



**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



<http://nsdl.org>



Tonight's Agenda



Frozen Face by Lisa Harding,
National Science Foundation

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

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



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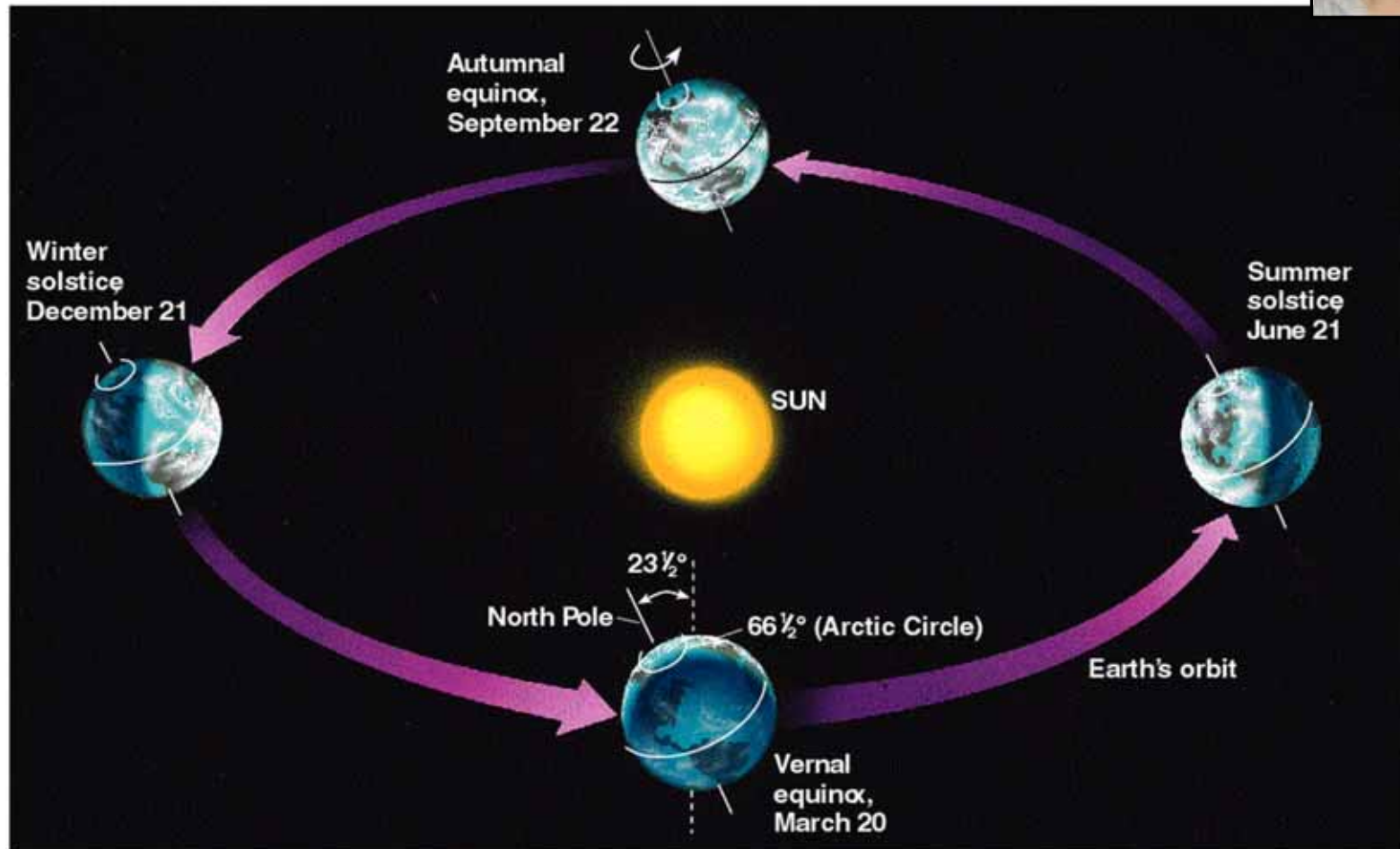


Which has greater effect on the earth's seasons? Stamp your answer:



Earth's variation in distance to the sun	The angle of incoming sunlight on the Earth's surface

What's wrong with this picture?
Enter your responses in the chat.



