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The Sun-Earth Connection

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Why is it important to understand how the Sun affects our lives? What is Earth's relationship to the Sun? These questions are the purpose of my curricular unit. Through my knowledge and experiences in this seminar, I will answer these questions and much more.

According to one of New Haven Public Schools science curriculum standards, students must recognize fundamental concepts about changes in the environment and the effects of the environmental change on the earth and its resources. In third grade, students study the solar system. This unit will touch upon the science standards and the third grade unit. The principal objective of this unit is to have creative, critical thinkers who are able to understand the relationship between the Earth and the Sun. This unit will provide elementary school teachers with hands-on activities that will integrate science, mathematics, language arts, and art.

In the third grade science curriculum, students learn about the solar system. Students study the basics. They learn about the sun and the planets and their position in the solar system. I have noticed that students do not know very much about the Sun. Students will draw or tell you that it is "yellow and hot." Therefore, it is important that students learn about the Sun and its relationship to us on Earth. Students need to know about this in the "real world." Students must understand their environment and how to take care of it. We will explore the Sun and the Earth and relate it to real life situations.

The Students

My students for this unit are third graders. My classroom is comprised of 20-26 students, about half of them are male students and half are female students. We are a very diverse classroom made up of Hispanic students, African American students, and White students. About half of the students receive LTSS (Language Transition Support Services). They are LTSS students because they were in bi-lingual classrooms. After thirty months, the students are exited and forced into mainstream classrooms, whether they are proficient or not. My students vary in levels from very low to very high. Almost half of the class is below level in reading.

In third grade, students practice reading, writing, phonics, and vocabulary during the literacy block. The math program that is used is Saxon Mathematics. This program touches upon all of the CMT math strands.

The science curriculum for grade three students includes the following topics: plant growth and development, chemical tests, rocks and minerals, the solar system, health, and ecology. The New Haven science department issues two science kits for the year. In the beginning of the school year, third graders complete the science kit on chemicals and chemical tests. Towards the end of the school year, third graders focus on a science kit for plant growth and development. The other four units in third grade do not have specific science kits. Therefore, this unit will serve as a supplement for the solar system unit.

In the beginning of the school year, third grade students are introduced to chemistry. They examine the different physical and chemical properties of common household chemicals. They focus on physical properties of color, form, and texture. Then they discover the changes in these chemicals when they are mixed, separated, or heated. Students are challenged with new vocabulary, such as evaporation and filtration. Students are able to classify some substances as acids, bases, or neutral substances.

Toward the end of the school year, third grade students examine plant growth and development. By growing and observing their own plants, students learn about the life cycle of a plant. As they watch their plants grow, students learn that plants need nutrients from the soil, water, and sunlight to grow. Students also learn about bees and pollination.

My students really enjoy these two science units. The science kits are very thorough and full of hands-on activities. The most difficult part for the students seems to be the vocabulary because most of my students are LTSS students (Language Transition Support Services).

For each unit, there are performance standards. In the solar system unit, students should be able to do the following:

Identify objects in the sky, such as the sun, moon, planets, and stars

Identify and describe the patterns of movement of objects in the sky from day to day and season to season

Explain the characteristics and patterns of movement of the moon

I have noticed that third graders do not know all of "the basics" about the solar system. I think that it is important that we begin with the basics. My unit will touch upon many concepts but most importantly it will focus on "the basics." For example, students will learn the name and location of each planet in our solar system. Students will also make solar system models in small groups that will be displayed in the classroom. But the main focus of this unit is the Sun-Earth connection. The Sun is vital for life on Earth, without its light and warmth life as we know it would not exist.

Therefore, the purpose of this unit is to show students the relationship between the Earth and the Sun. The unit will touch upon many key concepts such as, rotation and revolution. It is important that students learn about solar system, more specifically the Sun and Earth, because it relates to life. Through my experience, readings, and knowledge from this seminar, I will create a unit that will provide elementary school teachers with activities about the solar system. These activities will match district wide goals. This unit will fit in perfectly between to two science kits. After learning about the Sun and Earth, students will understand how important the Sun is and be able to relate this knowledge to the last unit on plant growth and development.

