps to form the image we see!
2. Do the light focusing activity
 - a. Set up a flashlight and magnifying lens to show how light can be focused.
 - b. What happens when the lens is rough (has an uneven surface) or **opaque** (define: completely or partially blocks the passage of light)
 - c. Show how the light scatters with an opaque lens and can't get through.
 - d. Ask students what they observe. Is the light able to be focused this time?
 - e. How do they think that might affect vision?



3. Connect the activity to the big picture

- a. Invite students to reflect on the importance of sight and how the pupil, lens, and retina of the eye work together to communicate with the brain.
 - What do you think would happen if the lens in our eyes was like this (point to opaque lens)?
 - What do you think we would see?
 - Sometimes the lens is clear but doesn't allow light to focus on the retina because of its shape, or distance from the retina. Some of you may wear glasses, or know people that do. Glasses use lenses and like the one inside our eye, and they help place the light exactly where it needs to be on the retina, so that we can see better.
 - Does anyone have a family member that had cataracts or cataract surgery? Cataract is an opacity in the lens, and it is common in older people, but can also occur in children. When this happens, a doctor will replace the opaque lens in the eye with a new clear one, so that people can see again, and find their way in the world.
- b. Emphasize the overall takeaway of the lesson: **the structure and function of our eyes are essential to vision and helping us function in the world around us.**

Key learning outcome: Basic anatomy of the eye and learn that a clear lens is needed for light to enter the eye and reach the retina so an image can be formed.

Station 3: Importance of Sight!

1. Engage students in a conversation about how we rely heavily on our vision
 - a. Prompt students with some guiding questions: "How do we make sure that we don't bump into things when we're walking?" "How do we identify different objects?" "How do we recognize our friends and family?"
 - b. We use our eyes and vision to find food, shelter, and to know when something is safe. "What would be some things that would be hard to do if you couldn't see?"



- c. Do you know people with a visual impairment [problem seeing]? How does this affect them? How have they coped with this? [a guide dog, stick, help from other people, special glasses, etc.] People with visual impairment can perform this task very well, since they learn to use their other senses much better once they can no longer rely on their vision.
2. Do the Sight activity
 - a. Set up paper bags (one for each student), each filled with an object.
 - b. Have each student put on an eye mask so they aren't able to use their vision. Help students if they have trouble putting these on.
 - c. Give each student a bag filled with an object and ask them to try and guess what the objects in the bag are.
 - d. Were some of the objects easy to identify? Which ones were difficult to figure out?
3. Connect the activity to the big picture
 - a. Invite students to reflect on the importance of sight. Even if they try to take off the eye mask or use their eyes to look at the object, point out that they are relying on their eyes. We are very visual animals!
 - b. Return to the question of "what would be hard for you to do if you couldn't see?"
 - c. Emphasize the overall takeaway of the lesson: **the structure and function of our eyes are essential to vision and helping us function in the world around us.**

3. Wrap Up: Review and Discuss the Learning Experience (5 minutes)

Have students rejoin you on the carpet for a wrap-up discussion.

- What is vision? What are the parts of the eye? Review of vocabulary words.
- What did we learn at station 1, 2, & 3?
 - What did you learn about animals and their eyes? Do all animals have the same eyes [No] Why? [Different animals live in different environments and have different needs]
 - What do we need to see? [Light! And a clear lens] Can we see in the dark? [Not well]
 - Is it easy to know what kind of object you're holding when you can't see it? [No!]
- Prompt students to think about what other questions they have about vision and how scientists might figure out the answers to those questions.

4. Connections & Close (5 minutes)

If possible, tie lesson back into your research or role model story.

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Close:

- Ask students if they have any questions about science, being a scientist, or about becoming a scientist
- Close with a good bye and a thank you, and encourage the kids to keep thinking about ways they use their vision every day to help them stay safe and function in the world around them!
- Don't forget to help clean up. Thanks and goodbye!

Follow Up: After the Presentation

Teachers who wish to extend the impact of this lesson may find the following CRS web pages useful:

- <http://www.crscience.org/educators/helpfulreports>
- <http://www.crscience.org/educators/treasuretrove>

Standards Connections

NGSS:

- Connections by topic
 - Life Science: 1. Structure and Function
 - Physical Science: 1. Waves: Light and Sound
- Connections by disciplinary core ideas
 - Life Science: 1-LS1. From Molecules to Organisms: Structure and Processes
 - Physical Science: 1-PS4. Waves and their Applications in Technologies and Information Transfer
- Connections by scientific & engineering practices
 - 8. Obtaining, evaluating, and communicating information
- Connections by crosscutting concepts
 - 2. Cause and Effect: Mechanism and explanation
 - 6. Structure and Function: Determine properties of things
- Connections by performance expectation
 - 1-LS1-1. Use materials to design a solution to a human problem by mimicking how plants and/or animals use their external parts to help them survive, grow, and meet their needs.
 - 1-PS4-1. Plan and conduct investigations to provide evidence that vibrating materials can make sound and that sound can make materials vibrate
 - 1-PS4-2. Make observations to construct an evidence-based account that objects can be seen only when illuminated.