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Image courtesy of Quite Interesting
<http://www.qi.com/talk/viewtopic.php?p=121093>



Earth's orbit



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

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

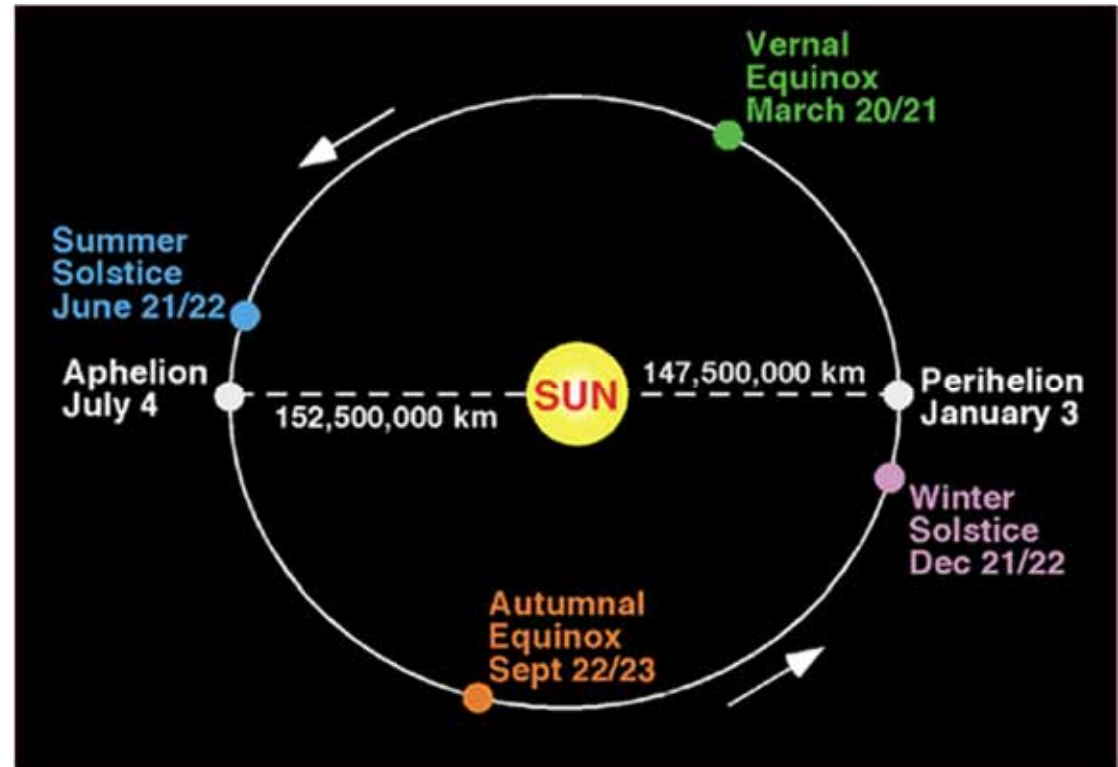


Image from

<http://www.physicalgeography.net/fundamentals/6h.html>



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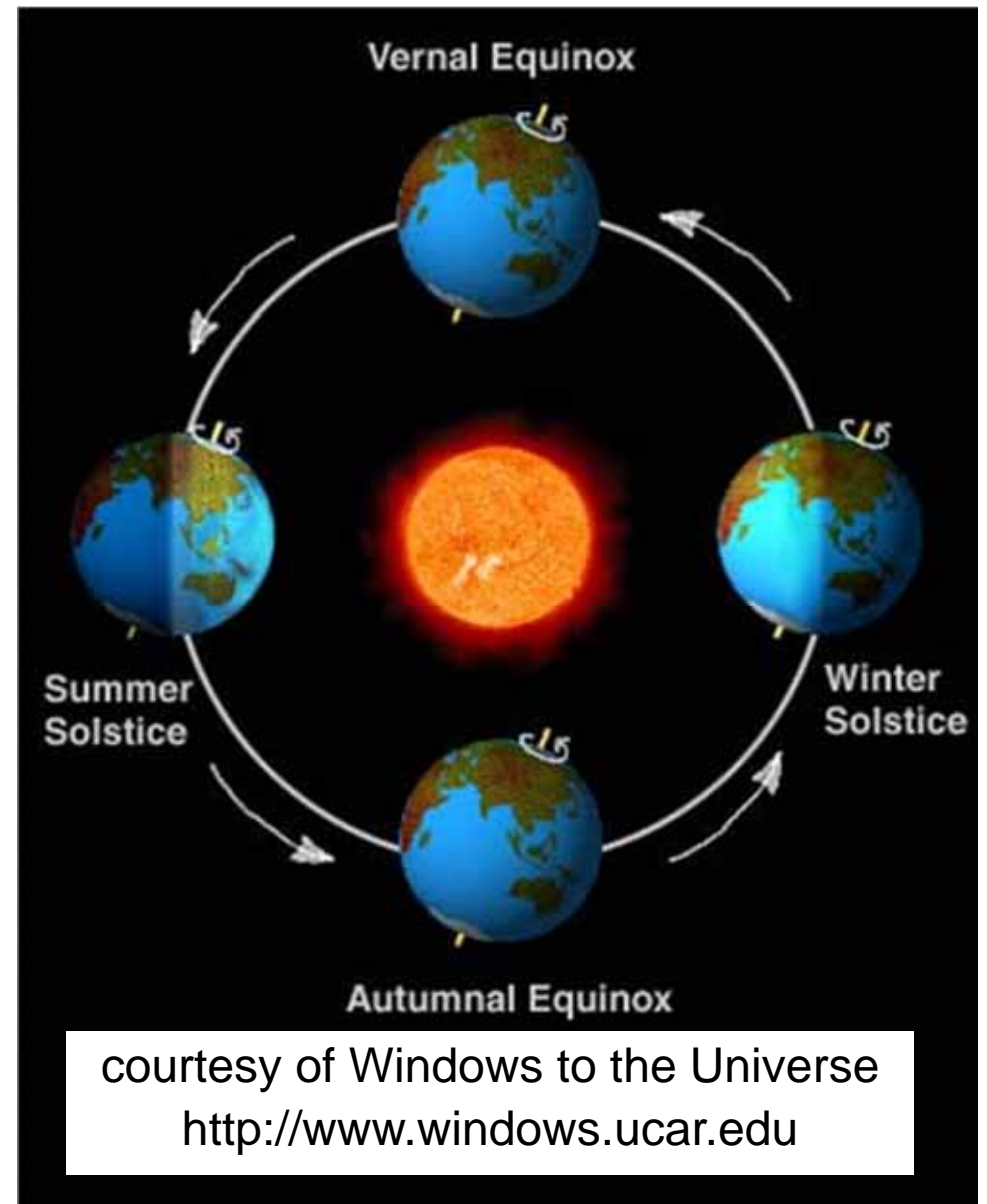
Seasons

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



<http://beyondpenguins.nsd.org> May 2008 (Issue 3)



BEYOND PENGUINS AND POLAR BEARS *an online magazine for k-5 teachers*

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[Polar Patterns: Day, Night, and Seasons - Issue 3, May 2008](#) » [Professional Learning](#) » [Science Content Knowledge](#)

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 Antarctica, and the aurora (northern and southern lights).

SEASONS

A Reason for the Seasons

<http://www.nationalgeographic.com/xpeditions/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

http://www.sciencenetlinks.com/pdfs/seasons_teachsheet.pdf

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.

