Day & Night

Children talk about the differences between daytime and nighttime, including the activities they do at each time. Then they model the Earth's rotation with a globe and with their own bodies, to explore the reason for day and night. This activity works best in a workshop.

15–20 minutes

Workshop

Up to 15 children

Content Learning Goals

Children will begin to understand:

- We live on the planet Earth, which is a sphere.
- Daytime is when the Sun is in the sky and nighttime is when the Sun is not in the sky.
- The Earth is rotating (spinning), and this causes daytime, when our side of the Earth is facing the Sun, and nighttime, when our side of the Earth is facing away from the Sun.
- When it is daytime for us, it is nighttime on the other side of the Earth.

Materials

- Images of daytime and nighttime activities
- Images of the sky in the day and at night
- Globe or Earth ball
- Bear figures, two different colors
- Tape or other adhesive
- Bright light

Science Practices

Children will begin to engage in science practices around the phenomenon of day and night by:

- **Comparing** their observations of day and night to make a claim about how daytime is when the Sun is in the sky and nighttime is when the Sun is not in the sky.
- Using a **model** of the Sun and Earth (their own body) to explain why we see the Sun during the day and not the night.

SET-UP

- Set up in a location where children will have plenty of room to move around and where you can switch off the lights.
- Check that you can use the light to illuminate one side of the Earth ball such that all of the children will be able to see each side of the Earth, the light and the dark.
- Stick tape or other adhesive on the bottoms of the two bears so that you can stick them onto the Earth ball.

ACTIVITY DESCRIPTION

1. Invite children to discuss their ideas about the activities they engage in during the day and help them connect these experiences to the Sun:

- When you play outside in the daytime, is it dark or is it light?
- Do you need a flashlight to see?
- Where does the light come from in the daytime?
- What are some other things you do in the daytime when it is light outside? (eat, play, do chores, shop, school, watch television, etc.).

2. Ask children about their experiences with the nighttime:

- What do you see in the sky at night?
- When do you see the stars in the sky?
- When you go to sleep, and then wake up while it's still nighttime, do you see the Sun?
- What are some things you do in the evening when it's dark outside? (If they turn a light on inside, they can eat, read, watch television, take baths, etc. You must emphasize that they have to turn a light on; the Sun doesn't make light in their house at night. They sleep when the Sun and all other lights are off.)

3. Show some photographs of daytime and nighttime skies:

- Ask the children, *What do you notice in this photo? Is it day or night? How can you tell?* They may point to the Sun in the sky for the day. But some children see the Moon in the daytime sky and think this means it is nighttime.
- Ask the children, *What is different about the daytime sky compared to the nighttime sky?* or *What can we only see in the daytime sky and not at night?* They might say other things, such as the sky is blue during the day or that we see stars at night, but all of this still comes back to whether the Sun is in the sky or not. This conversation allows you to help the children to summarize their observations as a claim about the major difference between day and night skies: the presence or absence of the Sun.

4. Use a physical Earth ball to model how rotation explains day and night:

- Let's make some models to help explain why we only see the Sun during the daytime and not during the nighttime.
- Here is a bigger model of the Earth (show Earth ball or globe). Red Bear lives on Earth, in the same place that we live. (Ask children if anyone can point to where we live. Place the bear on that spot with some tape or other adhesive.)
- Blue Bear lives on the other side of the Earth, over here in China. (Place the Bear on the spot.)
- We'll turn off the lights and use this bright light as the Sun. See how the Sun is shining on one side of the Earth? Red Bear is on that side of the Earth so it's daytime for her right now. She sees the Sun when she looks up in the sky, and it is daytime for her. She's eaten her breakfast and went outside to play. She went to swimming lessons and all the things she does in the daytime.
- Blue Bear is on the dark side of the Earth. Can Blue Bear see the Sun right now? (No, the Earth is in the way.) He doesn't see the Sun in the sky and it is dark outside. It's nighttime in China where Blue Bear lives. Blue is sound asleep. It's nighttime and everyone in his family is sleeping in their beds.
- Is it always light here where Red Bear lives? Is it always dark in China where Blue Bear lives?
- Watch what happens as the Earth rotates (spins). Slowly rotate the globe in a counter-clockwise direction:
  - Even though we don't feel it, the Earth is actually always moving. Here Red Bear is now having dinner, maybe having a bath, getting ready for bed. (Keep rotating the globe.)
  - Blue Bear is now waking up and brushing his teeth and eating breakfast, getting dressed.
  - Red Bear is now tucked into bed.
  - Blue Bear is playing outside in the park, walking his dog, and going swimming.
  - By the time Red wakes up, and Blue goes to sleep again, one day (24 hours) has passed.

