NSDL/NSTA Web Seminar:
Timely Teachings: Seasons and the Cycles of Night and Day

Thursday, December 10, 2009

Resources from this web seminar are listed at:
http://www.diigo.com/list/nsdlworkshops/web-seminar-seasons
Today’s NSDL Expert

Jessica Fries-Gaither
Project Director, Beyond Penguins and Polar Bears, and Education Resource Specialist with The Ohio State University
Tonight’s Agenda

• Content knowledge refresher and resources
• Student misconceptions and formative assessment
• Standards alignment and instructional resources

http://nsdl.org

Frozen Face by Lisa Harding, National Science Foundation
Day and Night

Earth rotates on its axis once every ~24 hours (23 h 56 m 4.09 s)

Counterclockwise Rotation (west to east)

Creates periods of darkness and light that vary with season and latitude

Image generated from Earth and Moon Viewer
http://www.fourmilab.ch/earthview/vplanet.htm

Diagram: http://www.polaris.iastate.edu/NorthStar/Unit3/unit3_sub1.htm
Which has greater effect on the earth’s seasons? Stamp your answer:

<table>
<thead>
<tr>
<th>Earth’s variation in distance to the sun</th>
<th>The angle of incoming sunlight on the Earth’s surface</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

http://nsdl.org
What’s wrong with this picture? Enter your responses in the chat.

Image courtesy of Quite Interesting
Earth’s orbit

Perihelion: point in Earth’s orbit closest to the Sun

Aphelion: point in Earth’s orbit furthest from the Sun

Image from http://www.physicalgeography.net/fundamentals/6h.html
Seasons

Earth is tilted ~23 degrees on its axis.

As Earth revolves around the sun, the angle of incidence of incoming light affects amount of energy absorbed (and temperature).

Number of hours of daylight also influences changes in temperature.

These changes produce the environmental conditions we know as the seasons.

courtesy of Windows to the Universe
http://www.windows.ucar.edu
How many hours of daylight did you have today? Type your answer on the map.
Understanding Seasonal Change, Polar Extremes in Seasons, and the Aurora: Content Knowledge for Teachers

by Mary LeFever

For as long as humans have inhabited the earth, knowledge of the regularity of the seasons and day and night has been used to enhance the quality of life. Changing of the seasons was marked with elaborate celebrations around four important dates: the vernal equinox, summer solstice, autumnal-equinox and winter solstice. Key weather events such as thunderstorms, tornadoes, drought, hurricanes or blizzards were explained through myths involving supernatural powers. No longer are such explanations sufficient.

Science relies upon empirical evidence rather than faith in mythical stories for explanations of seasons, weather-related phenomena, and phases of the moon. For example, we know the tilted earth’s axis and the resultant angle of incidence of the sun’s rays at the poles as compared to the equator, in combination with the earth’s revolution about the sun, are responsible for the seasons. Auroras are visible as functions of the atmospheric content in combination with electromagnetic radiation. The resources listed below will allow you to develop your content knowledge regarding seasons, seasonal change in the Arctic and Antarctic, and the aurora (northern and southern lights).

SEASONS

A Reason for the Seasons

http://www.nationalgeographic.com/expeditions/activities/07/season.html

Although this is actually a lesson, the background information is helpful in enhancing teacher content knowledge.

Misconceptions About Why Seasons Occur


This pdf is the teacher background piece to a lesson plan. It contains links to two clips from A Private Universe, an educational research video that revealed college graduates’ misconceptions regarding the seasons.
Middle School Pathway Science Guides

http://msteacher2.org

http://nsdl.org
Let’s pause for questions from the audience....
## Misconceptions about day/night

Progression of ideas for elementary students.

Place these concepts in order of progression

*(No peeking on the next slide!)*

<table>
<thead>
<tr>
<th>Order</th>
<th>Concept</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>The Moon covers the Sun.</td>
</tr>
<tr>
<td></td>
<td>Clouds cover the Sun.</td>
</tr>
<tr>
<td></td>
<td>The Earth spins on its axis once a day.</td>
</tr>
<tr>
<td></td>
<td>The Sun goes behind hills.</td>
</tr>
<tr>
<td></td>
<td>The Sun goes behind the Earth once a day.</td>
</tr>
<tr>
<td></td>
<td>The Earth goes around the Sun once a day.</td>
</tr>
</tbody>
</table>
Misconceptions about day/night

Progression of ideas for elementary students:

– The Sun goes behind hills.
– Clouds cover the Sun.
– The Moon covers the Sun.
– The Sun goes behind the Earth once a day.
– The Earth goes around the Sun once a day.
– The Earth spins on its axis once a day.

Concept of spherical Earth is crucial!

http://nsdl.org
Formative Assessment


Probe includes the assessment item, answer guide, research, related resources, and suggestions for teaching.
Time for a **Season Quiz!**

**True or False:** Stamp your answer

<table>
<thead>
<tr>
<th></th>
<th>True</th>
<th>False</th>
</tr>
</thead>
<tbody>
<tr>
<td>The earth is closer to the sun during summer and farther away during winter.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Seasons happen at the same time everywhere on earth.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Seasonal characteristics and change are the same everywhere on earth.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Formative Assessment: Seasons and Hemispheres

Probe modeled (with permission) after those found in *Uncovering Student Ideas in Science*.

