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Soaking Up the Sun!

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The Discovery

Children love asking questions, especially when it relates science or inquiry. Our world is full of science and questions that are just waiting to be answered. *Why is the sky blue? What makes a car move? Why do bees buzz?* Questions could go on for hours and hours by simply looking at the wonders of nature. This unit will help students tap in to their own natural curiosity about energy in a fun and exciting way! We will discover the vital role the sun contributes to the survival of plants, humans and the balance of our ecosystem.

The Purpose

When we look in the sky, what do we see? The SUN. Where do plants get their energy? The SUN. What object helps with wind power? The SUN. The purpose is for students to realize just how much the sun plays a role in our lives and keeps our Ecosystems balanced. This science-based unit is designed for elementary age students, specifically 3 rd -5 th . Within this unit students will learn the function and parts of plants, the process of photosynthesis and the environmental conditions that affect their growth and survival in various parts of the world. My hope is that students become more aware of their surroundings and the role they play in their environment. I want students to walk away with a new appreciation of where they live and understand that their actions not only affect themselves, but the world.

Energy is a very abstract concept to teach to younger students and I want to use this unit to give students a basic understanding and foundation of science that they can use to help them in the future. Energy is defined as the ability to do work. I want students to understand that energy is all around us and can be seen in various forms such as static energy, hydroelectric energy, heat/thermal energy, light energy, etc. To do this, they must first understand that energy has two basic types: Kinetic and Potential. Because these terms are not familiar to most 7-8 year olds, it is important to use the terms, but also break it down in ways that they will be able to understand.

Kinetic: **K**eep it **K**ickin'/ Keep it Moving
Potential: **P**laying **P**ossum/Put it at Rest

School Demographics

Lansdowne Elementary School is a suburban school serving students K-5. The school is located in the heart of a historic neighborhood as part of the Charlotte-Mecklenburg School System. The school has a diverse population of 565 students. Within our subgroups, our student background is 30% African American, 48% White, 12% Hispanic, 7% Multi-Racial, and 3% Asian. Our school received its hallmark distinction as being an International Baccalaureate School in 2008. As part of our IB program, students develop questions and use research skills such as the Scientific Method to answer their questions. Each student has an IB portfolio to document their growth and performance as they move from grade to grade.

Our school serves students with physical, emotional and mental special needs as part of our Inclusion program. Students also have opportunities for enrichment through our Talent and Development Program, English as a Second Language Program, Girls on the Run, Student Government, Odyssey of the Mind and Chess Club. This school has been an integral part of our community and school system for more than 50 years.

Our PTO involvement is very high within the school as parents volunteer both their time and monetary gifts. Currently each 3 rd , 4 th and 5 th grade classroom has SMART boards installed in their classroom and the goal for PTO is to have each classroom equipped with this essential resource. Having a SMART board enables me to display daily content and gives opportunities for student interaction.

Through the IB program, Lansdowne also participates in several service projects to help the community and demonstrate positive examples of helping others. Lansdowne also initiated a Gardening Project with the help of our PTO. Students have an opportunity to plant, harvest and grow crops such as green beans, onions, lettuce, spinach and much more. Once students harvest the vegetables, they are taken to the Second Harvest Food Bank to give to those in need. What a great way to use hands-on learning and caring hearts to better the community!

Background Knowledge

To ultimately understand the role of the Sun and how it is important to our lives, we must explore how the Sun transfers energy to other objects. When referring to plants, this process is known as ***photosynthesis***. The type of energy used in photosynthesis is chemical but the transfer from the sun is through radiation. Some may ask themselves, so there are different forms of energy? Absolutely! We will take a deeper look into the most common forms of energy, and then analyze the form of Light Energy or Radiation as it relates to photosynthesis.

To appreciate the benefits and effects of energy, it is important for teachers to also know the foundation of energy and its various forms. First, there must always be a balance of energy and it is neither lost nor created. We call this balance Energy Conservation. We often think of the word conserve as "saving" or cutting back. For example, a common phrase is "Conserve Energy by turning off the lights when you are not using them." However, in scientific terms, conservation has a slightly different meaning. Energy can change from one form to another or transfer from one object to another. It can change, but cannot be created or destroyed. [1]

Both students and teachers often have several misconceptions about energy. This unit will help clarify those misconceptions and allow you to go beyond your own thinking by thinking outside of the box. One common misconception is that energy only occurs in moving objects. This is not true and to help clarify this misconception we will take a look at examples of both moving objects and objects at rest.

