



Teacher Created Resources®

STEM

Hands-On Challenges

Grade

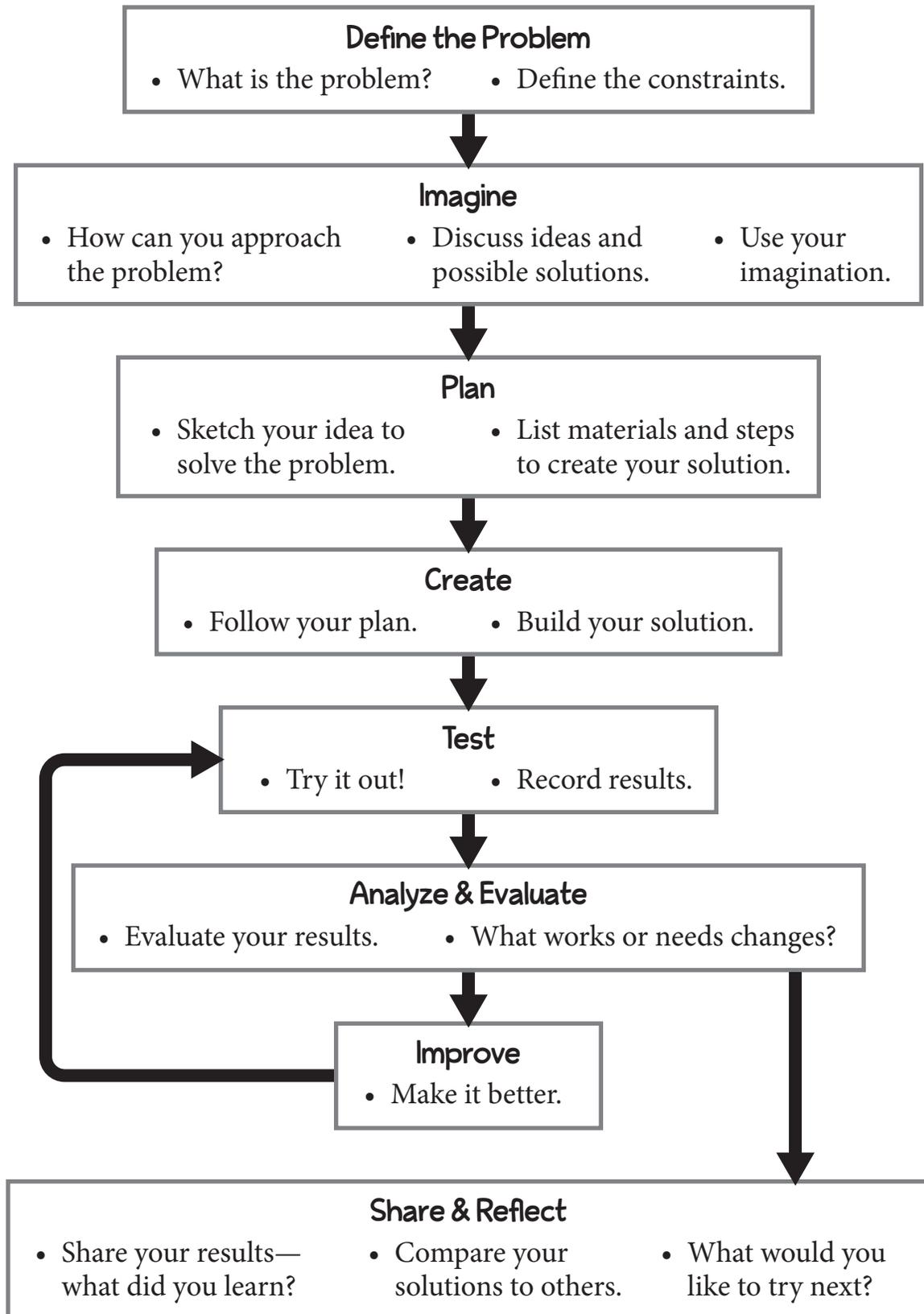
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Engineering Design Process

—a series of steps used by engineers to solve a problem—



Me and My Shadow

Objectives

- ▶ Students will learn about how shadows are made by participating in simple, hands-on demonstrations.
- ▶ Students will then investigate how their shadows change as the sun moves during the day.
- ▶ Students will be exposed to some academic vocabulary that is used in scientific investigation.

