

ELEMENTARY SCIENCE PROGRAM
MATH, SCIENCE & TECHNOLOGY EDUCATION

A Collection of Learning Experiences

**SUNSHINE AND
SHADOWS**



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SUNSHINE AND SHADOWS

GRADE K

Unit Overview

Sunshine and Shadows allows students to explore shadows. Students will observe how shadows form, how light effects objects, and how shadows change throughout the day. Through the use of the skills of observing, communicating, and manipulating, students will investigate the properties of shadows.

Scheduling

This unit may take from two to four weeks to complete depending upon the goals of the teacher and interests of the students. Use of the section included in this manual called More Ideas may extend the time span of this kit.

Materials to be obtained locally:

Please make **one** student activity book for **each** student.

chart paper	felt tip markers
cup with handle	white butcher paper
pencil	crayon
marker	scissors
colored chalk	large piece of cardboard
globe	metric ruler
projector	Objects around classroom (blocks, scissors, play animals, cars, etc)

Caution

Remind students to wash their hands after handling any of the materials in the kit. Small objects should be handled with care.

About the Format

Each learning experience is numbered and titled. Under each title is the objective for the learning experience.

Each learning experience page has two columns. The column on the left side of the page lists materials, preparations, basic skill processes, evaluation strategy, and vocabulary. The evaluation strategy is for the teacher to use when judging the student's understanding of the learning experience.

The right column begins with a "Focus Question" which is typed in italicized print. The purpose of the "Focus Question" is to guide the teacher's instruction toward the main idea of the learning experience. The "Focus Question" is not to be answered by the students. The learning experience includes direction for students, illustrations, and discussion questions. These discussion questions can be used as a basis for class interaction.

Background Information

Shadows

A shadow occurs when a light source is blocked. **Opaque** materials create dark shadows because light cannot pass through an opaque object. Opaque materials can absorb and reflect light. Aluminum foil, cardboard, and metal are all examples of opaque objects.

Translucent materials make shadows as well. However, translucent materials make lighter, less solid-looking shadows because only some of the light is blocked. Examples of translucent materials are waxed paper, tissue paper, and frosted glass. Light is scattered through these objects so images cannot be clearly seen through them.

Transparent objects allow light to pass through them. A clear window pane, cellophane, and plastic wrap are all examples of transparent material. Transparent materials create very light shadows because most of the light is not blocked.

Time

An imaginary line or **axis** runs through the Earth from the North Pole to the South Pole. The Earth rotates on this axis. It takes about 24 hours for the Earth to make one complete rotation. This rotation causes day and night. When the Earth is rotating, the part of the Earth that receives light from the sun is experiencing daytime. However, as that same part of the Earth rotates away from the sun it experiences nighttime. The sun appears to move in the sky, however, the sun is stationary. It is the Earth's rotation that causes the sun to rise and set. As the Earth rotates the position of the light hitting objects during different times of day changes. Therefore shadows of objects change position throughout the day.

Learning Experience 1: What Do You Know About Shadows?

Objective: Students will use their background knowledge to create a word web about shadows.

Materials:

For the class:

Chart paper*

Felt-tip markers*

*provided by teacher

Preparation:

Prepare a word web on chart paper with the word shadows in the center. Prepare students to take a walk around the school grounds or neighborhood.

Basic Skills Development:

Discussing

Describing

Evaluation Strategy:

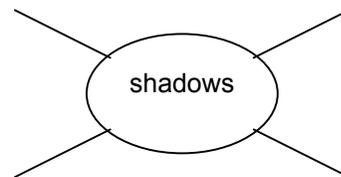
Students will contribute to a class word web on shadows.

Vocabulary:

shadow

What is a shadow?

On chart paper, draw a word web with the word shadows in the center of the web. Ask students to contribute to the web by asking them what they “think” they know about shadows. Write down student ideas on the word web. At the end of this unit, review the word web with students. Revise previous thoughts about shadows that were not accurate and add new learning.



Take a school grounds or neighborhood walk as a class. Observe, discover, and investigate the various shadows cast by large stationary objects. Include such things as playground equipment, trees, buildings, street signs, parked cars, etc.

Discussion Questions:

What makes a shadow?

Does everything have a shadow?

Are all shadows going in the same direction?

Why do shadows look different?

Does a shadow look different than the object casting it?

What was most interesting shadow you saw?