The two most common forms of energy are: **Kinetic and Potential.** Energy is the ability to do work. One way we can explain this difference to our students is by having them engage in a simple demonstration using a pencil. Have students place the pencil at the edge of their desk. The energy inside the pencil is Potential or stored energy. Then have them push the pencil off their desk and onto the floor. The movement within the pencil is Kinetic energy or energy in motion. If you place the pencil higher off the desk, it has more potential energy. The higher it is from the ground, the further it could fall which gives it more potential energy. [2]

Bill Nye, the Science Guy, also shows an excellent demonstration to help explain the conservation of energy using a pendulum. By pulling the pendulum back, you are giving it potential energy. When you release it, it now has more kinetic energy that it gained during the movement. If you stand in the same spot when you pull back and release, the pendulum will never hit you because kinetic energy can never be greater than potential energy. [3]

Forms of Energy

- Radiant Energy (*Light Energy) This type of energyis electromagnetic energy that travels in transverse waves. Radiant energy includes visible light, x-rays, gamma rays and radio waves. Light is one type of radiant energy. Sunshine is also radiant energy, which provides the fuel and warmth that make life on Earth possible. (*Starting with the sun is a great way to show students how it affects all parts of our lives.)

- Thermal Energy (*Heat): This type of energy is the vibration and movement of the atoms and molecules within substances. As an object is heated up, its atoms and molecules move and collide faster. For example, if you heat up liquid glue, the molecules begin to move faster causing it to run out of the tube at a faster rate.

- Sound Energy: This type of energy moves through substances in compression waves. Sound is produced when a force hits or causes an object to vibrate — the energy is transferred through the substance in a wave.

- Electrical Energy: This type of energy is transferred by tiny charged particles called electrons, typically moving through a wire. Lightning is an example of electrical energy in nature.

- Chemical Energy: This type of energy is energy stored in the bonds of atoms and molecules. Chemical energy is converted to thermal energy when we burn wood in a fireplace, when we cook or when we burn gasoline in a car's engine. Chemical energy also occurs in plants when they make their own food through photosynthesis.

- Spring Energy: This is a type of potential energy. A good example to use is a Slinky to show how the spring

does the opposite motion of the force being applied to it. For example, when you pull on it and apply force, it will push or spring back in the opposite direction.

Although this list is not a comprehensive list or all inclusive, it illustrates the most common forms of energy we face on a daily basis. Let's reference back to the first form, Radiant Energy. This form is vital to the process of photosynthesis, which must have participation from the Sun in order to take place. It seems as if the Sun definitely is a major contributor to all forms of energy and critical to our survival.

Photosynthesis

How do plants breathe and make their own food?

When teaching the section on plants for this unit, it is important for you to understand how photosynthesis occurs. Photosynthesis can be divided into two parts semantically, with photo meaning "light" and synthesis meaning "putting together." Both words are Greek and when combined together produce a meaning: "using light to put things together." Another common misconception is that plants "eat" food. This is not correct because plants are unique organisms that ***make*** their own food. In relating this to students, I will begin by asking them what some of their favorite foods are or where their food comes from using a picture or diagram. Common responses for young children are often: "My mom made it," "It came from the grocery store," "What do you mean……it came out of that box?!" Further pose the questions to get them thinking about the process of their food. Where did it come from before it arrived at the grocery store? What products were used to make your food? For example, if their favorite food is pizza, there are a lot of ingredients used to make pizza. Just starting with the dough, the main ingredient is grain. Where does grain come from? It must be planted, grown and harvested. When it is planted, what does it need to grow? Bingo! The SUN! Everything ultimately reverts back to the sun.

The sun transfers light energy to the leaves of a plant into tiny cells that contain chloroplasts. In the cell of the plant, light combines with carbon dioxide from the air and water from the roots to start the Light Reaction of Photosynthesis. Depending on the age of your students and their developmental level, you could then discuss the Dark Reaction of Photosynthesis or the "Calvin Cycle."

