TRB 6:2 - Activity 3 - Earth's Journey Around the Sun

Summary

This lesson will demonstrate to students that the angle of the sun's rays is a factor determining the seasons.

Materials

- globe mounted on its axis
- small table lamp
- small nail with a large head
- tape
- flexible ruler
- a sign labeled "North"

Additional Resources:
Gould, Alan, Carolyn Willard and Stephen Pompea. The Real Reasons for Seasons Sun-Earth Connections. GEMS Lawrence Hall of Science, University of Berkeley, CA, 2002.

Background for Teachers

Earth orbits the sun. Earth is slightly tilted (23.5 degrees) and spins on its axis. The north end of the axis always points toward the North Star as Earth circles the sun. Because it is tilted and travels around the sun, we have seasons. The time it takes to complete an orbit is 365 1/4 days. Seasonal changes give us a change in temperature and a change in the length of daylight.
We live in the Northern Hemisphere. It is summer when the North pole is tilted toward the sun. At this time, the sun is high overhead and we receive strong sun rays. The sun shines for many hours each day. Its strong rays have a lot of time to heat Earth. In the far North, the sun shines for 24 hours a day. This gradually changes. Days get shorter and cooler, and the sun appears low in the sky at noon as the North pole moves slowly away from the sun. Summer turns to fall, and then to winter. In winter, the North pole is tilted away from the sun. We do not receive the strong rays and the sun is low in the sky. The sun shines for fewer hours each day. These weak rays do not have time to heat Earth. This explains the colder winters even though the sun is shining. Winter turns to spring and then back to summer as Earth completes one journey around the sun.

Intended Learning Outcomes

1-Use science process and thinking skills
4-Communicate effectively using science language and reasoning
5-Demonstrate awareness of social and historical aspects of science

Instructional Procedures

Invitation to Learn:
Ask students to predict why we have four seasons. Have the class discuss the predictions and talk about why the predictions may or may not be accurate. Lead a class discussion on what may cause seasonal changes. Do not give any answers to the class, just enough information to start them thinking and wondering. For example:

- Think about how the sun feels on your face in the middle of June. Now think how it feels in December. Why do you think there is a difference?
- If the sun is shining during the winter, why isn't it as warm as when the sun is shining in the summer?
- Does the length of daylight affect the temperature? When are the shortest days of the year? Is it

colder then or when the sun shines for more hours? Why?

In the spring and in the fall, the length of daylight is about the same. However, it seems to be warmer in the fall. Can you predict why this is the case?

Instructional Procedures:

Have the students gather around the area where you will be working.

Place the lamp (shade removed) on the floor and turn it on. The lamp represents the sun.

Put the "North" sign down in the correct direction.

Find where we live on a tilted globe.

Place the globe on the ground on the south side of the sun. The globe should be tilted toward North. This is the summer position for the Northern Hemisphere. Ask the students what they notice about the sun's rays.

Rotate the globe counter clockwise. One rotation represents one day or 24 hours. When light is shining on our location, it is day. When it is dark, it is night.

Repeat your observations for each of the other seasons. Move the globe counter clockwise from summer (South) to fall (East) to winter (North) and spring (West). Make sure that the globe is always tilted toward north. Have students pay attention to the amount of sunshine we get during each season. Also, have them observe if the sunlight hits the Earth's Northern Hemisphere at a large or small angle.

Remind students that when Earth makes one revolution summer, fall, winter, and spring) one year has passed. It takes one year or 365 1/4 days for Earth to make one complete revolution around the sun.

Next, tape a small nail, head down, on top of the location where we live.

Have students predict what the nail's shadow will look like in the summer position. Discuss predictions as a class. Next, have students record their predictions in their notebooks for what the nail's shadow will look like for the other seasons.

Place the globe in the summer position (south of the sun).

Measure the length of the shadow produced by the nail. How does the shadow look? Were their predictions correct?

Move the globe to the other seasons, measuring the nail's shadow for each season and discuss the students predictions.

As a class, discuss the following questions: During which season is the nail's shadow shortest? During which season is it the longest? A short shadow indicates direct sunlight. A long shadow indicates weaker sunlight coming at an angle. During which season do you get the most daylight? During which season do you get about the same amount of daylight and darkness? In general, the stronger the sunlight during the day, the warmer the day.

Put the globe in the summer position one more time, this time have the students pay attention to the Southern Hemisphere. Ask students what season the Southern Hemisphere is having while we are having summer. Do the same demonstration for each of our seasons. Have students predict what season the Southern Hemisphere is experiencing. Point out that seasons in the Southern Hemisphere are reversed from the Northern Hemisphere. Have students explain why this is the case.

Lead another class discussion with the same questions asked at the beginning of the activity. Students should realize that the angle of the sun's rays is a factor determining the seasons. They should also realize that when days are longer, the sun has a longer time to heat Earth.

Extensions

Remind students that seasons are reversed in the Southern Hemisphere. Have them write how their lives would be different if midsummer came in January, and midwinter came in July. Students might mention the change in how holidays are celebrated, when school is in session,

or when vacations are taken.
Have students work in small groups to form explanations for why the hottest day of the year is usually not the longest day. Possible answer: The hottest day usually occurs in mid to late summer when Earth's surface has had a chance to retain enough solar energy to produce high temperatures.

Assessment Plan

Have students write a paragraph explaining why the tilt of Earth's axis and its yearly orbit around the sun produces the seasons.
In their science journals, have students explain how the tilt of Earth affects our lives.
Have students draw a diagram depicting the four seasons and the relationship of Earth's tilt and the sun.

Bibliography

This lesson is part of the Sixth Grade Science Teacher Resource Book (TRB3) http://www.usoe.org/curr/science/core/6th/TRB6/. The TRB3 is designed to be your textbook in teaching science curriculum to your students. This book covers all the objectives of each standard and benchmark. If taught efficiently, a student should do well on the End-of-Level (CRT) tests. The TRB3 is designed for teachers who know very little about science, as well as for teachers who have a broad understanding of science.

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