

Core Science Concepts



- Light as energy: The bright glow from the heater elements shows how light travels and makes objects visible in darkness
- Shadows and illumination: The dark shadows cast by the frame against the glowing mesh demonstrate that objects block light and create dark areas behind them
- Heat energy and light: The orange-red glow indicates that when objects get very hot, they emit light (an advanced precursor to understanding energy forms)
- Patterns and visibility: The regular pattern of holes in the mesh is only clearly visible because light passes through and illuminates it differently...

Lesson Overview

- Grade Level: First Grade
- Subject: Science (Physical Science)
- Time Allotment: 90 minutes total (can be split into two 45-minute sessions)
- NGSS Standards:
 - 1-PS4-2: Make observations to construct an evidence-based account that objects in darkness can be seen only when illuminated.
 - 1-PS4-3: Plan and conduct investigations to determine the effect of placing objects made with different materials in the path of a beam of light.

Learning Objectives

Students will be able to:

1. Observe that objects in a dark space become visible when light shines on them
2. Predict and describe what happens when different materials block light
3. Explain that we need light to see things
4. Design a simple investigation to test how light helps us see

1. ENGAGE

Objective: Activate curiosity about light and seeing by exploring the photograph in a darkened or dimmed classroom.

Materials:

- Photograph (printed or displayed on screen)
- Classroom light switch or lamp
- Optional: flashlight

Activity:

1. Dim the classroom lights before students arrive or ask them to close their eyes. Display the photograph on a screen or hold up a printed copy.

2. Ask students to open their eyes and look at the image in the dimness. Say: "This is a special picture taken in very low light. What do you notice? Can you see the bright orange parts clearly? What about the dark parts?"
3. Pose these discussion questions (pause for responses after each):
 - "Why can we see the bright orange glowing parts so well?"
 - "What do you think is making that bright orange light? Have you seen light like this before?"
 - "What happens to the dark shadows? Why are those parts harder to see?"
 - "Do you think we could see this picture if the room was completely dark with no light at all?"
4. Wonder prompt: "I wonder what would happen if we turned on a flashlight in a completely dark room—what would we see first?"
5. Gradually brighten the classroom lights while the photograph is still displayed so students see the difference between low light and bright conditions.

Transition: "Today, we're going to be light detectives! We're going to do some experiments to discover exactly how light helps us see things."

2. EXPLORE

Objective: Students investigate how light reveals objects and how materials affect what we can see.

Materials:

- Small flashlights or clip lamps (1 per pair/small group)
- Dark box or area (classroom corner with blackout curtains, or a sturdy cardboard box with lid)
- Various small objects: toy car, block, button, coin, pencil, small picture
- Transparent materials: clear plastic sheet, clear glass or plastic cup
- Translucent materials: frosted plastic, tissue paper, wax paper
- Opaque materials: construction paper, cardboard piece, aluminum foil, wooden block
- Chart paper or whiteboard for predictions
- Observation sheets (with pictures and lines for drawing)

Activity:

Setup: Create a "dark box exploration station" (a large box with the lid or a darkened corner of the room where you can control light). Place objects inside beforehand.

Part 1: Light Reveals Objects (10 minutes)

1. Tell students: "We're going to be light detectives. First, we need to look inside this dark box with NO light. Tell me—what do you see?"
2. Without opening or shining light, ask students to predict: "What objects do you think are in this box?"
3. Demonstrate: Shine a flashlight into the box or corner for just 2-3 seconds. Ask: "Now what did you see? Did the light help you?"
4. Partner exploration: In pairs, give each pair a turn to:
 - Make a prediction about what's in the box (without light)
 - Have one student shine the light while the other observes

- Switch roles
- Record: Draw or list what they saw when the light was on

Part 2: Materials Block Light (10-15 minutes)

1. Introduce materials: Show students three piles of materials: transparent (clear), translucent (frosted), and opaque (dark/blocking).
2. Do a quick demonstration: Hold each type up to a flashlight and ask, "Can you see the light through this one? A lot? A little? Not at all?"
3. Guided exploration: Provide each group with a flashlight and samples of materials. Direct them to:
 - Hold each material up to the light
 - Observe what they can see through it
 - Record: Draw a picture showing which ones let light through (bright) and which block it (dark)