The purpose of the Calvin Cycle is to take energy from the Light Reaction and start Carbon Fixation, which is the process of adding more carbons. [4] Once this is combined using a chemical reaction with the light and water, sugar or glucose is formed. Oxygen is then released into the atmosphere, giving us what we need to breathe and survive.

If we didn't have carbon dioxide, we wouldn't be a warm planet; we would be cold like the moon. If we had too much carbon dioxide, we would be like Venus, which is a really hot planet. Plants keep our atmosphere from getting too much carbon dioxide and heating up by turning a lot of it into biomass and oxygen. To help students understand the difference between carbon dioxide and oxygen, explore a simple breathing activity. When we inhale, we are breathing in oxygen. When we exhale we are blowing out carbon dioxide. Give each student a small cup filled with water and a straw. Have them practice blowing through a straw to simulate the carbon dioxide released from our lungs. To extend and make it truly scientific, you can use BTB, a Bromothymol Blue solution to observe the change in colors when our breath reacts with the solution. This change lets us know that carbon dioxide is present. For this simulation, it is best for the teacher to model with the BTB solution and have students practice with water so they don't accidently drink the solution. We are constantly breathing carbon dioxide out and taking in oxygen. But what happens when carbon dioxide increases in the air and plant production decreases? This question could then lead to a discussion of Global

Warming and how what we do has an impact on the amount of carbon dioxide put into the atmosphere.

Global Warming

What role does the Sun play?

Global Warming occurs when there is an increase in temperature which in turn causes a climate change. What are the causes of climate change? That issue has been highly debated, but most scientists feel that humans are the main cause in Global Warming due to their increased use of fossil fuels. Imagine our world with one or two people using fossil fuels and driving cars. It wouldn't be detrimental to our environment. However, with over 6 billion people in our world, the use of fossil fuels and release of carbon dioxide is an alarming realization. Decreasing the use of fossil fuels can help keep our Ecosystem balanced. For example, when leaving a room, turn off the lights and any electrical devices not in use. Try to carpool with neighbors when riding to school to reduce the amount of gas emitted from your car each time it is driven. Creating a flow map with students is a useful organizer that may help them understand how humans impact the environment (See Figure 1). Energy from the sun allows plants to help balance this emission of greenhouse gases in the atmosphere.

Fossil Fuels

What role does the Sun play?

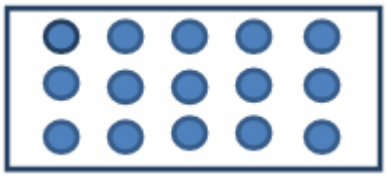
There are three major forms of fossil fuels: coal, oil and natural gas. All three were formed many hundreds of millions of years ago before the time of the dinosaurs – hence the name fossil fuels. Long ago, as trees and plants died, they sank to the bottom of the swamps and oceans. They formed layers of a spongy material called peat. Over many hundreds of years, the peat was then covered by sand and clay and other minerals. This turned into a type of rock called sedimentary. More and more rock piled on top of more rock, and it weighed more and more. It began to press down on the peat. The peat was squeezed and squeezed until the water came out of it and it eventually, over millions of years, turned into coal, oil or petroleum, and natural gas. [5] If we go back to the first step, the trees and plants died which means they were once alive. What helped the plants survive? Bingo! The Sun! To simulate this process for students you can make dirt cups to show the different layers. Simply get a clear cup and place tiny leaves or grass at the bottom for layer one. Then cover with sand and tiny pebbles for layer 2. Layer 3 will include larger rocks and the last 2 layers will be soil and grass to show the "topsoil." To make this simulation even more interesting, you can substitute the outdoor

items for food such as crushed Oreos, graham crackers, etc.

Alternatives to Fossil Fuels: What are other methods we can use to decrease the amount of Carbon Dioxide in our environment?