STEM Focus

Earth and Space Science

Patterns of the motion of the sun, moon, and stars in the sky can be observed, described, and predicted.

Science Inquiry

Use observations of the sun, moon, and stars to describe patterns that can be predicted.

Science and Engineering Practices

Plan and carry out investigations; analyze and interpret data; construct explanations and design solutions.

Crosscutting Concepts

Patterns; cause and effect; stability and change

Time Frame

- ▶ The Introduction and Mini Challenge can be completed in one class session of about 20 minutes.
Note: Do the Mini Challenge and the Main Challenge on separate days.
- ▶ The Main Challenge should be completed in two 30-minute segments, one in the morning and one in the afternoon on a sunny day.

Vocabulary

analyze
evidence
light

observe
opposite
predict

record
shadow

Me and My Shadow

Introduction

Materials

- flashlight
- small toy or stuffed animal

Setup

1. Arrange the flashlight and stuffed animal in an area for all students to view.
2. Have chart paper or a board nearby in order to add vocabulary and other important words as needed.

Mini Challenge

Materials

- copy paper or other blank paper
- pencils
- flashlights for each pair or group
- small plastic toy, block, or animal

Setup

1. Collect flashlights for each pair or small group.
2. Collect an assortment of small, plastic toy animals or other small, opaque objects for students to use in casting shadows.
3. If appropriate, prepare a tray that has flashlights, paper, pencils, and small toys or stuffed animals for each group area.

Main Challenge

Materials

- *Me and My Shadow* (page 20)
- colored sidewalk chalk
- clipboards or other portable writing surfaces
- pencils and colored pencils

Setup

- ▶ Locate a space outdoors in full sun where students can trace their own shadows on the ground in chalk both in the morning and later in the day.
- ▶ The space should be away from buildings and trees so that the shadows don't overtake the workspace as the day goes on.

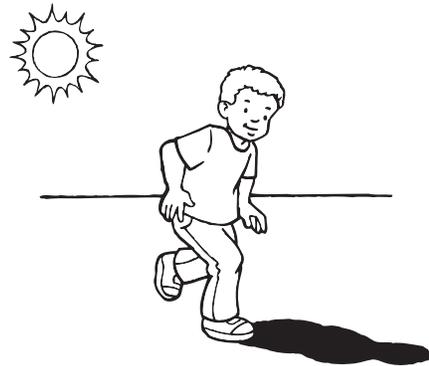
Me and My Shadow

Introduction

1. Tell students that in this challenge, they will be learning about **shadows**.
 2. Ask students to talk with a partner about what a shadow is and how a shadow is made.
 3. Have some volunteers share their ideas about shadows.
- 🗨 Write the word *shadow* on the board.
4. Hold up a small toy animal and a flashlight, and ask how you could use these to make a shadow. After some discussion, place the toy on the table and shine the flashlight at it to create a shadow.
 5. Ask students to **observe** (*look carefully and notice things*) the shadow and describe it.
 - Is it short or long?
 - Is it wide or narrow?
 - What color is the shadow?
- 🗨 Write the word *observe* and its definition on the board.

Explain the Science

Lead students to understand that **light** travels in straight lines. If a solid object gets in the way, it stops the light rays from traveling through it, forming a dark area (shadow) on the other side.



6. Review what things are needed to make a shadow, and add them to the board if appropriate.

To make a shadow, you need:

- ✓ light
- ✓ an object to cast the shadow
- ✓ a surface for the shadow to fall on



Me and My Shadow

Introduction *(cont.)*

Making Shadows

1. Have two student volunteers make shadows for the class to observe. Ask students to observe and discuss with a partner how each shadow is different.

(This one is longer; That one is on the other side.)

2. Hold the flashlight to one side of an object, creating a shadow on the opposite side. Ask:

—How can I make the shadow move to the other side?

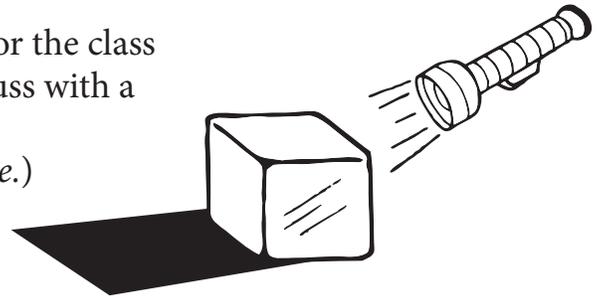
(Move the flashlight to the other side.)