For many of the facts about the Sun, Earth, and solar system I have relied on my reading of *Universe* by William Kaufmann and Roger Freedman. I have also used many websites. All of my sources opened my eyes to

new ideas.

There are many ideas that should be discussed in this unit. The topics that I suggest are as follows:

Planets and their position in the solar system/Model of the solar system

The Sun

The Earth

Sun-Earth Connection

Weather

Climate and Seasons

The Unit

Planets/Solar System

Our solar system is a small part of the Milky Way Galaxy. Our solar system has many parts. The Sun is the center of our solar system. Nine planets with their moons orbit, go around, the Sun. Planets move in two ways. They move around the Sun. Each planet travels along its own path (orbit). Planets also spin around like a top. The orbits of the four inner planets are crowded in close to the Sun. The orbits of the outer four planets are widely spaced at great distances from the Sun. The orbits of the planets all lie in nearly the same plane. They are inclined at slight angles to the plane of the ecliptic. Pluto is an exception to this because the plane of its orbit is tilted at about 17 degrees to the ecliptic. All of the planets revolve in the same direction. But the planets speeds are different. The farther the planet is from the Sun, the longer it takes to finish a revolution. The closer the planet is to the Sun, the faster the revolution. (2)

Planets are classified as either terrestrial or Jovian by their physical attributes. The four inner planets are called terrestrial or Earth-like planets. The terrestrial planets are less massive than the Jovian planets. They have hard, rocky surfaces with mountains, craters, canyons, and volcanoes. They are Mercury, Venus, Earth, and Mars. They are small and dense planets. The outer four planets are called Jovian or Jupiter-like planets. They are mostly gaseous or liquid. They are Jupiter, Saturn, Uranus, and Neptune. All of the Jovian planets have rings. They are large planets and have a low density. (2)

The exception is the final planet, Pluto. Pluto doesn't belong in either category. Pluto is a mixture of ice and rock. It is not always the farthest planet from the Sun. Pluto's noncircular orbit sometimes brings it closer to the Sun than Neptune. Pluto's orbit does not lie in the same plane as the other planets. Pluto is the outermost planet, yet has the smallest diameter. (2)

Some of the planets in our solar system are smaller than Earth (Mercury, Venus, and Mars). Some of the planets are larger than the Earth (Jupiter, Saturn, Uranus, and Neptune). One difference between the terrestrial and Jovian planets is their diameters. The Jovian planets are much larger than the terrestrial planets, with Jupiter as the largest. Earth is the largest of the four terrestrial planets. Pluto is even smaller

than the terrestrial planets even though it is the outermost planet. The terrestrial and Jovian planets also have different masses. (2)

The Sun

The Sun is the most important part of the solar system. It is a star. It is the star we know best because we see it almost every day. The Sun is the closest star to us. The Sun is much bigger than the Earth. It would take about 1,300,000 earths to fill the Sun. It looks small because it is so far away. It is 93 million miles or 150 million kilometers away. Its light reaches us in about 8 minutes. Its composition is 74% hydrogen, 25% helium, and 1% other elements. The surface temperature of the Sun is about 10,000 degrees Fahrenheit. The center of the Sun reaches a temperature of 27,000,000 degrees Fahrenheit. (2)

The center of the Sun is called the core. All of the Sun's energy comes from the core. The Sun creates huge amounts of energy. The energy moves slowly toward the Sun's outer edges. The energy radiates, or travels in waves, away from the Sun as heat and light energy. After it leaves the Sun, the energy moves very fast. (2)

The Sun makes so much light, it hides the other stars in the daytime. At night, when the Sun is not part of the sky, we can see the other stars. The Sun is so bright that its rays could destroy the retina and cause blindness, so you should never look directly at the Sun. When viewing the Sun, astronomers use dark filters so their eyes are protected. (2)