Solar Energy

There are several pros and cons to the use of Solar Energy. There are three main ways solar energy can be converted for our use including: Photovoltaic, Biofuel, and Heat Engines. [6] Start by asking your students if they have ever seen a solar panel on the top of a building. Explain how this process is very similar to the process discussed earlier on how plants use photosynthesis to trap light energy from the sun. Many calculators in the school system also operate on solar power. When you are in a dark room or away from a window source, it makes it difficult to see the numbers on a calculator. However, placing it near light allows it to work with ease. Solar energy is great in the sense that it does not place harmful chemicals into the air. However, a downside to solar energy is that the sun does not shine everyday (cloudy days) and, therefore, it must be stored or combined with an alternate energy source as well. The Photovoltaic process involves the use of solar panels and solar grids. The grids are used to transport energy from the sun that has been converted into electricity. Individual solar cells are arranged in rows and columns to create Photovoltaic Cells (PV Cells). This is an excellent connection to math and 3 rd grade students should be very familiar with the use of arrays when referencing multiplication. Ex. 5 solar cells placed horizontally and 3 placed vertically produce a total amount of 15. Place several different sized solar cells and have students calculate the total number of single cells within each PV. Remind students that even though this is an alternate source to fossil fuels, it still requires the use of……..that's right…..THE SUN!



Wind Energy

Wind turbines are beginning to become a common form of energy in certain parts of the world. This type of energy involves kinetic energy of the wind which can be transferred into other forms such as mechanical or electrical. A familiar example for students to see is by using or making a pinwheel. Small turbines make enough energy to power a house. In order for a wind turbine to work efficiently, wind speeds usually must be above 12 to 14 miles per hour. Wind has to be this speed to turn the turbines fast enough to generate electricity. The problem with wind energy, like the sun, is that it is not blowing all the time. Therefore, the best way is to combine it with another source of energy. [7]

Once students have learned the basic forms of energy, the process of photosynthesis, the role of our Sun in energy transfer and alternative energy sources, they are ready to use that knowledge to take them to the next level. They will explore the positive and negative effects humans have on the environment and what they can do to help.

The Connection

The overarching idea for this unit is to create experiments and activities centered on plants, how they respond to their environments and the process of photosynthesis. I want students to understand the role of each plant part and the importance of the Sun to our survival. Without the Sun, life on Earth would not exist. The culminating activity for this unit is an Ecosystem Explo Activity. This will allow students to research and explore ecosystems all over the world and how the plants respond to that particular environment. They will research the landforms and other organisms inherent to that area, and the human impact involved in maintaining a healthy and balanced ecosystem for all. They will research energy consumption and production and how it has an effect on the environment. There are pros and cons to any situation and students will evaluate both sides to develop their own perspective. Knowledge from their research will be used in Mock Debates and Socratic Seminars to share their ideas with their classmates. Since students will be exposed to various ecosystems around the world, it is also important for us to understand what an ecosystem is.

Ecosystems:

An ecosystem can be considered as a group of living and non-living organisms that interact with each other. The Sun is needed ultimately to keep the Ecosystems balanced. Ecosystems can vary in size from being as large as the Sahara Desert to as small as a cup of water. Within each ecosystem there are habitats and biomes. ***Habitats*** are places specific to a population such as ant colonies, bee colonies, etc. ***Biomes*** are ecosystems where several habitats interact. There are six major biomes in the world including: desert, tundra, temperate, grasslands, woodlands, and rainforests. There are 2 major water Ecosystems including Freshwater and Saltwater.

- Tundra Biome: This biome is generally found in cold places of the world such as Antarctica and survival of life is difficult. The soil is permafrost (frozen) and temperatures can reach below -60 degrees Fahrenheit. In the summer, the tundra changes and the sun is out 24 hours a day, which allow small plants to grow.

- Desert Biome: You can find at least one desert on every continent except Europe. Each desert is different in some way, but they all have one thing in common. In order for an area of land to be considered a desert, it must receive less than 10 inches of water a year.

- Grassland Biome: Over one quarter of the Earth's surface is covered by grasslands. Grasslands are found on every continent except Antarctica, and they make up most of Africa and Asia. There are several types of grassland and each one has its own name. Prairies, plains and savannas are all grasslands.

- Temperate Biome: The temperate forest biome is found in regions where winters are cold and summers are warm.Temperate forests are almost always made of two types of trees, deciduous and evergreen. Deciduous trees are trees that lose their leaves in the winter. Evergreens are trees that keep their leaves all year long, like pine trees.