5. Use children's bodies as a model of the Earth as they explain day and night:

- Now we can all pretend that we are the Earth. Imagine we live on the tip of our noses, Mt. Nose! Can you face the Sun (lamp) so that it's daytime on Mt. Nose? Now slowly rotate so that is nighttime on Mt. Nose, facing away from the Sun.
- Rotate together as you sing this song:

Day/Night Song

To the tune of "Are You Sleeping / Frère Jacques"

The sun is shining, the sun is shining. (Face the lamp.)
It is day, it is day.
The sun is gone and now it's night. (Rotate so backs are facing lamp.)
We can't see without a light.
CHORUS
Day and night, (Rotate twice.)
Day and night.

- **Hold up some pictures of different activities, both daytime and nighttime.** Ask the children: *Does this picture show daytime or nighttime?* Next, ask the children which way they should be facing for the time shown in the picture: *Great, it is daytime? Can you show me where the Earth would be facing during daytime?* The children will rotate their bodies so that their noses face the light for daytime or face away from the light for nighttime as appropriate for the activity in the pictures.

  This is an important opportunity for children to actively engage in applying what they learned about the Earth's rotation to explaining why we see the Sun during the day and not the night.

- **Wrap up:** So, the Sun is in the sky in the bright daytime, and not in the sky in the dark nighttime, because the Earth is moving. That's why we have daytime and nighttime.

BACKGROUND INFORMATION

The following information about learning science and astronomy is intended for the educator who will facilitate the "Day & Night" activity. The activity is a developmentally appropriate first step toward the children eventually understanding the concepts explained below, perhaps years later. We do not intend the educator to cover most of these concepts with the children during the activity. This information is provided to give the educator a good basic understanding of the scientific concepts that the activity is moving toward and the way that many children think about these topics, and preparation to answer questions from very curious children or adults.

LEARNING SCIENCES

Shape of the Sun and Earth

Young children often do not conceptualize the Sun and Earth as spheres. Research across many cultural contexts have found that preschool-age and early elementary-age children in countries including China, France, New Zealand, and the United States hold a range of ideas about the Earth's shape including that it is flat, a hollow sphere, or that there is a separate Earth in the sky (dual earth model).[1,2,3] Valanides and colleagues investigated 5- and 6-year-old-children's ideas about the shape of the Sun and Earth.[2] They found that, prior to instruction, more children suggested that the Sun is a sphere (73%) than believed the Earth to be a sphere (55%). Only about half of the children thought that both were spheres based on their selection of a sphere shape over other possible shapes for these two objects.

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[1] Blown, E. J., & Bryce, T. G. K. (2006). Knowledge restructuring in the development of children's cosmologies. *International Journal of Science Education*, *28*(12), 1411–1462.

[2] Valanides, N., Gritsi, F., Kampeza, M., & Ravanis, K. (2000). Changing pre-school children's conceptions of the day/night cycle Changer les Conceptions d'Enfants d'Age Prescolaire sur le Phenomene du Cercle'Jour-Nuit'Cambiar las Concepciones de los Ninos Preescolares en el Ciclo Dia/Noche. *International Journal of Early Years Education*, *8*(1), 27–39.

[3] Vosniadou, S., & Brewer, W. F. (1992). Mental models of the earth: A study of conceptual change in childhood. *Cognitive psychology, 24*(4), 535–585.

However, after participating in 30 minutes of instruction on how the Earth's rotation causes day and night, using a globe and a light source, 88% selected a sphere to represent the Earth, 91% selected a sphere to represent the Sun, and 82% selected a sphere for the shape of both objects. Kallery also found positive results with instruction on the shape of the Sun and Earth with 4- to 6-year-old children; after instruction, 92.3% of the children make sphere shaped model of the Sun and Earth with playdough.[4]

Explaining Day and Night with the Earth's Rotation

Preschool-age children often associate the reason why we have day and night with the movement of the Sun, believing that it is actually moving up and down or from place to place.[2,4] In a study of 5- and 6-year-old children, the majority were reluctant to offer any explanation for the day/night cycle.[2] A few gave religious or mythological explanations. Almost a third of the children explained in terms of the Sun's motion. Only 2 out of 33 children used the Earth's movement and one of those used the Earth's rotation.

There is evidence that preschool children are capable, with experience and support, of shifting closer to using the Earth's rotation to explain day and night. In one 30-minute instructional intervention with 5- and 6-year-olds, the majority (63%) attributed day/night to the movement of the Earth though only four of these were using just the Earth's rotation.[2] The children were more likely to use a combination of the Earth's rotation and its motion about the Sun than the Earth's rotation alone. In a study of 4- to 6-year-olds involving a longer period of instruction (multiple days within a preschool), 86.8% of the children used the Earth's rotation to account for the change in day/night.[4]