Teacher Role:

- Ask guiding questions: "What do you notice?" "Does the light go through?" "Can you see the flashlight?"
- Do NOT tell students the answers—let them observe and discover
- Circulate and encourage students to try different angles and positions
- Help students record their observations with simple drawings or checkmarks

Expected Student Outcomes:

- Students discover that light helps us see objects in darkness
- Students observe that some materials let light pass through while others block it
- Students begin to understand that we need light to see things

3. EXPLAIN

Objective: Formalize observations with vocabulary and connect to the original photograph.

Materials:

- Photograph (displayed)
- Chart paper for vocabulary
- Flashlight for demonstration
- Clear, translucent, and opaque material samples from Explore
- Picture cards or labeled posters showing: light source, shadow, transparent, opaque

Activity:

1. Group share-out (5 minutes):
 - Ask pairs/groups to share ONE thing they discovered about light and seeing
 - Record their statements on chart paper
 - Affirm all observations (e.g., "Yes! Light helped you see the toy car!")
2. Introduce vocabulary (8 minutes): Using student observations, introduce and define:

Term	Student-Friendly Definition
-----	-----

- | Light | Energy that helps us see. Light comes from sources like the sun, flashlights, and lamps. |
- | Illuminate (or "Light up") | When light shines on something and makes it easy to see |
- | Shadow | A dark place made when light is blocked by something |
- | Transparent | Materials you can see clearly through (like clear plastic or glass) |
- | Opaque | Materials that block light so you cannot see through them (like wood or thick paper) |

3. Connect to the photograph (5 minutes):

- Display the original photograph
- Point to the bright orange parts: "These parts are illuminated—light is shining on them! That's why we can see them so clearly."
- Point to the dark areas and frame: "These are shadows—light is blocked here, so we cannot see as well."
- Show the mesh pattern: "The holes in this mesh are like transparent areas—light can pass through. The metal parts are opaque—they block the light."

4. Check for understanding:

- Hold up a flashlight: "Is this a light source? What does it do?"
- Show a piece of clear plastic: "Can you see through this? What word describes this?" (Transparent)
- Show dark construction paper: "Does light go through this? What do we call this?" (Opaque)
- Turn off the light: "Can you see me? Why not? What do we need?" (Light!)

Expected Student Outcomes:

- Students use vocabulary: light, illuminate, shadow, transparent, opaque
- Students connect their exploration to the photograph
- Students can explain that we need light to see

4. ELABORATE

Objective: Apply understanding of light and materials to a new, meaningful context.

Materials:

- Flashlights or clip lamps (1 per pair)
- Variety of safe materials: tissue paper, plastic wrap, aluminum foil, construction paper, wax paper
- White paper or poster board
- Tape
- Optional: colored tissue paper or cellophane

Activity: Design a Light Filter

1. Set the scenario: "Imagine you're helping a friend who is sensitive to bright light. We want to make something that lets SOME light through but not too much bright light. Let's be engineers!"
2. Challenge: "Your job is to pick a material and tape it over a flashlight. Then test: Does your material let light through? Is it bright or softer? Would it help your friend?"
3. Student steps:
 - Predict: "Will this material let light through? Will it be bright or soft?"
 - Design: Tape a material over the flashlight
 - Test: Shine it on a white paper and observe the light

- Record: Draw or write whether it worked
- Refine: Try a different material or layer materials (two pieces together)

4. Real-world connection: "Did you know? Theater lights use filters just like this to make different colored lights on stage! Sunglasses work the same way—they're opaque enough to protect your eyes but still let you see."

Teacher Role:

- Facilitate material selection
- Ask: "What do you notice? Is it brighter or softer than before? Would this work?"
- Encourage trying multiple materials
- Help students see the practical application

Expected Student Outcomes:

- Students apply knowledge of transparent/opaque to solve a real problem
- Students make connections between classroom learning and the real world
- Students demonstrate deeper understanding of how light interacts with materials

5. EVALUATE

Objective: Assess student understanding of light, illumination, shadows, and transparency.