Learning Experience 2: Create Shadows

Objective: Students will create shadows in the classroom and describe how they are created.

Materials:

For each pair of students:

Flashlight
2 batteries

For the class:

Objects around classroom (blocks, scissors, play animals, cars, etc)
Cup with handle (ex. mug)*
Felt-tip markers*
White butcher paper*
Projector*

*provided by teacher

Preparation:

Read background information on page 3.

Basic Skills Development:

Observing
Discussing
Describing

Evaluation Strategy:

Students will describe how shadows are created and how the direction of the light source effects the shadow's direction.

Vocabulary:

shadow
light
direction

What is a shadow?

Turn the overhead lights off in the classroom and turn on one light source. A flashlight has been provided, however, the light from an overhead, small halogen light, or sensor light could also be used. Ask students to notice if they see any shadows around the classroom. Place an object in front of the light. Ask student to notice the shadow of the object. Students should notice that a shadow will occur if there is an object blocking the light.

Give student pairs flashlights and other objects for them to experiment with. For example blocks, scissors, play animals, cars, etc. Encourage students to make shadows by moving the flashlight around the object and making an arc over the object. They will discover the answers to the discussion questions.

Ask a student to hold the cup with a handle in front of the light. Have the rest of the class observe the shadow of the cup as the student stands in front of the light then walks toward and away from the light. Ask students to describe the size of the shadow in relation to distance from the light. Students should observe the shadow get larger the closer to the light the object is and smaller the farther away the object is from the light source.

Discussion Questions:

How is a shadow created?

Is it easier to see a shadow in the classroom with the lights on or off?

Why?

Does a shadow move when the object that creates the shadow moves?

Learning Experience 2 continued

Page 2

How can a shadow change in size?
Does the shadow move as the flashlight moves?
Does the shape of the shadow change?

Instead of using just one light source, shine multiple light sources on the cup or another object. Ask students to count the number of shadows they see. Students should observe that each light source shining on an object creates a shadow. Place an object in the center of a large piece of white paper. Shine a light on the object at different angles. Use a felt-tip marker to mark the direction of each shadow that appears.

Discussion Questions:

Can an object have more than one shadow? When?
What position is the light source compared to the position of the shadow?

Get the other students in class involved with the shadow playing by shining an overhead projector against a bare wall or screen. While saying the rhyme below, invite students to create shadows on the wall as they perform the actions. Turn the projector off during the last line of the rhyme.

Shadow Rhyme

*One, two, three. What can it be?
There's a dark shadow following me!
Four, five, six. It can play tricks!
It runs and jumps and even kicks.
Seven, eight, nine. Is that shadow mine,
Playing with me in the bright sunshine?
I'm up to ten. Shadow's gone! But then—
That's what shadows do when the sun goes in!
Hold up fingers in sequence.
Point behind you.
Hold up fingers in sequence.
Run, jump, and kick in place.
Hold up fingers in sequence.
Make a circle with arms over head.
Hold up ten fingers.
Wave good-bye.*

On a sunny day, take your students outside. Encourage them to move to the song as they watch their shadow.

Sung to the tune of “Did You Ever See A Lassie?”

*Did you ever see a shadow, a shadow, a shadow,
Did you ever see a shadow [jump up and down]?
[Jump] this way and that way, and that way and this way?
Did you ever see a shadow [jump up and down]?*

Learning Experience 2 continued

Page 3

Create additional verses by substituting actions – ex. Twirl all around, hop on one foot, flap both arms, wave both hands.

I Wish I Were Your Shadow (sung to the tune of the Oscar Meyer Wiener theme song)

Oh, I wish I were your shadow on the sidewalk.

I'd come to play with you each sunny day.

I'd run and jump and skip whenever you did.

Then when the sun was gone, I'd go away!

Discussion Questions:

How can you shake shadow hands?

How can you make your shadow finger touch a spot on the ground, wall, or tree?

Have students make a circle with their shadow arms and try to encircle a stone or spot on the ground.

In teams of three, have students make a 6-legged or 6-armed figure with their shadows.

In teams of five, have students stand on each other's shadow shoulders.

Learning Experience 3: Light and Other Objects

Objective: Students will compare the differences between the shadows of objects and classify the objects as transparent, translucent, or opaque.