3. Demonstrate by moving the flashlight and having students point out the new location of the shadow.

4. Introduce the word **opposite**. Say, “The light and the shadow are on opposite sides of the (_____).”
object

5. Have students repeat the following phrase, and add it to the board if appropriate:

The light and the shadow are on opposite sides of the (_____).
object

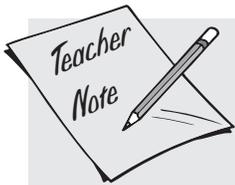


Me and My Shadow

Mini Challenge

1. Explain to students that they will be taking turns predicting where the shadows they make with their objects will “land.” Then, they will observe and describe their shadows. First, you will demonstrate the activity with volunteers.
2. Place a blank sheet of paper on the table and have a student choose a toy animal or other object.
3. Ask the student to place the chosen animal in the center of the sheet of paper and hold the flashlight (turned off) where they want to shine it on the object.
4. Ask the students observing to **predict** where the animal’s shadow will be and what it will look like when the flashlight is turned on. Tell students that *predict* means to think about what might happen.

⇒ Write the word *predict* and its definition on the board.



When students are asked to make predictions about what will happen in an experiment, be sure to let them know that it doesn’t matter whether their predictions match what happens.

Students will have a natural inclination to want their predictions to be “right.” Discuss how scientists make predictions all the time, but their predictions often turn out to be different from the actual results, and that’s okay!

What matters are results and evidence. *Evidence* is something real that you can see, hear, feel, or measure. If the evidence shows that a prediction was incorrect, scientists use what they have learned and change their ideas about how things work.

⇒ Write the word *evidence* and its definition on the board.

5. Have the student turn on the flashlight and ask all students to observe the shadow. Ask:
 - Did the shadow match the prediction? Discuss.
 - Can you describe the relationship between the flashlight, the object, and the shadow?

Me and My Shadow

Mini Challenge *(cont.)*

Possible Observations

The shadow is on the side of the object that is opposite from the flashlight.

The shadow is long because the flashlight is shining lower down on the object.

The shadow is all around the object because the light is right above it.

6. Ask another student to hold the flashlight in position as you show the first student how to trace the shadow of their object on the paper.
7. Then, ask the student to write or to dictate a sentence about the shadow he or she made.

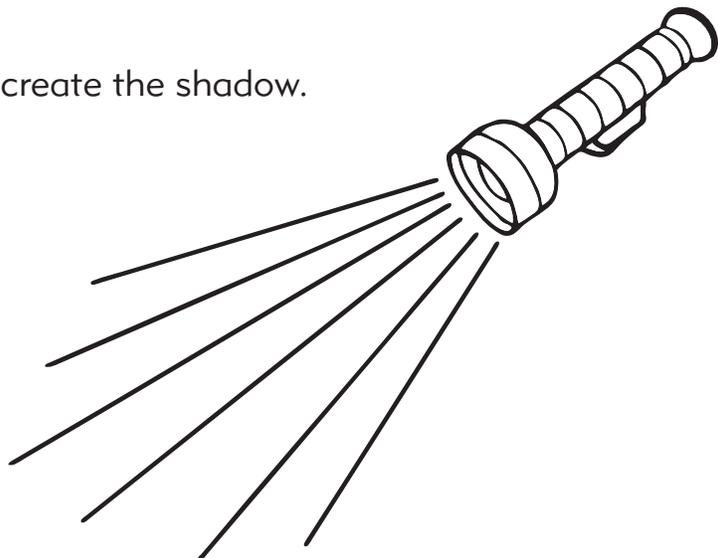
Shadow Activity

Have students work in pairs, taking turns holding the flashlight, predicting what the shadow will look like, and tracing it.

Shadow Predictions

Directions

1. Place the object on a sheet of paper.
2. Hold the flashlight while your partner predicts where the shadow will be.
3. Shine the flashlight to create the shadow.
4. Trace the shadow.
5. Describe the shadow.
6. Switch places.



Name _____

Date _____

Me and My Shadow

Record

1

1. Draw the sun and your first shadow
at



2

2. Draw the sun and your second
shadow at



Reflect

3. How did the sun and your shadow change over time?

4. Why do you think that your shadow changed over time?