Content Knowledge



<http://nsdl.org>



Middle School Pathway Science Guides

<http://msteacher2.org>



The screenshot shows a web browser displaying a page from the National Science Digital Library (NSDL) Wiki. The page title is "MiddleSchoolPortal/The Reasons for the Seasons". The main content area is titled "The Reason for the Seasons - Introduction" and discusses common student misconceptions about the cause of seasons. It includes a list of two misconceptions: 1) Earth's orbit being closer to the sun in summer and farther away in winter, and 2) the hemisphere tilted toward the sun experiencing summer because it is closer to the sun. A large image of Earth with the sun is titled "THE REASON FOR THE SEASONS". Below the text is a "Contents" table of contents with 10 items, including "Background Information for Teachers". The page also features a sidebar with navigation and search options.



<http://nsdl.org>





Let's pause for
questions from
the audience....



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Misconceptions about day/night

Progression of ideas for elementary students.

Place these concepts in order of progression

(No peeking on the next slide!)

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

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.

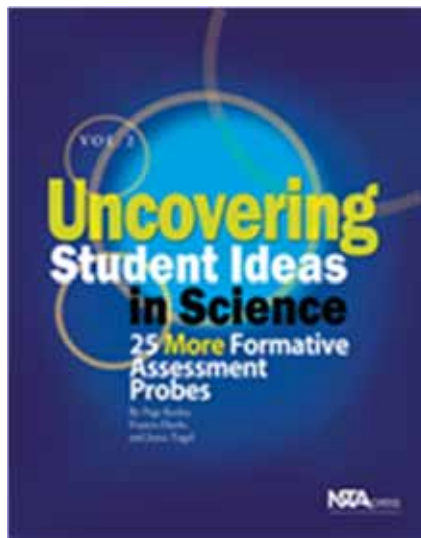
Concept of spherical Earth is crucial!



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Formative Assessment



“Darkness at Night” – assessment probe found in volume 2 of *Uncovering Student Ideas in Science* (NSTA Press, 2007).

Probe includes the assessment item, answer guide, research, related resources, and suggestions for teaching.



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Time for a **Season Quiz!**

True or False: Stamp your answer



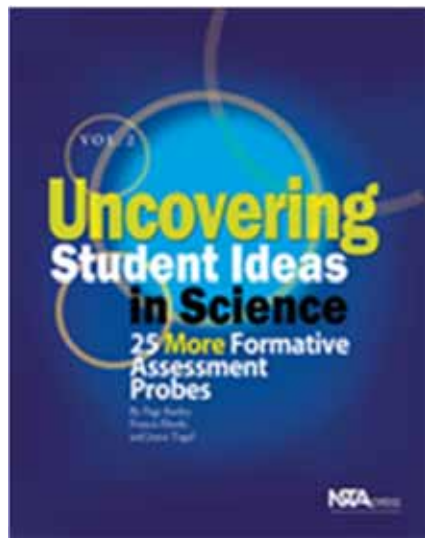
	True	False
The earth is closer to the sun during summer and farther away during winter.		
Seasons happen at the same time everywhere on earth.		
Seasonal characteristics and change are the same everywhere on earth.		

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.



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Let's pause for
questions from
the audience....



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NSES: Grades K-4



K-4 Earth and Space Science: Objects in the Sky

The sun, moon, stars, clouds, birds, and airplanes all have properties, locations, and movements that can be **observed** and **described**.

K-4 Earth and Space Science: Changes in the Earth and Sky

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.



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NSES: Grades 5-8



5-8 Earth and Space Science: Earth in the Solar System

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.



<http://nsdl.org>



NSDL science literacy maps: Solar System

<http://strandmaps.nsdl.org>



NSDL Science Literacy Maps
Helping teachers connect concepts, standards, and NSDL resources

Search for maps Search or -- Select a Topic --

The Physical Setting > Solar System [Print view](#) [Link to this page](#)

[View Student Misconceptions](#)

3-5

K-2

The rotation of the earth on its axis every 24 hours produces the night-and-day cycle. To people on earth, this turning of the planet makes it seem as though the sun, moon, planets, and stars are orbiting the earth once a day.