Materials:

For each pair of students:

2 Sunshine and Shadows Student

Activity Books

Flashlight

2 batteries

Waxed paper

Plastic wrap (10cm x 10cm)

Aluminum foil (10cm x 10cm)

Clear 9 oz plastic tumbler

Wooden block

Mirror

9 oz paper cup

12 oz. translucent cup

For the class:

Flashlight

2 batteries

Waxed paper (24cm x 24cm)

Aluminum foil (24cm x 24cm)

Clear plastic wrap (24cm x 24cm)

Metric ruler*

*provided by teacher

Preparation:

Read background information on page

3. Cut the clear plastic wrap and aluminum foil into 10cm x 10cm pieces.

Cut waxed paper, clear plastic wrap, and aluminum foil into 24cm x 24cm pieces.

Evaluation Strategy:

Students will classify various objects as opaque, translucent, or transparent and give reason for their classification.

Basic Skills Development:

Observing

Describing

Classifying

Comparing

Vocabulary:

opaque

transparent

translucent

compare

solid

How can we draw our shadows?

Ask a student to hold their hand in front of the light source. Ask the rest of the class what they observe about the hand and the parts that are lit up. Students should notice that just one side of the hand is lit by the light, while the other side is dark. Objects that are opaque block the light. Opaque objects form dark shadows of themselves when light shines on them. However, ask students to observe the shadow of the clear plastic tumbler. Students will be able to see the light source through the tumbler. This illustrates to students the transparent quality of the tumbler. Also, compare the shadows of the solid object to the transparent object. This shadow appears lighter due to its transparent quality.

Discussion Questions:

Does light shine through a solid object?

What happens when the light is blocked?

Transparent object? Why or why not?

Does the clear plastic tumbler appear as a solid shadow? Describe.

Which objects will the light from the flashlight pass through?

Which ones will the light not pass through?

Learning Experience 3 continued

Page 2

Student pairs are to use a flashlight to shine on the various objects provided (clear plastic wrap (10cm x 10cm), aluminum foil (10cm x 10cm), wood block, clear plastic tumbler, paper cup, and mirror) to classify if they are opaque or transparent. Students will make a prediction first and record their prediction on page 1 of the activity sheet for Learning Experience #3 in the Sunshine and Shadows Student Activity Book. On page 2 of the activity sheet students can record their data. Discuss the results.

Brainstorm household and classroom items that are transparent and opaque. Lead students to realize if they can see through an object it is transparent. If they cannot see through the object, it is opaque.

Discussion Questions:

What objects are opaque? transparent?

How do you know?

Describe the shadow of each?

Student pairs will compare the clear plastic wrap (24cm x 24cm) to waxed paper (24cm x 24 cm). Students may notice that light can be seen through the waxed paper, but not as clearly as seen through the plastic wrap. Introduce the word translucent. Translucent objects do let some light through them, but not as much as transparent objects. Compare the shadow of the plastic wrap, waxed paper, and aluminum foil. The shadow of the aluminum foil is darker than the waxed paper. However, the shadow of the waxed paper is darker than the plastic wrap. Compare the shadow of the 9 oz. clear plastic tumbler, paper cup, and translucent cup. Notice shadow differences.

Discussion Questions:

Describe a translucent object?

How does the shadows of an opaque, translucent, and transparent object compare? Explain.

Learning Experience 4: Familiar Shadows

Objective: Students will observe the shadows of familiar objects and compare the actual object to the shadow it creates.

Materials:

For each pair of students:

2 Sunshine and Shadows Student Activity Books

Flashlight

2 batteries

Wooden block

Wooden dowel

Cone shaped cup

9 oz. paper cup

Pencil*

2 large pieces of butcher paper*

Marker or crayon*

Scissors*

Preparation:

Have students use the wooden block, wooden dowel, cone shaped cup, and 9 oz. paper cup as objects used to cast shadows. Cut large pieces of butcher paper so students can draw their shadows.

Basic Skills Development:

Observing

Comparing

Discussing

Describing

Evaluation Strategy:

Students will manipulate different objects to produce different shadows.

Vocabulary:

shadow

light

size

shape

Does the shape of an object change in its shadow?