- Taiga Biome (Woodland): It is very cold andsnowyin the taiga during winter, with below freezing average temperatures. While it is not uncommon for temperatures to dive below freezing during the summer as well, it is generally warmer then. Days are long during summer in the taiga, ice thaws, snow melts, and it is often rainy.

- Rainforest Biome: Rainforests get their name because they receive a lot of rain - an average of 80 inches (203 cm) a year! Rainforests are usually found at and near the equator, where it is always warm and muggy. The temperature doesn't change very much during the year. There are areas of rainforests where plants are densely packed. Areas where sunlight can reach the surface are full of interesting plants. In other areas, a canopy made from the branches and leaves of tall trees shades the ground below, preventing smaller plants from growing.

- Freshwater Ecosystem: Freshwater includes rivers, lakes, ponds, streams, springs and wetlands.

- Saltwater Ecosystem: Saltwater makes up more than 70% of the Earth's surface. It includes oceans, coral reefs and gets its name from the amount of salt content found within.

Environmental Impacts: How do Humans impact the balance of our ecosystem?

Deforestation

How does it affect plant growth?

Deforestation occurs when Earth's forests are cleared on a massive scale and damage the quality of land. In certain parts of our globe, trees serve as an umbrella or canopy that shields plants and animals from too much sun during the peak of the day and holds in heat at night. This disruption of temperature can disturb the balance of our ecosystem. Trees also play a vital role in absorbing the greenhouse gases from the air that are caused by use of fossil fuels. Removal of trees also disrupts the balance of greenhouse gases in the air. The Sun allows the trees to grow and survive through the process of photosynthesis. [8]

Pollution

How does it affect plant growth?

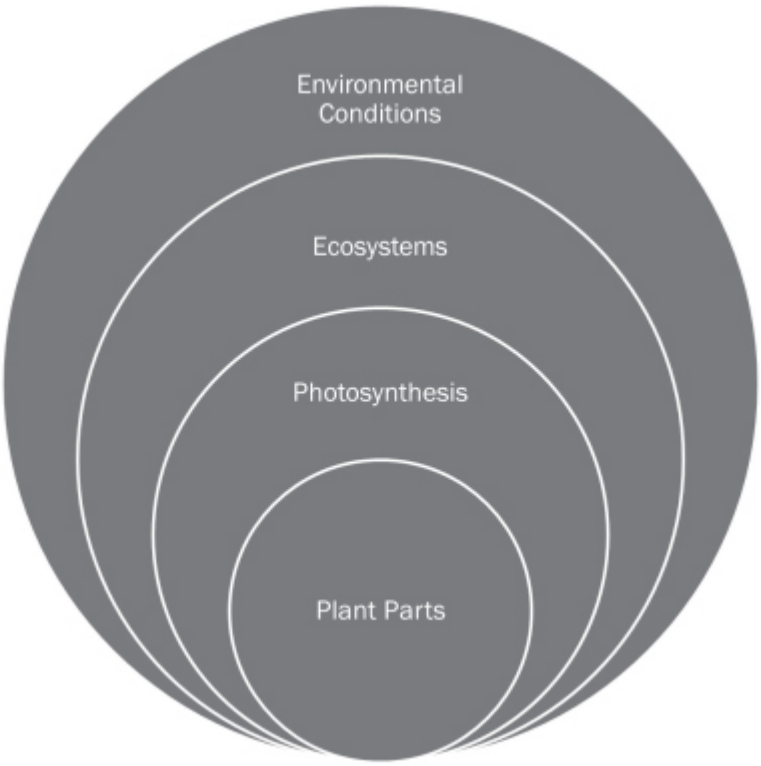
Pollution can be caused both by natural disasters as well as human disasters. Every year factories in the United States release over 3 million tons of toxic chemicals in the land, air and water. [9] Pollution is also caused by industrial and commercial waste, agriculture practices and everyday human activities. Some of the major contributors of land pollution include: human sewage, oil refineries, littering, overcrowded landfills, etc.

To let students see the reality of pollution, have them go on a nature walk outside school and record any objects or activities that contribute to pollution. Then they will observe their own neighborhood and home for one week to collect data about the amount of pollution emitted by themselves or their family. An alarming fact discovered by the researchers from Green Students showed that 80% of trash that arrives in most landfills could be recycled, but wasn't. Major contributors to water pollution include: oil spills, human sewage, pesticides, fertilizers and household chemicals not properly disposed of.

