TRB 6:2 - Activity 2 - Tracking the Sun

Summary

In this activity students plot the movement of the sun across the sky. As they make their own records over a period of time, they learn first hand the actual movement of the sun for their location.

Materials

plastic dome hemisphere, ideally one per four student team, available from Learning Technologies, 40 Cameron Avenue, Somerville, MA 02144, 800-537-8703 (sold in sets of 10, $19.00 per set)

OR

clear round bowl or dome sectioned into quarters
erasable overhead transparency markers or wax pencils for each team
card stock with an outline of the dome and a large X dividing the dome into four equal sections, one per team.
compass
tape,chalk

Background for Teachers

Most students think the sun rises due east, passes directly overhead, and sets due west. It is a strongly held misconception that the sun is overhead at noon, regardless of the time of year. Some students also believe that there are twelve hours of daylight every day. In actuality the sun rises and sets at different points along the horizon depending on the time of year. The sun is never directly overhead north of the tropic of Cancer or south of the Tropic of Capricorn. And, in fact, it is only directly overhead for two days at locations between the Tropic of Cancer and Tropic of Capricorn. The zenith or high point of the sun is defined as local noon, but it is usually not exactly at 12 noon. How far a location is from the central meridian of the time zone (105 degrees west in the Mountain Time Zone) and daylight savings time both affect actual local noon.

Intended Learning Outcomes

1-Use science process and thinking skills
2-Manifest scientific attitudes and interests
3-Understand science concepts and principles
4-Communicate effectively using science language and reasoning
5-Demonstrate awareness of social and historical aspects of science
6-Understand the nature of science

Instructional Procedures

Invitation to Learn:
Hold up a clear plastic hemisphere and show the inside of the dome. Explain that the dome represents the sky. Tell them that where the ribs meet the base, this represents the directions north, south, east, and west. Label these direction points on the dome. Give each team or pair of students a clear plastic hemisphere. Have the students label the directions. Challenge them to predict where the sunrise was that morning. Use a transparency pen or wax pencil to write an R on the spot. Have them predict where the sun will be at noon. Write an N to record their prediction. Finally have them predict the sunset. Write an S on the location. Have them connect these points with a curved line to show the sun's path. Ask them: How could you find out if they are correct?
Instructional Procedures:

In this activity students plot the movement of the sun across the sky. As they make their own records over a period of time, they learn first hand the actual movement of the sun for their location. Before class calculate as closely as you can the exact location of north. First use a compass to find magnetic north. To find true north you will have to adjust the magnetic north direction about 15 degrees to the left (in Utah locations) to compensate for the difference between magnetic north and true north.

Have students place their dome on a flat, horizontal surface in direct sunlight. The dome should be directly over the circle on the cardstock. Oriented it so that the X on the cardstock is facing directly north and south and east and west. The ridges on the dome should align with the cross marks on the circle. The dome should always be placed in exactly the same position. Draw a line around the cardstock with chalk so that it can be aligned.

Plot the sun 's position on the top of the dome. Carefully move the tip of the marker close to the plastic hemisphere, but do not let the marker touch the sphere. Move the marker around the outside of the dome until the shadow cast by its tip falls directly on the cross point of the X mark on the cardstock. Mark a dot on the hemisphere at this location. Label the time. The dome represents the sky and the mark represents where the sun appears in the sky at that particular date and time. As Earth rotates, the sun's position in the sky changes throughout the day. (see attachments for an example)

You will need to decide when and how often the students record the sun's position. In part it will depend on how long a period you have your students. A teacher in a traditional elementary classroom will want to record the sun's position throughout the day, perhaps every fifteen minutes. When you have students for shorter periods of time you may have them record the sun's position every ten minutes for an entire class period. At each measurement the students will mark a dot as described in Step 2 and label the time for the plotting.

Either at the end of the day or the following class period have students connect the dots with a line. Draw the line on the inside of the hemisphere. Label the date for this line. Discuss the results of the observations. Ask the following questions. In what direction did the sun rise? Where is the sun at noon? (You may have volunteers track the sun during the noon period or share the domes that were created in classes who were in session at noon.) In what direction will the sun set?

Have students make predictions for future observations. Have students predict where the sun will be in two weeks? In December? In March? In June? This is a good time for students to record their observations and predictions in their science journals. Have them leave space for future observations.

Students should have opportunities to track the sun throughout the school year. Before each observation have students predict where the sun's path will be. Have students repeat their observations two weeks to one month later and continue throughout the school year. After the initial observation you may want students to plot the points at half or one-hour intervals rather than every ten minutes. Ideally, begin observations at the beginning of the school year. Try to make observations before, on, and after the autumn and spring equinoxes and the winter solstice. (You may need to plan around Christmas vacation). Year round schools have the opportunity to observe the summer solstice. Label each new tracking with times and dates. You may use different colored pens to record each path of the sun.

Occasionally, perhaps once a month, discuss findings with students. Discuss the following questions: How is the sun's position in the sky changing? Why is this happening? Why is the sun higher or lower in the sky? Is the sun ever directly overhead? Why or why not? Discuss Earth's rotation and revolution. Help them relate their observations to the tilt of the Earth's axis. Toward the end of the school year have students make a final comparison of the differences in the sun's position.

Extensions

Give students opportunities to check out the hemisphere and compass and plot the sun in the morning as it rises and in the evening as it sets.
Have students graph the results of their observations. Begin by measuring the distance from the top of the dome to the sun's location at a particular time of day for several months. Then graph these measurements.
Have students record their own observations of sunrises and sunsets. Or alternatively they may consult almanacs, newspapers, or Internet sites to record sunrises and sunsets.

Assessment Plan

Students keep a journal record of the sun's movements for one month.
Students make posters, picture books, charts, etc. showing how the sun's position changes in the sky throughout the year.

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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