Darken the classroom and shine a light on a wall or screen. Hold up various objects in front of the light beam so the object creates a shadow. Have student pairs hold the various objects in different positions in the light. Observe the shadow when the object is standing up, lying flat, or at a different angle in the light. Ask students to find out how many different kinds of shadows each of the differently shaped objects can make. Students can draw a picture of their object on the activity sheet for Learning Experience #4 in the Sunshine and Shadows Student Activity Book. Students can then draw a picture of the different shadows the object makes depending on the direction of light source and position of the object. Students may notice that the round, curved objects look flat and lose their roundness in their shadow. They may also notice that the shadows of some things look very different from what we expect them to look like. A pair of scissors lying flat can look like a straight line and a pencil held horizontally can look like a small circle. Students may also notice that the further the object is away from the light source the shadow more accurately represents the object's true size.

Discussion Questions:

What shadows do different objects make? Does an object's shadow look just like the object? Explain?

Learning Experience 4 continued

Page 2

Can you change the shape of a shadow? How?

What shapes do you see?

What happens to round objects when they make shadows?

What happens to shapes or objects when they are very close to the light?

Students can then compare their own shadows to themselves. Place large sheets of butcher paper or craft paper on an outside surface. Have one student cast a shadow onto the paper while another student or teacher draws the outline of the shadow. Students should cut out their own shadow. Compare their shadow to their own size, shape, and features.

Discussion Questions:

What does your shadow look like?

Is it the same or different than your real body? Explain?

Lie down on top of the drawn shadow. How is it different?

Which one is bigger? Smaller?

How could we change your shadow?

Learning Experience 5: Shadow Movement

Objective: Students will observe how the shadows of objects change direction throughout the day and explain why the shadows change.

Materials:

For each student:

Sunshine and Shadows Student

Activity Book

Modeling clay

Wooden dowel

Straw

Large piece of cardboard*

For the class:

Flashlight

2 batteries

Colored chalk*

Globe*

*provided by teacher

Preparation:

Read background information on page 3.

Basic Skills Development:

Observing

Comparing

Discussing

Describing

Evaluation Strategy:

Students will describe changes in size and shape of a shadow over a period of time and explain the reason for this change.

Vocabulary:

sun

shadow

position

size

rotate

How does a shadow change from the morning to afternoon?

On a sunny day, use chalk to trace around a student's shadow cast on a flat surface. Later, have the same student stand on the feet of the original shadow. Trace the second shadow with a different color chalk. Repeat several more times. Allow sufficient time between tracings to ensure a change in position.

Discussion Questions:

What happened to the shadow?

How did it move?

Does the second shadow look the same or different from the first? Explain?

In the classroom, use a globe and a flashlight to demonstrate why the shadows we observe change throughout the day.

Use the globe to represent the earth and the flashlight to represent the sun. Place a piece of clay on the globe where we live. Turn the lights out in the room and shine the flashlight on the globe. Rotate the earth until the light is shining on the clay. Students should observe that one side of the earth is in the light and one side is in the dark. Ask students which side is experiencing night and which side is experiencing day. Continue to rotate the earth so that the clay is in the dark. The earth is continuously moving, but we cannot feel it moving because everything around us is moving. Students can role-play this

Learning Experience 5 continued

Page 2

same learning experience by pretending that their body is the earth. If they are facing the light, the front side of their body would be experiencing day and the back of their body would be experiencing night.

As you rotate the earth, have the students observe where the sun is located. Students should observe the sunlight moving across the globe. However, it is important to make clear that the sun is stationary in our solar system, and it is the earth that rotates. With the Earth's rotation, the sun rises and sets. This movement affects shadows that we observe. Although the sun stays still, it appears to make an arc in the sky. To observe this, have each student place a piece of clay on their desktop and push a straw into the clay. When the sun is low, our shadows are long. When the sun is directly overhead, our shadows are short. Use the flashlight, to demonstrate this arc and observe the shadow of the straw in relation to the light's position.

To observe this phenomena outside, have each student place a piece of clay on a large piece of cardboard. Place the wooden dowel in the clay. Place the cardboard with the dowel in the sun. Mark the shadow and the time the shadow was taken on the cardboard. Later in the day, take the same marking. Notice the location and size of the shadow. By marking the shadows at different times during the day, the class will have created a sundial. On the activity sheet for Learning Experience #5 in the Sunshine and Shadows Student Activity Book, record the position of the sun and the shadow cast by the dowel at four different times of the day.

Discussion Questions:

What happened to the shadow?
How did the shadow move or change?
Why does this change occur?