Activity:

Formative Assessment (ongoing during lesson):

- Observation checklist during Explore: Do students adjust light position? Do they predict before testing? Do they ask questions?
- Vocabulary checks during Explain: Can students use "light," "illuminate," "shadow," and "opaque" correctly in context?
- Question responses during Elaborate: Can students explain WHY they chose a material?

Summative Exit Ticket (5-7 minutes):

Provide each student with a simple exit ticket with 2-3 questions (pictures + words for emerging readers):

1. Picture-based question: Show an image of a dark room with a flashlight. Ask: "Circle YES or NO: Can we see things in a dark room? Do we need light?"
2. Material sorting: Show 3 pictures (clear cup, dark paper, tissue). Ask: "Which ONE lets light go through?" (Point or circle the correct one)
3. Application question (oral or picture-based): "If you wanted to see a toy in a dark box, what would you need?" (Answer: Light/flashlight/lamp)

Success Criteria:

- Developing: Student shows understanding that light helps us see (answers 1-2 questions correctly)
- Proficient: Student correctly identifies that we need light to see, identifies transparent vs. opaque materials (answers 2-3 questions correctly, uses 1-2 vocabulary words)
- Advanced: Student explains WHY light helps us see, distinguishes between transparent and opaque, makes real-world connections (answers all questions, uses 3+ vocabulary words)

Expected Student Outcomes:

- 80%+ of students can identify that light helps us see objects
- 75%+ of students can sort materials by transparency
- 70%+ of students can use 2+ vocabulary terms correctly

Differentiation

Support (for struggling learners):

1. Pair with a peer: Assign each student a "light buddy" for Explore and Elaborate activities
2. Simplified vocabulary: Use simplified terms initially (bright/dark instead of illuminate/opaque) and introduce formal vocabulary gradually
3. Concrete examples: Provide real, hands-on materials rather than pictures; let them hold and manipulate items repeatedly
4. Pre-teaching: Before the lesson, show the photograph to families and ask them to talk about lights and shadows at home (building schema)
5. Shortened exit ticket: Reduce to 1 yes/no question + oral response rather than multiple prompts

Challenge (for advanced learners):

1. Material investigation: Ask advanced students to categorize more complex materials (frosted plastic vs. clear plastic, wax paper vs. tissue) and explain the differences
2. Light sources hunt: Challenge students to identify light sources around the school (windows, lights, screens) and investigate whether they can create shadows with each
3. Prediction challenge: "Can you predict what will happen if we layer two transparent materials together? Two opaque? One of each?" Then test and explain
4. Design problem: "How could we use transparent and opaque materials together to make a special light show?" (Allow students to create and test)
5. Vocabulary extension: Introduce related terms like "translucent" (in addition to transparent/opaque) and ask them to find examples

Extension Activities

1. Shadow Puppet Theater:
 - Provide a white sheet, flashlight, and puppets/hands/objects
 - Students create shadow stories, experimenting with how far objects must be from the light to change shadow size
 - Connects to: how light travels in straight lines, opaque objects block light
 - Time: 15-20 minutes
2. Light Source Hunt Around School:
 - Take students on a guided walk with a checklist of light sources (window, overhead light, lamp, screen, reflective surface)
 - Students mark which ones they find
 - Discuss: Natural light (sun) vs. human-made light (electricity)
 - Connects to: identifying light sources in the real world
 - Time: 15-20 minutes
3. Glow in the Dark/Reflection Experiment:
 - Provide aluminum foil, white paper, black paper, and a flashlight in a dark area

- Students shine light on each surface and observe what happens (reflection, absorption)
- Record which surfaces "glow" brightest when light hits them
- Connects to: how materials interact with light in different ways
- Time: 10-15 minutes (can be center activity or homework exploration)

4. "What's Hidden in the Dark?" Sensory Game:

- Place mystery objects in a dark box
- Challenge students to identify them using OTHER senses (touch, sound) when light is off
- Then illuminate and verify with sight
- Connects to: how much we depend on light to see vs. other senses
- Time: 10 minutes
