Transparent, Translucent, or Opaque

Grade: 4th

Lesson Overview: Students will investigate different materials (transparent, translucent, and opaque) in order to describe how light interacts with the materials in a way that explains why they behave the way they do. They will use their observations to develop models depicting the behavior of light as it interacts with transparent, translucent, and opaque materials.

- **Standard 4.P.4:** The student will demonstrate an understanding of the properties of light and sound as forms of energy.
    - **4.P.4A. Conceptual Understanding:** Light, as a form of energy, has specific properties including color and brightness. Light travels in a straight line until it strikes an object. The way light reacts when it strikes an object depends on the object's properties.
        - **Performance Indicator 4.P.4A.5:** Plan and conduct scientific investigations to explain how light behaves when it strikes transparent, translucent, and opaque materials.

Science and Engineering Practice:

- **SEP 4.P.1A.3:** Plan and conduct scientific investigations to answer questions, test predictions and develop explanations: (1) formulate scientific questions and predict possible outcomes, (2) identify materials, procedures, and variables, (3) select and use appropriate tools or instruments to collect qualitative and quantitative data, and (4) record and represent data in an appropriate form. Use appropriate safety procedures.

Crosscutting Concepts:

- Patterns
    - Students should recognize the similarities and patterns between different materials based on how light behaves when it shines on them

Materials:

- Flashlights with batteries (one per each small group)
- Science journals
- Variety of materials with different optical properties for each group (transparent, translucent, opaque)
    - Suggested materials include (but are not limited to):
        - Transparent: clear water bottle, classroom window, clear plastic bag
        - Translucent: plastic grocery bag, cleaned milk or water jug, translucent plastic boxes, wax paper
        - Opaque: block of wood, book, building blocks, rock

Teacher Directions:

1. Activate prior knowledge about what they know about objects that are transparent, translucent, and opaque.
2. Split into small groups and give students the different objects to sort into groups depending on whether they would classify them as transparent, translucent, or opaque. Have each group share out their classifications and why.
3. Ask each group to draw what they think light is doing as it interacts with each different kind of material.
4. Give each group a flashlight and ask them to come up with a way to figure out how light behaves when using the flashlight and the different materials.
    a. Students should describe some variation of shining the flashlight at the different materials while one group member looks from the opposite side of the material to describe what the light looks like. Give them feedback on their plan, including how they will ensure that each trial will be a fair test (keep the distances between the light, the object, and observer constant for each trial).
5. Once you approve of their plans, allow them to re-test each object, making a chart of their observations of the flashlight interacting with the material.
6. As a small group, students use their observations to revise their models illustrating how a beam of light from the flashlight interacts with materials that are transparent, translucent, and opaque.
    a. Be sure to prompt the students to use the term reflection if it has been introduced by this point.
7. Have each group share out their models, explaining what their model shows and how they developed their models based on their observations.

Evidence of understanding: Students should be able to use their observations to describe how light behaves as it interacts with materials that are opaque, transparent, and translucent. They should then be able to use descriptions and observations to develop models illustrating these behaviors.