Oh, Mr. Sun

*Oh Mr. Sun, Sun,
Mr. Golden Sun
Hiding behind the tree
Oh Mr. Sun, Sun
Mr. Golden Sun,
Please shine down on me.*

MORE IDEAS

Language Arts

- ◆ Write a story or poem about your shadow.
- ◆ Use descriptive words to describe your shadow.

Books:

Allen, Lisa and Sharp, Julis Time for Bed – The Secret of Shadows
Asch, Frank – Moonbeams Shadow
Bulla, Clyde Robert - What Makes A Shadow
Stevenson, Robert Louis – My Shadow
Chorao, Kay – Shadow Night
Welling, Peter – Andrew McGroundhog and His Shady Shadow
Birenbaum, Barbara – Groundhog Willie's Shadow
Michaels, William – Clare and Her Shadow

Art

- ◆ Using paper, crayons, and scissors, encourage students to make cut-out designs to cast shadows.
- ◆ Cut out magazine pictures describing you and paste them on the cut out of your shadow.

Physical Education

- ◆ Students can play various playground games using shadows instead of traditional methods. Examples are below.

Shadow Tag: Play the game of tag with finger shadows tagging shadows, or tagging a shadow with a foot or tagging a shadow with a hand's shadow.

Shadow Simple Simon: Play the game of Simple Simon with commands pertaining to shadow: such as Simon Says, "Touch your shadow." Simon says, "Stand with your shadow in front of you."

Shadow Follow the Leader: Play the game of follow the leader with shadows by the leader making different shadow movements and the rest of the group imitating these.

Math

- ◆ Measure the length and width of your shadow in a particular position with paper tape or centimeter blocks. Graph measurements.
- ◆ Measure length of shadow on sundial.

INQUIRY AND PROCESS SKILLS

Classifying	Arranging or distributing objects, events, or information in classes according to some method or system.
Communication	Giving oral and written explanations or graphic representations of observations.
Creating Models	Displaying information by means of graphic illustrations or other multi-sensory representations.
Formulating Hypothesis	Constructing a proposition or assumption of what is thought likely to be true based on reasoning, which serves as a tentative testable theory.
Gathering & Organizing	Collecting information about objects and events which show a specific situation.
Generalizing	Drawing general conclusions from information.
Identifying Variables	Recognizing the characteristics of objects or events which are constant or change under different conditions.
Inferring	Making a statement or conclusion based on reasoning or prior experience to explain an observation.
Interpreting Data	Analyzing information that has been collected and organized by describing apparent patterns or relationships in the information.
Making Decisions	Choosing an alternative from among several and basing the judgment on defensible reasons.
Manipulating Materials	Handling or treating materials, equipment or procedures skillfully and effectively.
Measuring	Making quantitative observations by comparing to a standard.
Observing	Becoming aware of an object or even by using any of the senses to identify properties.
Predicting	Making a forecast or estimate of what future events or conditions may occur.

GLOSSARY

Compare:	examine two or more people or things to discover similarities and differences between them.
Direction:	the way in which somebody or something goes, points or faces.
Light:	the energy producing brightness; an artificial source of illumination.
Position:	the way or direction in which an object is placed or arranged.
Opaque:	not allowing light through.
Rotate:	to turn around on an axis or fixed point.
Shadow:	a darkened shape on a surface that falls behind somebody or something blocking the light.
Shape:	the outline of an object's form
Size:	the quantity or extent of a particular object
Solid:	consisting of compact, inflexible material
Sun:	the star at the center of our solar system around which the Earth and eight other planets orbit. It provides heat and light.
Translucent:	allowing light to pass through but only diffusely, so objects on the other side cannot be distinguished.
Transparent:	allowing light to pass through with little or no interruption so objects on the other side can be clearly seen.

TEACHER REFERENCES

Levenson, Elaine – Teaching Children About Physical Science. TAB Books

Media Library

Call the media library to order media materials and to check on new materials that are available. The number to be reached is (716) 376-8212.

Web Sites

http://pbskids.org/arthur/grownups/activities/play_learn1/shadow_play.html

<http://www.osv.org/kids/crafts2.htm>

[http://www.teacherfiles.com/sharing_science.htm#\"Transparent,%20Translucent%20and%20Opaque\"](http://www.teacherfiles.com/sharing_science.htm#\)