Earth Navigators Lesson Plan

LESSON TITLE: Season's Greetings

GRADE LEVEL: 5-8

TOPIC/SUBJECT MATTER: Earth Science

TIME ALLOTMENT: 1-2 Class periods

OVERVIEW:

This lesson uses video segments from the NATURE film "Earth Navigators" to explain what causes the Earth's seasons and seasonal changes. Students will explore the causes and effects of the changes in the Earth's seasons using a hands-on activity and a Web interactive. As a culminating activity, students will learn about seasonal milestones using video segments from 'Earth Navigators."

MEDIA RESOURCES:

Video:

Access the streaming and downloadable video segments for this lesson at the Video Segments Page.

Clip 1: Spring Equinox

Clip 2: Summer Solstice

Clip 3: Autumn Equinox

Clip 4: Winter Solstice

Web sites:

Seasons Interactive
(http://www.sepuplhs.org/students/iaes/simulations/SEPUP_Seasons_Interactive.swf)

This Web interactive contains seasonal information for four cities around the world over the course of one year.

Times Solstices & Equinoxes 2000 - 2010
(http://aa.usno.navy.mil/data/docs/EarthSeasons.php)

This Web site gives the times and dates of the solstices and equinoxes from 2000 - 2010, using information drawn from the U.S. Naval Observatory

Standards:

National Science Education Standards, Grades 5-8
(http://www.nap.edu/openbook.php?record_id=4962)

Earth and Space Science

Content Standard D

As a result of their activities in grades 5-8, all students should develop an understanding of

- Structure of the earth system
- Earth's history
- Earth in the solar system

EARTH IN THE SOLAR SYSTEM

[See Unifying Concepts and Processes]

- The earth is the third planet from the sun in a system that includes the moon, the sun, eight other planets and their moons, and smaller objects, such as asteroids and comets. The sun, an average star, is the central and largest body 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.

The sun is the major source of energy for phenomena on the earth's surface, such as growth of plants, winds, ocean currents, and the water cycle. Seasons result 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.

MATERIALS:

For each student:

- Seasonal Milestones Organizer
- Seasonal Milestones Organizer Answer Key

For each pair/group:

- Seasons Interactive Organizer
- Seasons Interactive Organizer Answer Key

For the class:

- Globe
- Large beach ball
- Seasonal Milestones Organizer Answer Key
- Seasons Interactive Organizer Answer Key

Objectives:

Students will be able to;

- Explain Earth's pattern of orbit around the Sun
- Describe seasonal milestones
- Identify factors that contribute to seasonal changes
- Compare seasons in the Northern and Southern Hemispheres

Before the Lesson/Prep for Teachers:

Prior to teaching this lesson, you will need to:

Preview all of the video segments and Web sites used in the lesson.

Download the video clips used in the lesson to your classroom computer, or prepare to watch them using your classroom's Internet connection.

Bookmark the Web sites used in the lesson on each computer in your classroom. Using a social bookmarking tool such as del.icio.us (http://delicious.com/) or diigo (www.diigo.com/) (or an online bookmarking utility such as portaportal, www.portaportal.com/) will allow you to organize all the links in a central location.

Make copies of the Student Organizers for each student in the class.

INTRODUCTORY ACTIVITY

1. Begin by leading the class in a discussion about Earth's seasons. Ask students to identify some characteristics of each of the Earth's seasons: spring, summer, autumn, winter. (*Answers will vary but should cover weather, climate, hours of daylight*). Write on board or chart paper. Ask students what causes these changes over the course of a year? (*The Earth's orbit around the sun.*)

2. Use a large beach ball to represent the sun and a globe to represent the Earth. Ask for a student volunteer to hold the beach ball (Sun). Ask for another student volunteer to hold the globe (Earth) perpendicular to the plane of Earth's orbit around the sun (straight up and down, with the North Pole facing the ceiling). Ask the student holding the globe to walk slowly in a small circle around the Sun, spinning the globe and keeping the Earth's axis straight. Ask students if this is an accurate representation of the Earth's orbit around the Sun. (*No.*) Why not? (*The Earth should be tilted*.) Explain that if the Earth's orbit was really like this then every place on Earth would always have 12 hours of daylight and 12 hours of darkness, and there would be no seasons.

3. Ask the student holding the globe to tilt it slightly, so that the Poles are no longer aligned with the floor and the ceiling. Ask the student again to walk slowly around the Sun, spinning the tilted globe. Explain to students that the Earth is always tilted at approximately 23°, so depending on the time of year different places get different amounts of daylight. This is what causes variances in temperature and daylight hours that make up the seasons.

LEARNING ACTIVITY

1. Write the following vocabulary terms on the board and/or ask students to write them in their notebooks.

- **Orbit**
- **Rotation**
- **Axis**
- **Hemisphere**

Go through the terms one at a time, asking students to contribute working definitions for each of the terms, continuing to use the beach ball and globe as visual aids if desired. (*Orbit: the Earth's path around the sun. Rotation: Earth's spin on its axis. Axis: the*

imaginary line around which the Earth rotates, tilted approximately 23 degrees. Hemisphere: half of the Earth; split into Eastern/Western or Northern/Southern.)

2. Explain to students that these attributes account for the seasonal changes that we experience, such as changes in temperature and weather, and increased or decreased daylight hours. During the winter (in the Northern Hemisphere) the Sun sets earlier and it is colder. Ask students if they can think of why the Earth is colder at certain times of the year and warmer at others? Explain that in the winter the Sun's rays hit the Northern Hemisphere at an angle but in the summer the Sun's rays are direct.