The dark patches on the Sun are called sunspots. Sunspots are low-temperature regions in the photosphere. The number of sunspots on the Sun varies from year to year. Every eleven years, the number of sunspots increases to a very large number and then decreases again. When sunspots are at their maximum, the Sun is in an active period. Solar flares generally erupt near sunspots. Flares sometimes send huge streams of glowing gas into space. They release so much energy that they are the largest explosions in the solar system. (2)

There are three main layers of the Sun's atmosphere. These are the photosphere, chromosphere, and the corona. The photosphere is the layer of the Sun we see. It is sometimes called the surface but it is not solid. It is made up of pockets of gas called granules. The chromosphere is a thin blanket of gas that glows pink. It is impossible to see this layer because the photosphere is much brighter. The corona is a layer of gas that surrounds the Sun. It is hotter than the photosphere even though it is far from the core. We can only see the corona when the rest of the sun is blocked. It looks like a glowing halo. (2)

The Sun gives off energy. A small part of the Sun's energy travels to Earth. It gives us heat and light. Without the energy of sunlight, the Earth would be frozen and lifeless. Plants also need sunlight. It helps plants make food for us to eat and oxygen for us to breathe. (2)

The Earth

The Earth is about the same size as Venus. It is the fifth biggest planet, but is tiny compared to the Sun. The diameter of Earth is 12,756 km or 7,926 miles. The Earth's diameter is the largest of the four inner, terrestrial planets. The Earth's mass is 5.974 x 1024 kg. The Earth's mass is the biggest the greatest when compared to the inner planets. But Jupiter has the largest diameter and mass of all the planets. If the sun were the size of a beach ball, the Earth would be smaller than a pea. The Earth is very wet, about 71% of the Earth's surface is covered by water. There is no liquid on Mercury, Venus, Mars, or the Moon. The Earth is the only known planet that has life on it. (2)

The Earth is made up of four layers. The thin outer shell is called the crust. It is divided into pieces called plates, which fit together like a puzzle. The crust forms the land and the ocean floor. The mantle is hot, partly molten rock. At the top, the mantle is made of solid rock. Deeper down it is so hot that the rock melts and becomes molten. The rock in the mantle is made of mainly iron and magnesium. Beneath the mantle there is a layer of liquid metal called the outer core. The outer core is a mixture of very hot liquid iron and nickel. In the center of the Earth, there is a ball of very hot solid metal called the inner core. (2)

The Equator is an imaginary line around the middle of our planet. It divides the Earth in half. The two halves are called hemispheres. Most of the continents are in the Northern Hemisphere. The Earth's magnetic field produces a magnetosphere. The Earth's magnetic field is like a bar magnet. Magnetic field lines seem to stream from one end of the magnet to the other. The magnetic field of the Earth is created by the motion of electric currents in the liquid outer core. It is as if there were a giant bar magnet inside the Earth. The magnetic axis is tilted 11.3 degrees from the Earth's rotation axis. Because of this tilt, the north and south magnetic poles are not the same locations as the true north and south poles. A compass needle points toward the north magnetic pole, not the true North Pole. (2)

The Earth is always turning. It never stops. It travels, or revolves, around the Sun once every year. The Earth spins on its axis (use a toy top or stick a pencil in an orange to help illustrate this). The top turns around and moves around on the point that sticks out. The rod sticking out the top and bottom represents the center line, called the axis. The Earth does not have a pole through its center, but it does have an axis that goes from the North Pole to the South Pole. It makes one turn on its axis once every 24 hours. (2)

The Earth is wrapped in a thick layer of air called the atmosphere. Scientists have divided it into five invisible layers. These layers are made up of a mixture of gases, such as oxygen and nitrogen. These layers are the exosphere, thermosphere, mesosphere, stratosphere, and troposphere. The exosphere is 300 to 5,000 miles above the Earth's surface. Weather satellites orbit in the exosphere. The thermosphere is 50 to 300 miles high. The temperature of this layer increases with height. At the top it is about 4,000 degrees Fahrenheit. The mesosphere is 30 to 50 miles high. The temperature of this layer gets colder with height. It varies from 50 degrees to -110 degrees Fahrenheit. The stratosphere is 5 to 30 miles high. This layer is cold, but the temperature increases with height. In this layer is ozone gas, which filters out the Sun's harmful rays. Airplanes fly in the stratosphere to avoid rough weather. The height of the troposphere is up to 10 miles. This layer contains nearly all the water vapor and most of the other gases in the atmosphere. It gets colder with height. All weather related phenomena occur in the troposphere. (2)

