



LESSON PLAN: ACTIVITY 4: CREATING SHADOWS OF A MODEL EARTH

Students experiment with making shadows of a three-dimensional object, including a globe, to see how they can alter the size, shape and position of their shadows.

Teaching Tip

Remove the lampshade if the light is not strong enough, or if you cannot darken the room sufficiently to make shadows

Materials

- Lamp with 75-100 watt bulb
- 2 spheres (e.g. ideally a world globe about 12 inches in diameter & a tennis or ping pong ball, but any balls of these relative sizes will do)
- A sheet of 36" white poster board
- 1 toy (1"-2") "Matchbox-style" car truck, or other models of real objects

WARM-UP & PRE-ASSESSMENT

- How can you "make" a shadow?
- Can you make more than one shadow?
- How can you change the size, shape, or position of your shadow?
- Where does the light come from that makes the shadow?
- Can light get around the corner to make a shadow around a corner?





PROCEDURES

1. Have the children sit in a large circle. Darken the room.
2. Place the lamp on a stool or a file cabinet inside the circle.
3. Hand one ball to a child and have him or her stand in the circle near the lamp, holding the ball at arm's length. During this time, ask the children to predict what they will see.
4. Ask questions about what the children observe.
 - Is the ball making a shadow? If so how do you know? Where is the shadow?
 - If there is no shadow, why not? Where do you think it should be?
5. Hold a piece of poster board right behind the ball and have students observe its shadow. Discuss with them how they needed something on which to see the shadow. (They may have noticed it on the floor or on the classroom wall before this).
6. Hand a small toy car to another child and have him or her stand about a foot behind the first child and further from the lamp, with the car extended at arm's length. Ask what the children observe. (NOTE: The first ball should be making a visible shadow on the toy car behind it; adjust the children's distance if necessary, and use the poster board to emphasize the light difference.)

Teaching Tip

If you want to convey the straight line of light concept, use a string to pull between the lamp and the ball, then behind it to the toy car. Have students observe that the light does not turn left and right and cannot reach behind the solid ball)





PROCEDURES

7. Exchange the second ball with other objects of different sizes. Ask the children:

- What happens when the object is much smaller than the ball? Larger?
- How can the small car get out of the shadow?
- Have the children predict: If you're in the car in the shadow, are you cold or hot?
When you go into light, how do you feel?

8. Place the thermometers in the light near the lamp and in the shadow behind the ball. Record the temperatures.

9. Tell the students now to pretend that the ball is the Earth, and that they are standing on it! Remind them that we are sending up a rocket into space with a little spacecraft called MESSENGER. It will be very far away from Earth. Since it won't have any shadows to rest in when it gets too hot, we had to build something to give it a shadow all the time; that something looks like an umbrella and is called a sunshade.

- Use a toy car or spacecraft and move it towards the lamp and far from the ball, to show how it gets no shade anymore from the large planet Earth.
- Ask the students if this model MESSENGER got too close to the lamp, and were left overnight there, how hot would it get?
- Discuss how MESSENGER's sunshade is like the umbrella, that it keeps most of the light and heat away, so that the cameras under it will stay cooler than if they were out in the sun. Use the temperatures from their experiment to prove this.

10. Record the temperatures on the board. See if the children can identify hotter temperatures by their numbers. Help the children conclude that it's hotter in the light than in shadow.





DISCUSSION & REFLECTION

Discussion and reflection questions are embedded in the procedures above.

ASSESSMENT

Reread *Bear Shadow*. As a class, identify those aspects of the story that are purely fictional and those that “could happen,” paying particular attention to how shadows change during the day. Ask students to discuss how they notice temperatures changing during the day, too. Help them make correlations where appropriate.

For example, ask:

- Where would you want to sit to be coolest when it’s a summer day: in the shadow of a big building or in full sunlight in the middle of a baseball field?
- When it’s freezing outside and there’s snow everywhere, where can you warm up most: in the shadow of a big building or in full sunlight in the middle of a baseball field?

Compare the shadows in *Bear Shadow* to those students made and tracked in Activity 1. Revisit the discussion questions from the Warm-up and Pre-assessment activity, especially focusing on the last one, “What other questions do you have about shadows?” You could spend time answering the students’ questions, as well as generating ones to be answered in the other lessons of this series.

As a class, create a nonfiction version of the story.