The patterns of stars in the sky stay the same, although they appear to move across the sky nightly, and different stars can be seen in different seasons.

The moon looks a little different every day, but looks the same again about every four weeks.

There are more stars in the sky than anyone can easily count, but they are not scattered evenly, and they are not all the same in brightness or color.

Magnifiers help people see things they could not see without them.

The sun can be seen only in the daytime, but the moon can be seen sometimes at night and sometimes during the day. The sun, moon, and stars all appear to move

NSDL science literacy maps: Weather and Climate



NSDL NSDL Science Literacy Maps
Helping teachers connect concepts, standards, and NSDL resources

Search for maps Search or -- Select a Topic --

The Physical Setting > Weather and Climate [Print view](#) [Link to this page](#)

6-8

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

Thermal energy is transferred through a material by the collisions of atoms within the material. Over time, the thermal energy tends to spread

Water evaporates from the surface of the earth, rises and cools,

Do you use children's literature in science class? Stamp your answer



Elementary Teachers		Middle School Teachers		Other	
YES	NO	YES	NO	YES	NO



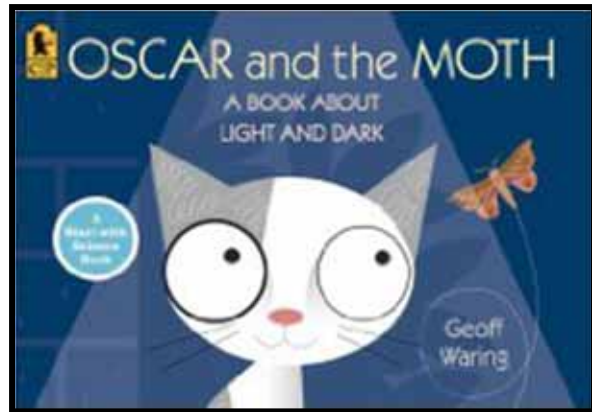
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Integrating Children's Literature: Grades K-2



***Oscar and the Moth: A Book about Light and Dark.* Geoff Waring. 2006.**



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

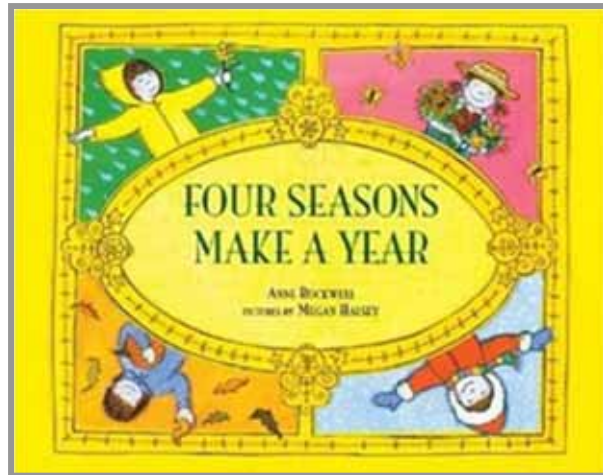
Language arts skills are linked to the learning of science in a literacy-based approach to the study of shadows.



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Integrating Children's Literature: Grades K-2



Four Seasons Make a Year.
Anne Rockwell. Illustrated by
Megan Halsey. Walker &
Company. 2004. 32 pp.
Recommended Ages: Primary.

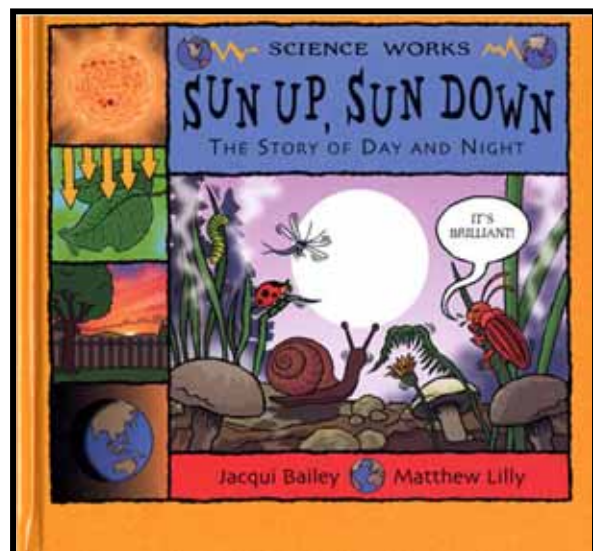
“A Season to Inquire”

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.