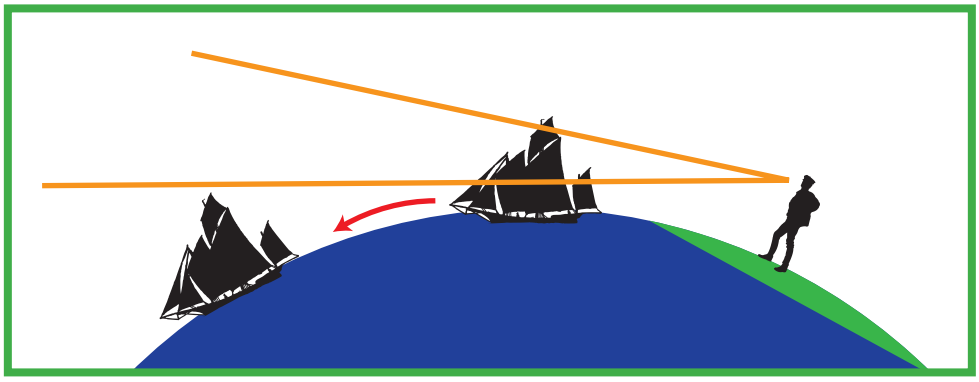
Some research has found that even older elementary students may not be aware of the Earth's rotation;[5] however, just knowing that the Earth rotates is not enough for students to use this concept to explain day and night. *My Sky Tonight* researcher Dr. Julia Plummer and her colleagues found that most of the third grade students they interviewed knew that the Earth rotates.[6] However, fewer than half used the Earth's rotation to explain why the Sun appears to move to cause day and night. This suggests that children need support in connecting what the Earth is doing in space (rotating) to what we see happening to change day and night.

ASTRONOMICAL SCIENCE

What shape is the Earth?

In our day/night model we use a round ball for the Earth, but have to admit that the roundness of the Earth is not an easy thing to observe while walking around on its surface. The only people who have directly observed that the Earth is spherical are astronauts who have traveled far enough off the surface to get this unique perspective. But long before the space program, the ancient Greeks did know that the Earth is round through other evidence. Consider:

1. Watch a ship with tall masts sail away. As all things do, it appears to get smaller, but the bottom of the ship will disappear first. Eventually, the mast will, too. What, except the curve of the Earth could explain that?



[4] Kallery, M. (2011). Astronomical concepts and events awareness for young children. *International Journal of Science Education, 33*(3), 341–369.

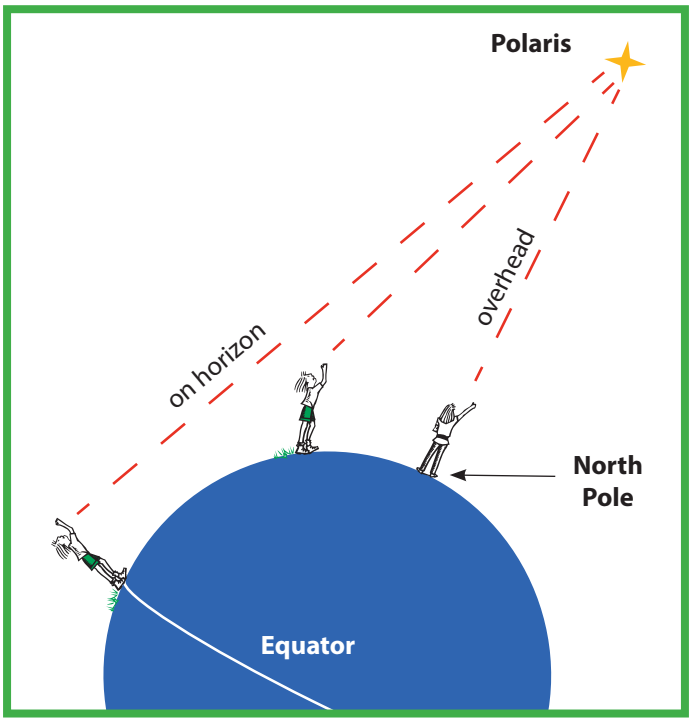
[5] Sharp, J. G. (1996). Children's astronomical beliefs: a preliminary study of Year 6 children in south-west England. *International Journal of Science Education, 18*(6), 685–712.

[6] Plummer, J. D., Kocareli, A., & Slagle, C. (2014). Learning to explain astronomy across moving frames of reference: Exploring the role of classroom and planetarium-based instructional contexts. *International Journal of Science Education, 36*(7), 1083–1106.

2. Watch a lunar eclipse. As the Moon enters the Earth's shadow, the shape of the edge of the shadow is always an arc of a circle. This image shows the shape of the Earth's shadow as the Moon moves from right to left through it.

The only shape that would consistently cast a circular shadow is a spherical object. If the Earth were round, but flat like a plate or disk, there would be angles where eclipse shadows are ellipses, not circles. Try it!

3. As you move north on the surface of the Earth, the position of the North Star is higher in the sky.



Earth's Rotation

The Earth rotates continuously in a counter-clockwise direction. The most direct evidence of the rotation of the Earth is the rising and setting of the Sun, Moon, and stars each day and night. You might wonder why there isn't a strong wind, like you experience when moving in a fast car, but in fact the atmosphere is rotating with the solid earth, so the wind that we feel is from local air pressure differences rather than from the overall rotation of the Earth.

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