When harmful pollutants are placed in the water, land or air it affects plants by all three areas. Too many harmful substances in the air prevent plants from providing oxygen for us to breathe. Too many harmful substances in the soil make it difficult for plants to sustain their growth. Too many harmful substances in the water travel to the plant as well transferring the harmful substances to the plant.

Unit Activity Overview

Students will have opportunities to engage in several hands on experiments centered on the big ideas of plant functions, photosynthesis, environmental conditions and how all three are interrelated to our Ecosystem. The big ideas all stem back to the central theme of how our Sun is necessary for survival and balance of our Ecosystem (See Figure 2).



- Create an Energy Mural that describes the different forms of energy students have heard of before. *Can be used as a pre assessment.

- Energy Scavenger Hunt: Students will search around the classroom and school to find objects that give off some type of energy using a scavenger hunt checklist.

- Plant Part Experiments (Celery Experiment, Leaf Experiment, Plant Cover Up, Seed Sort)

- Solar Energy Centers:

- Plant Power: Scientific experiment using one plant as a control in a normal setting, one plant in direct sunlight and one plant in a brown paper bag. Students will observe each plant to see which plant has the best survival rate over a set period of time.
- Thermometer Traps: Students will use a dark sneaker and a white sneaker and place a thermometer in each. They will observe and track the temperature when both sneakers are placed outside in the sun. Which one is hotter? What does that tell you about dark objects vs. light objects?
- Liquid Glue Relay: Students will place one glue bottle outside in the sun, one glue bottle in a bucket of ice and one glue bottle at room temperature. They will use a piece of cardboard and set it at an incline. 3 students will take the glue bottles and pour them at the same time to see which bottle oozes down

the cardboard incline first. They will record the time for each bottle and record on a graph after 3 trials.

- Ecosystem Exploration: Students will research an Ecosystem and analyze the plants native to that particular environment. They will describe how plants in that area are able to make their own food, emphasizing how the Sun is able to transfer Light Energy to plants. Students will also describe environmental conditions associated with that area and what humans are doing to positively or negatively impact the balance of the ecosystem (ex. Deforestation, Global Warming, Pollution, etc.)

- Energy Expo: Students will culminate the unit with an Energy Expo. They will present their research in various forms of choice including: brochures, posters, power points, models, etc. to showcase what they have learned. They will present their information to lower grade levels and explain how energy is all around us and the importance of the Sun to our survival. They will create an action plan to describe what we can do to help keep balance and sustainability within our Ecosystem.

Estimated Length of Unit: 6-8 weeks

The Arrangement

All 3 rd grade students will gain knowledge about and experience with energy during a 6-8 week Energy Blast. The first two weeks will focus on an energy overview for all students. The overarching objectives for the entire curriculum unit are for students to understand: 1) what energy is, 2) how plants use energy from the sun, 3) how environmental conditions affect growth and survival of plants, and 4) how the sun helps keep our Ecosystem balanced.

For this unit, I would like to arrange students in a variety of ways from independent reflection to small group collaborations. For some of the activities, it is better for students to work independently and use trial and error to confirm or disprove their own predictions. On other solar activities, students will have opportunities to work with collaborative groups to gain knowledge from others and problem solve together.

Science Journals

One strategy to help students organize their thinking and keep track of their data is by using Science Journals. For Science Journals to be most effective, students should set them up at the beginning of the year. The first page of their journal can be dedicated to science they already know from previous grades as well as their own interpretation of what they think a scientist looks like. Journals are powerful tools that allow students to record key vocabulary terms studied throughout the year as well as making pictures and diagrams from demonstrations and experiments.