Science & Children

Integrating Children's Literature: Grades 3-5



***Sun Up, Sun Down: The Story of Day and Night.* Jacqui Bailey. 2004.**

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.



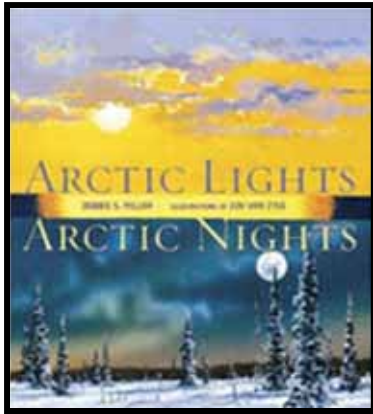
Have students record number of hours of daylight and graph over time.



<http://nsdl.org>



Integrating Children's Literature: Grades 4-6



Arctic Lights, Arctic Nights. Debbie S. Miller. Illustrated by Jon Van Zyle. Walker Publishing. 2003. (Unpaged). NSTA Outstanding Trade Book (2004).

“Seasons by the Sun”

Science & Children

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



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Let's pause for
questions from
the audience....



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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



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



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Real Data: Grades 3-5



Astronomy with a Stick/Day into Night

Why do daylight hours vary in length where we live?



- 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.

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



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Real Data: Grades 4 and up

Global Sun Temperature Project



<http://www.ciese.org/curriculum/tempproj3/en/>

- 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.



<http://nsdl.org>



Interested in learning more?



<http://beyondpenguins.nsdsl.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!



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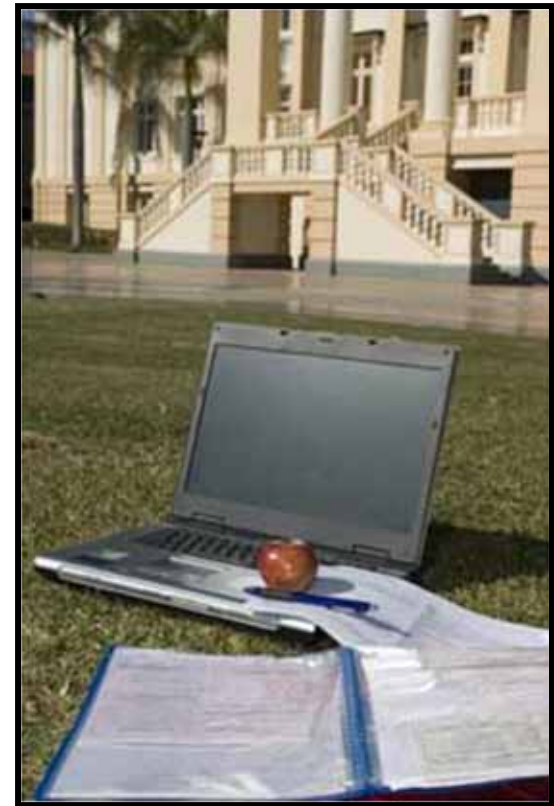


Resources from this web seminar are listed at:

<http://www.diigo.com/list/nsdlworkshops/web-seminar-seasons>

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>



<http://nsdl.org>



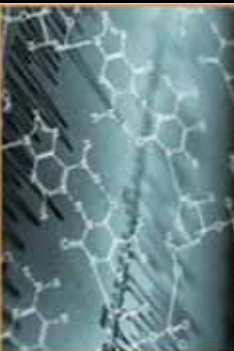







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January 12, 2009

					
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