The Earth has one satellite called the moon. The moon is about 239,000 miles from Earth. It is out nearest neighbor in space. It goes around the Earth one time a month. It is smaller than the Earth and usually seen at night. The moon is 2,155 miles across or about one-quarter the size of the Earth. The moon has holes called craters on its surface. The moon does not make its own light. We can see it because it reflects light from the sun. It seems to change shape on different nights. The amount of Moon that we see is called a phase. As the Moon revolves, our view of it changes, and we can see different parts of its sunlit surface. There are eight different phases of the moon. The phases are new moon, new crescent, first quarter, waxing gibbous, full moon, waning gibbous, third quarter, and waning crescent. (3)

The moon is the only place, other than Earth, that humans have visited. Neil Armstrong was the first person to step on the Moon in 1969. The Moon's gravity is one-sixth as strong as Earth's, so things weigh less on the Moon. An object that weighs 60 pounds on Earth would weigh only 10 pounds on the Moon. (3)

Sun-Earth Connection

Life on Earth would not exist without the Sun's warmth and light. As the Earth spins on its axis, the side that faces the Sun warms up in the daylight. The side that is hidden from the Sun cools down in the darkness. As the Earth spins we move from day, to night, to day, to night over and over again. The Sun seems to move across the sky during the day. It is really the Earth's spinning that causes this to happen. The change in temperature causes winds to blow, clouds to form, and all other types of weather to develop. (1)

The Sun warms Earth's air, helping to create wind. Wind helps move rain, giving plants and animals water. Wind is also an energy source (windmills). The Sun's heat also creates a water cycle. The Sun warms water from oceans and lakes, causing it to rise as vapor. Vapor forms clouds. When the clouds cool, the vapor condenses and falls back to Earth as rain or snow. (1)

Weather

The Earth's weather is always changing. We use satellites in the exosphere to take a picture of the weather below. Experts on the ground can tell us what the weather will be. Weather is created by a mixture of water, heat, and air. The Sun heats up the air, which makes it move. This moving air is called wind, and it carries heat and water vapor, which is invisible gas. Clouds, rain, snow, and fog are made from water vapor. (1)

Wind happens when warm air moves up and cooler air moves in to replace it. Rain forms inside rain clouds. Water vapor that evaporated from below forms tiny water drops and when they are heavy enough they fall. Snow is water that freezes inside the clouds and when they are heavy enough they fall. A rainbow may occur when it is raining or after it rained. When sunbeams shine through drops of rain the light breaks up into seven colors, a rainbow appears. (1)

Lightning is a bright, giant spark of electricity that jumps between a cloud and the ground, between two clouds, or within a cloud. Each bolt has an electrical charge of about 30 million volts. This is enough electricity to light up a small town for several months. Lightning is five times hotter than the Sun. It is hot enough to set a tree on fire. Thunder follows lightning. Lightning heats the air and the heated air explodes making a loud crack of thunder. Thunderstorms occur where the climate is warm and damp. Tropical regions in Africa get thunderstorms five days a week. In the United States, thunderstorms happen in the summer. Florida gets about one hundred storms per year. (1)

Weather affects our lives, so scientists try to tell us what it will be like in the days ahead. This is called weather forecasting. Meteorology is the study of weather, so scientists who study weather are called meteorologist. They use temperature, wind speed, air pressure measurements, and satellite photographs to forecast the weather. Weather stations on land and at sea, airplanes, weather balloons, and satellites in space are all used for watching and measuring the weather. (1)

