

SHADOW PATTERNS: DESIGN & EARTH'S PROCESSES

GRADE: 3-8

TIME: 1 day, 15-30 minute increments

Every hour in Frank Lloyd Wright's Frederick C. Robie House is a new experience as the sunlight moves through its art glass windows and casts changing patterns of light and shade. In this lesson, participants observe and record changes in shadows to learn about Earth's movement and use the Robie House to consider the effect of the Sun on architecture and design. This Lesson pairs with *Building with the Sun: Nature & Design*.

INTEGRATED SUBJECTS: Visual Art & Science

OBJECTIVES

MATERIALS | RESOURCES

Images of Robie House interior
Compasses
Yard stick or measuring tape
Worksheets (included at end of lesson)
Pencils
Dowel rod

1. Engage in the scientific method by observing and recording the movement of shadows.
2. Explore pattern and structure in the built environment, as evidenced by Wright's designs.
3. Consider the relationship between Earth's processes and design solutions.

ESSENTIAL QUESTIONS

1. What is unique about Frank Lloyd Wright's designs?
2. How do the Earth's processes affect the way we design?
3. How can innovative design shape and improve the way we live?
4. How can exploring design help us to better understand the world around us?

LESSON PROCEDURE

EXPLORE

10 minutes

- Introduce Frank Lloyd Wright and his Frederick C. Robie House in Chicago's Hyde Park (<https://www.teachingbydesign.org/about/robie-house/>). Spend time looking at interior images of the house and details of Wright's art glass window designs. Images and videos are available on vimeo at <https://vimeo.com/871547477?share=copy> and <https://vimeo.com/873820082?share=copy>.
- Begin a discussion about what participants observe. Ask: What do you see? How do the pictures make you feel? What do you see that makes you feel that way?
- Compare multiple images, and ask participants to discuss how they are similar and different. How do shadows move throughout the room or change, and why do you think this is? Does it change the way you feel? Together as a class, develop a question for inquiry as it pertains to the shadows in Robie House. Have participants brainstorm a question to research based on the images they have just seen.
- Participants might ask questions such as:
What effect does the Sun have on where the shadows are in the house? Why does the light inside the house move throughout the day? How does the direction of the Sun affect shadows? How do shadows change throughout the day?

ENGAGE

1 day, 15 minute increments minutes

- Ensure that participants have an understanding of cardinal directions before beginning an investigation as a class, exploring first-hand how shadows change throughout the day. Outside, push a pencil or dowel into the ground, tilting it slightly to the north.
- In groups, ask participants to record the time, location of the Sun, and direction and length (measured to the nearest inch) of the shadow cast by the rod, going out to check every hour throughout the day. *Always remind participants not to look directly at the Sun.
- Using the data collected outside, have participants complete a line graph of the change in the length of the shadows (y axis) at each hour of the day (x axis). Participants may have to count by tens or even 20, depending on the length of rod used for the experiment.
- As participants work, make sure to meet with each group to facilitate small group discussions. Ask:
What have you noticed so far? What patterns do you see? Why might that happen? Is that what you expected to happen? How has your thinking changed? What conclusions can you draw?

CRITIQUE & INTERPRET

15 minutes

- Ask participants to write a fact-based argument in response to the class's question for inquiry using the data that they have collected and discussed. Participants can begin with the statement, "Shadows change throughout the day" and add how and why shadows change based on the evidence they found.
- Finally, return to the photos and video of Robie House, and consider how the Earth's processes might affect the way an architect designs.
- Ask:
How does the position of the Earth in relationship to the Sun affect the way we design? How might the Sun have helped or hindered Frank Lloyd Wright as he designed his art glass windows for Robie House? What other tools or designs in our lives might have been affected by the Sun?

SHADOWS AND THE SUN				
TIME	SUN LOCATION	SHADOW DIRECTION	SHADOW LENGTH	NOTES AND OBSERVATIONS

TIME OF DAY



LENGTH OF SHADOW