5E Learning Cycle

The 5E Learning Cycle model is an additional strategy that most educators use in the classroom, especially with science. This is an Inquiry process where students are active learners in their learning process. The 5 stages are: Engage, Explore, Explain, Elaborate, and Evaluate. In the first stage, students are drawn into the lesson by discussing their prior knowledge or thinking of questions they would like to explore. In the second stage of the learning cycle (explore), students participate in experiments and demonstrations that help spark

their inquiry process. Notice with this type of model, teachers are seen more as facilitators rather than pouring out a wealth of knowledge. Teachers guide student thinking in the explain process by asking students to think about the experiment and helping students form generalizations. The fourth and fifth step of this process is critical because we want students to go further with their questions and develop or plan alternate explanations. They need to know how it relates to their everyday lives and how they can apply it. Often teachers have students complete an experiment without having students evaluate or reflect upon their process. This leaves students thinking "now what?" "We completed an experiment, but why?" Therefore, it is essential that the Learning Process Model is carried out to the end.

Socratic Seminars

Another arrangement for this unit includes the use of Socratic Seminars. They will be used at the end of the unit to allow all students to showcase their knowledge and learn from others in the group. This strategy is a common method used in education to help students investigate multiple perspectives. Elfie Israel describes it beautifully by saying:

The Socratic seminar is a formal discussion, based on a text, in which the leader asks open-ended questions. Within the context of the discussion, students listen closely to the comments of others, thinking critically for themselves, and articulate their own thoughts and their responses to the thoughts of others. They learn to work cooperatively and to question intelligently and civilly. [10]

Mock Debates

Mock Debates is another strategy that will be used in this unit to expose students to differing viewpoints and allow them to become more Open Minded with their decision making. With this teaching strategy, students will have an opportunity to look at pros and cons of a debatable topic and begin to brainstorm their own personal perspective. They then have opportunities to work in small groups that have the same perspective before presenting their side to the entire class. Before using this strategy, it is important to set a warm, comfortable environment where students feel comfortable expressing their ideas even if they are different. Essential agreements should be established as a whole group where everyone agrees upon at least 3-5 "ground rules" to keep order and respect present in the classroom.

This unit is designed for 3 rd to 5th grade students but can be adapted to meet the needs of any students using the content. Students will gain knowledge by learning about someone new and have an opportunity to use their creativity to design their own Energy Station for the Expo! Let the creativity begin!!

Student Activities and Exploration

Activity 1: "What's For Dinner?"

To begin this activity, students will think about their favorite food for breakfast, lunch or dinner. Once students choose their favorite, create a class graph or chart labeling it "Fantastic Food Fads." Have students think about where their food came from by creating a pictorial representation or ladder using arrows. For example, if their favorite food is ice cream they will draw an ice cream cone at the top of their ladder. Then they will draw milk or one other ingredient that is used in ice cream on the rung below. Milk comes from cows;

therefore, cows will be on the next rung of their ladder. In order for cows to survive, they have to eat grass so grass will be on the fourth rung of their ladder. What helps the grass grow? You've got it! The SUN! No matter if their favorite food comes from plants or animals, they all revert back to the sun. Remind them to think about all the ingredients used in their favorite food because this can then become quite complicated. Save drawings as a pre-assessment and discuss how none of our favorite foods would be possible without the Sun.

"Fantastic Food Fads"

Directions: Think of your favorite food and where it came from. Design a path or road you think your food took before getting to your plate. (*Was it grown in the ground, on a tree, on a vine? Did it go to a factory? Etc.)

Activity 2: "Living Sunlight"

This activity will incorporate reading, writing, and art. Show students the cover of *Living Sunlight* by Molly Bang and ask them to discuss the plants and animals represented in the environment. By looking even closer, see if they notice the yellow glow that surrounds each object. This glow is a representation of the Sun and how it lives within each and every organism in our Ecosystem. After reading the book, students will create their own piece of art using one organism as their focal point. This could be a plant, a tree, an insect, animal, etc. Then they will use yellow paint and Q-tips to show the sun rays illuminating around their object. They will write a paragraph underneath explaining the importance of their particular object as a focal point and the adverse effects if our Sun was not present.

Activity #3: Photosynthesis Power

After an in depth look at photosynthesis, students will have an opportunity to create a play or skit showing the process. Divide class into 6 groups including: Sun, Carbon Dioxide, Oxygen, Leaves, Sugar and Water. Each group will use paper plates and table cloths to "transform" into their selected group. Ex. The sun group will paint or draw the sun on their paper plate and use yellow table cloths to cover themselves. While reading "The Sun Gives Us Energy to Survive" (Appendix C), students will act out each part of photosynthesis.