Temperature is the degree of hotness or coldness measured by a thermometer. Humidity is a measure of the water vapor content of the air. Visibility is the distance one can see horizontally. The amount of moisture in the air is called humidity. It comes from water that evaporated, mostly from oceans. Warm air has more moisture than cold air. (1)

Climate and Seasons

The usual weather pattern in a region is called its climate. Different areas of the planet have different

climates. The weather changes throughout the year and these changes are known as the seasons. Most places have four seasons, but some only have two. Where you live determines what kind of seasons you have. (1)

The polar climate, at the North and South poles, is very cold and frigid. The coldest place is at the poles. Near the equator, the climate is hot and humid throughout the year. The hottest place is at the equator. This is because more of the Sun's rays reach Earth at the equator than at the poles. The deserts are very hot and dry. The tropical rain forest is warm and wet. In between the poles and the equator are the temperate zones. These places are either warm or cool, depending on the time of year. (1)

The Earth is tilted on its axis. As the Earth moves around the Sun, this tilt makes the poles point toward or away from the Sun at different times of the year. The tilt is why the amount of sunlight a part of the Earth gets changes. The seasons change depending on the amount of sunlight. (1)

When the North Pole tilts towards the Sun, the northern half of the Earth has summer. The days are long and the nights are short. Long days mean the Earth gets a lot of warmth from the Sun. When the North Pole tilts away from the Sun, there is winter. The days are short and the nights are long. Short days mean the Earth is not getting warmth from the Sun. Spring and fall have days and nights that are about the same length. (1)

The seasons are opposite north and south of the equator. When it is summer to the north of the equator, it is winter to the south. When it is fall to the south of the equator, it is spring to the north. Spring is the season when the days get longer and warmer. Nights are cold, and the weather often changes. Summer is the hottest season. The Sun is high in the sky, the days are long, and there may be thunderstorms. In the fall, nights are longer and days are shorter. The temperature cools and leaves change color and fall from the trees. Winter is the coldest season. The Sun is low in the sky and the days are short. Snow falls, icicles form, and rivers and ponds freeze. (1)

Some places have only two seasons. These areas have wet and dry seasons. In the wet season, the air is humid. Winds blow in from the sea bringing heavy rain. In the dry season, winds blow cool, dry air from the land out to sea. East Africa, India and Southeast Asia have only two seasons. (1)

Lessons Plans

Planet Lesson

Objectives: Students will examine the location of the planets. Students will begin researching the nine planets. Students will observe the size difference between the planets.

To introduce the planets and solar system read "Postcards from Pluto: A Tour of the Solar System." This book is a great introduction for this unit. It really gets the children thinking about the different planets. It is important to look at the planets, their locations, and their orbits. Ask students to make up their own way to remember the position of the planets. For example, "My Very Excellent Mother Just Served Us Nine Pizzas."

Next, divide the students into nine groups. These groups will do research projects on their planets. They may consult books, magazines, and given websites. Students will use their information to create poster board

presentations on their planet. The presentations will be way fun way for students to teach one another the basics about each planet.

Finally, show students the solar system by using fruits and vegetables as the planets. This will give students an idea about how big each planet is.

Mercurya fresh pea

Venuswalnut

Earthslightly larger walnut

Marsone dry pea

Jupitera cabbage (about 9 inches across)

Saturna cabbage (about 8 inches across)

Uranusan orange

Neptunea grapefruit

Plutoa bean

Earth Lesson

Objective: Students will observe the Earth's movement that causes day and night and the seasons.

This experiment is used to show students why we have day and night and seasons. The materials that you need are as follows:

Light source (lamp or flashlight)

Small cutout of a person

Tape

Globe

Tape the cutout to our location on the globe. Stand the globe six feet from the light source. Turn out the lights. Remind students to watch the cutout on the globe. Slowly rotate the globe to the right until a full circle has been made. This represents one day. Rotate the globe several more times, having students say "day" and "night" as the cutout moves in and out of the light.

At the end of the activity, ask students to reflect on the experiment. Some possible questions or writing prompts are as follows:

What did you see when the cutout was facing the light?