3. Tell students that they are going to see some more examples of the effects of seasonal changes. Direct students to the Seasons Interactive (http://www.sepuplhs.org/students/iaes/simulations/SEPUP_Seasons_Interactive.swf), and FRAME the Web site by telling them that this Web interactive will allow them to explore these seasonal changes in four cities located in different places around the world. Divide class into pairs or small groups. Give students a FOCUS by asking them to note the differences in temperature and daylight hours in the four cities over the course of the year. Distribute the Seasons Interactive Organizer, which allows students to note the information for March, June, September, and December. Give pairs/groups 10-15 minutes to explore the interactive and enter the information on the organizer.

4. Review answers with class, and FOLLOW UP by asking the following questions. You may display the interactive on a screen for the whole class as a visual reference, if desired.

- Which city experienced the most variation in temperature and daylight hours? (*Anchorage, AK*) Which city experienced the least? (*Quito, Ecuador*)
- Why was there such a fluctuation in the data for Anchorage? (*The city is close to the North Pole, and therefore experiences the most change due to the tilt and orbit.)*
- Why is the data in Quito basically the same year-round? (*The city is on the Equator so the amount of sunlight that it gets is not affected by the Earth's tilt.*)
- Compare the data for Chicago, IL and Melbourne, Australia. What is the same? What is different? (*Their temperatures and daylight hours are comparable due to their latitude, but their seasons are reversed.*)
- Explain to students that the seasons are "reversed" in the Southern Hemisphere. Ask students why they think that is? If they need visual clues they can refer to the Web interactive or the globe and beach ball. (*Because of the tilt of the Earth, the Northern Hemisphere and Southern Hemisphere point in different directions and so they are affected differently by the Sun.*)

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CULMINATING ACTIVITY

1. Explain to students that there is a reason they only had to collect information from four months out of the year from the Web interactive. These are the times of the year that the seasons change, and are marked by the spring equinox, summer solstice, autumn equinox, and winter solstice. Tell students that they are going to watch a short video clip. FRAME the clip by explaining that it focuses on these seasonal milestones. Give students a FOCUS for watching by asking them to observe the dates and characteristics of each of these milestones. Distribute the Seasonal Milestones Organizer for students to use to note their observations.

2. PLAY the clip. Give students a few minutes to complete the questions on the organizer. Replay the clip if necessary. FOLLOW UP by reviewing the information students pulled from the video clip about the spring equinox, summer solstice, autumn equinox and winter solstice. Ask students what they think the dates for these seasonal milestones are in the Southern Hemisphere. (*Spring Equinox: September 21, Summer Solstice: December 21, Autumn Equinox: March 21, Winter Solstice: June 21.*)

3. Explain to students that the dates of these milestones are not always exactly on the 21st of March, June, September, and December. Direct students to Times Solstices & Equinoxes (http://www.erh.noaa.gov/box/equinox.html) 2000 - 2010, or display the Web site on a screen for the class. Observe some of the dates for the solstices and equinoxes throughout the decade. Students should observe that the dates are always in the vicinity of the 21st, but not always exactly on that date. Ask students: why would the dates be different from year to year? (*Variances in the length and shape of the Earth's orbit.*)

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NAME: _____

DATE: _____

SEASONAL MILESTONES

Spring Equinox Date: Description:	Summer Solstice: Date: Description:
Autumn Equinox Date: Description:	Winter Solstice Date: Description:

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DATE: _____

SEASONAL MILESTONES

Spring Equinox Date: March 21 Description: Everywhere on Earth gets 12 hours of daylight and 12 hours of darkness. This marks the beginning of Spring.	Summer Solstice: Date: June 21 Description: The longest day of the year in the Northern Hemisphere. The Arctic is in continual sunlight. This marks the beginning of Summer.
Autumn Equinox Date: September 21 Description: Everywhere on earth gets 12 hours of daylight and 12 hours of darkness. This marks the beginning of Autumn, and the nights begin to get longer than the days in the Northern Hemisphere.	Winter Solstice Date: December 21 Description: The longest night of the year in the Northern Hemisphere. This marks the beginning of winter.

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DATE: _____

SEASONS INTERACTIVE

MARCH:

	Temperature	Daylight Hours
Anchorage, AK	_____	_____
Chicago, IL	_____	_____
Quito, Ecuador	_____	_____
Melbourne, AUS	_____	_____

JUNE:

	Temperature	Daylight Hours
Anchorage, AK	_____	_____
Chicago, IL	_____	_____
Quito, Ecuador	_____	_____
Melbourne, AUS	_____	_____

SEPTEMBER:

	Temperature	Daylight Hours
Anchorage, AK	_____	_____
Chicago, IL	_____	_____
Quito, Ecuador	_____	_____
Melbourne, AUS	_____	_____

DECEMBER

	Temperature	Daylight Hours
Anchorage, AK	_____	_____
Chicago, IL	_____	_____
Quito, Ecuador	_____	_____
Melbourne, AUS	_____	_____

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DATE: _____

SEASONS INTERACTIVE

MARCH:

	Temperature (F°)	Daylight Hours
Anchorage, AK	27°	11:48
Chicago, IL	37°	11:56
Quito, Ecuador	58°	12:07
Melbourne, AUS	64°	12:22

JUNE:

	Temperature	Daylight Hours
Anchorage, AK	55°	19:19
Chicago, IL	69°	15:13
Quito, Ecuador	58°	12:05
Melbourne, AUS	50°	9:33

SEPTEMBER:

	Temperature	Daylight Hours
Anchorage, AK	48°	12:53
Chicago, IL	65°	12:29
Quito, Ecuador	58°	12:07
Melbourne, AUS	52°	11:49

DECEMBER

	Temperature	Daylight Hours
Anchorage, AK	16°	5:31
Chicago, IL	27°	9:10
Quito, Ecuador	58°	12:10
Melbourne, AUS	63°	14:46