What to Wear?

Asks students to consider how seasons vary across Northern and Southern Hemispheres.

http://nsdl.org
Let’s pause for questions from the audience....
The sun, moon, stars, clouds, birds, and airplanes all have properties, locations, and movements that can be observed and described.

Objects in the sky have patterns of movement. The sun, for example, appears to move across the sky in the same way every day, but its path changes slowly over the seasons.

Weather changes from day to day and over the seasons.
Most objects in the solar system are in regular and predictable motion. Those motions explain such phenomena as the day, the year, phases of the moon, and eclipses.

Seasons results from variations in the amount of the sun’s energy hitting the surface, due to the tilt of the earth’s rotation on its axis and the length of the day.
NSDL science literacy maps: Solar System

http://strandmaps.nsdl.org
The temperature of a place on the earth’s surface tends to rise and fall in a somewhat predictable pattern every day and over the course of a year. The pattern of temperature changes observed in a place tends to vary depending on how far.

Thermal energy carried by ocean currents has a strong influence on climates around the world. Areas near oceans tend to have more moderate temperatures than they would if they were farther inland but at the same latitude because water in the

The number of hours of daylight and the intensity of the sunlight both vary in a predictable pattern that depends on how far north or south of the equator the place is. This variation explains why temperatures vary over the course of the year.
Do you use children’s literature in science class? Stamp your answer

<table>
<thead>
<tr>
<th>Elementary Teachers</th>
<th>Middle School Teachers</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>NO</td>
<td>NO</td>
<td>NO</td>
</tr>
</tbody>
</table>

http://nsdl.org
Integrating Children’s Literature: Grades K-2


Friendly illustrations complement this story about Oscar, a curious cat, who learns about light and dark from a moth. The moth teaches Oscar about the rotating earth, the sun and stars, shadows, and interesting facts about light and dark.

Casting Shadows Across Literacy and Science

Language arts skills are linked to the learning of science in a literacy-based approach to the study of shadows.

http://nsdl.org
Integrating Children’s Literature: Grades K-2


“A Season to Inquire”
Students read *Four Seasons Make a Year*. They then draw a schoolyard scene repeatedly through the year, measuring shadow lengths, compare observations, and make predictions and connections.
Integrating Children’s Literature: Grades 3-5


This visually appealing and conceptually sound book introduces elementary students to the concepts of day and night. The book provides many opportunities to stimulate discussions and perform demonstrations.

Have students record number of hours of daylight and graph over time.

http://nsdl.org
Integrating Children’s Literature: Grades 4-6


“Seasons by the Sun”

Students record data about hours of daylight and create a graph. Launch a similar data collection project for hometown, other locations across the globe.

http://nsdl.org
Let’s pause for questions from the audience....
Do you use real data in science class?

A. Never
B. I’ve wanted to use data but have never figured out a way to do it
C. I’ve tried but not successfully
D. I’ve done it on occasion
E. It’s a regular part of a lesson that I teach

http://nsdl.org
Real Data: Grades K-2

Real data comes from making observations and identifying patterns in movement of sun, shadows, and seasonal changes.

Casting Shadows Across Literacy and Science
Integrated inquiry-based unit

A Season to Inquire
Draw a schoolyard scene throughout the year and measure shadow lengths

http://nsdl.org
Real Data: Grades 3-5

• Three units
  – Tracking a Moving Shadow
  – The Rise and Fall of Daylight Hours
  – Making and Using Models

• Students make observations, create models, graph data, keep journals, and discuss findings.

Astronomy with a Stick/Day into Night

Why do daylight hours vary in length where we live?

http://nsdl.org
Real Data: Grades 4 and up

**Journey North: Mystery Class**

http://www.learner.org/jnorth/mclass/index.html

- 11-week online collaborative activity
- Students use clues (sunrise and sunset times) from 10 mystery locations and data from their hometown
- Goal: determine locations of mystery classes based on comparison of data
- Begins in February 2010
Real Data: Grades 4 and up

Global Sun Temperature Project


• Online collaborative activity
• Students from around the world share data to determine how geographic location affects temperature and minutes of sunlight per day.
• Registration will open on March 29, 2010.
Interested in learning more?

http://beyondpenguins.nsdl.org
December 2009 issue: Keeping Warm

http://msteacher2.org

Archived seminars (NSDL):
Arctic and Antarctic Birds
Physical Science From the Poles
Energy and the Polar Environment
Polar Geography
Jessica Fries-Gaither
fries-gaither.1@osu.edu

THANK YOU!
Learn about new tools and resources, discuss issues related to science education, find out about ways to enhance your teaching at: http://expertvoices.nsdl.org/learningdigitalK12

Resources from this web seminar are listed at: http://www.diigo.com/list/nsdlworkshops/web-seminar-seasons
Next in the NSDL Web Seminar Series:

**Thinking Like a Scientist: Teaching and Learning with Current Science Issues**

January 12, 2009
http://www.elluminate.com
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Dr. Francis Q. Eberle, Executive Director
Zipporah Miller, Associate Executive Director
Conferences and Programs
Al Byers, Assistant Executive Director e-Learning

NSTA Web Seminars
Paul Tingler, Director
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