What did you see when the cutout turned away from the light?

What caused this to happen?

How is this like what happens to us on Earth?

Sun Lesson

Objective: Students will learn how to observe the Sun and identify sunspots.

To observe the Sun, you must project it on to another surface. You can make an observatory to find sunspots or watch eclipses. The materials you will need are as follows:

Piece of cardboard

Hole punch

Tape

Wood stake or stick

Mirror

White Paper

First, punch a hole in the cardboard and tape it to the wood stake or stick. Push the stake into the ground a couple of feet away from the wall of a building. Tape the paper to the building wall directly in front of the cardboard. The teacher should hold the mirror behind the hole in the cardboard so that the mirror reflects sunlight through the hole. The Sun is projected on the paper.

Students can identify and trace the dark spots (sunspots) on the paper. This experiment may be repeated for a few days to see if the sunspots have moved. At the end of the activity, students should reflect in their science logs. Students may describe what they observed and what they learned from this experiment. As a final writing activity for this lesson discuss the different types of Sun protection, such as sunglasses, sun hats, suntan lotions, and sunburn remedies. Ask the students to invent their own Sun product. Students can write an advertisement for their product. Students should include the following:

Name of the product

Who would use the product

Available colors, sizes, or scents

The price

Where to buy it

Weather Lesson

Objective: Students will learn weather terminology and a variety of climates through examining and recording weather characteristics in cities around the world.

This activity relates to third grade math, in that, students will graph their results. They may show the results

using line graphs, bar graphs, or pictographs. The materials you will need are as follows:

Newspapers with daily weather forecasts or internet websites

Graph paper

Pencils and markers

Rulers

Discuss the weather in New Haven, Connecticut. During this discussion, focus on words like humidity, temperature, and visibility. After students have a good understanding of these words, have students pick a city that they would like to do their weather project on. Everyday, at the same time of day, students should check the newspaper or internet and record their city's weather.

After two weeks of recording, have students graph their results for each weather term. Students may present their graphs to their classmates.

At the end of the activity, students should reflect in their science logs. Students can compare different cities by discussing similarities and differences. You can also focus on a few cities in different areas and graph them on a large class graph for discussion (choose a different color to represent each city).

Tornado Lesson

Objectives: Students will collect information about tornados from the internet in order to understand how tornados form and learn safety steps to follow. Students will make a "tornado in a bottle."

This experiment is a fun way for students to learn about tornados. The materials you will need for each student are as follows:

Two 2-liter clear plastic bottles

One 35mm film canister

Knife

Strong tape

Water

Dishwashing detergent

Glitter

Movie clips for "Twister" or "Wizard of Oz"

Tornados are fascinating. It's important to begin the lesson by discussing some of the myths. This will help students feel more comfortable and less fearful of tornados. Explain to students that tornados happen in many places around the world and that they are the most violent of windstorms. This is a great opportunity to discuss the good and bad things about wind. For example, wind is good because it helps move sailboats, carry

seeds, and dry clothes; it's bad because it blows down trees and houses.

Tornados usually occur when cool dry air from the north mixes with warm moist air from the south. Most tornados are weak and cause little damage. Show students a map of the United States and mark "tornado alley."

Give students the opportunity to search the internet for information on tornados and safety steps to follow. Discuss their findings. For instance, if you are inside your house, go down to the basement or to a room with no windows on the lowest floor of the house. If you are outside and can't get indoors, lie down (in a ditch if possible).

Then have students make tornado models. Pour water into one 2-liter bottle until it is ¾ full. Add detergent and glitter. The teacher should cut off the closed end of the film canister (or have the students bring them in pre-cut). Place the canister on top of the bottle and secure it with tape. Place the other bottle on top by pushing it into the canister and secure it with tape. Turn the entire tube over and rotate it. The tube will produce a tornado-like funnel inside as water pours from one bottle into the other.

At the end of the activity, show clips from the movies. Have students write a "safety plan" for their house in their science logs.

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