Optional Song instead of Chant:
Sung to the tune of Peanut Butter and Jelly
The sun is amazing. (girls) Yeah. (boys)
Repeat
First it takes its light and it shines, it shines, gives light to the leaves. (*SUN)
Then they trap it, they trap it, they trap it in their openings. (*LEAVES)
Chorus
Next CO_2 tries to mix, to mix, to mix with the light. (*CO_2)
And the water, the water wants to join in too. (*WATER)
Chorus

Now we have all three so we're ready, we're ready, we're ready to react.
So we mix and mix together that's a fact.
Chorus
Now we made 2 things one is sugar, its sugar but don't you try to taste it. (*SUGAR)
Next its oxygen, oxygen it helps us when we breathe. Poof! (*OXYGEN)
Chorus

Students will use their knowledge of photosynthesis to create a comic strip describing each step. Ex. "Hi I'm Larry the Leaf. I take in Sunlight and drink lots of water." They will choose one of the 6 "characters" from the model and write their comic strip from that particular characters' point of view. If they were writing from the perspective of oxygen, they may have a different attitude towards photosynthesis because they are always being released from the leaves. "Hey, why did you kick me out Mr. Sun?! I was here first!" Students will be assessed using a rubric of their knowledge and accuracy depicted from photosynthesis.

Activity #4: Blowing Bubbles

Students will work in pairs to practice their breathing. Partner A will take deep slow breaths by breathing in and out while partner B records how many breaths were completed in a minute. Remind students to look for signs of breathing such as a raised stomach, sounds coming from their mouth or nose and body expressions. The first round will be completed using normal breaths. For the second round, have Partner A run in place for 1 minute, then have Partner B record how many breaths were completed in a minute. Compare results from the first round and second round. Are there any noticeable differences? Why or why not?

For the next portion of this activity, students will need plastic cups, straws, food coloring and BTB (Bromothymol Blue) solution. Each cup needs to be filled halfway with water. Give students an opportunity to practice blowing out carbon dioxide from their lungs by making bubbles. When we blow out carbon dioxide, plants are able to use that carbon dioxide to help with photosynthesis. However, too much carbon dioxide in the air creates problems for the environment. When students have a good grasp of blowing out carbon dioxide, add 2-3 drops of BTB solution. This solution is NOT intended for consumption so it is **imperative** that you review safety precautions with your students. Have students observe what color the solution was to begin with and record it in their science journals. Students will experiment blowing bubbles with the solution and watch the color change magically before their eyes! What causes the solution to change colors? (Carbon dioxide from our lungs) Finally, place a leaf inside the cup and let it set in the light for at least 30 minutes. Have students observe and record what happens to the solution and what is responsible for that change.

*(The leaves absorb the carbon dioxide and cause the solution to change to blue). Continue the cycle of photosynthesis explaining how plants provide oxygen for us to breathe and we blow out carbon dioxide to start the cycle again.

Activity #5: Extracting Chlorophyll

For this activity, you will need 4-5 spinach leaves, a clear glass, spoon, nail polish remover or rubbing alcohol, coffee filter, pencil, scissors, and tape.

- Tear the leaves into small pieces.

- Place the pieces into the bottom of the glass and press them down with a spoon.

- Add several teaspoons of nail polish remover (or rubbing alcohol) to the leaf mush. Wait until the leaves settle at the bottom of the nail polish remover. If the remover does not cover all the leaves, add enough so that they are totally covered.

- Cut a rectangle from the coffee filter. Tape the rectangle to the pencil and, when the leaves are settled, place the pencil across the top of the glass so that the coffee filter rests in the nail polish remover without touching the leaves.

- Let the glass sit for several hours in the sunlight.

Have students observe what happens to the coffee filter as the green color from the leaves travels up the filter. What would happen if you use red leaves, orange leaves, etc. during the fall? Will you get the same results?

Activity #5: Environmental Conditions

With this project, students will work in teams to develop a model or simulation of a specific ecosystem found in the world. Before starting this activity, immerse students in a rich array of literature related to the environment and the world around us. *Seeds of Change* is a phenomenal book that depicts the struggle and determination a young woman named Wangari Maathai had to change her country. She saw how her environment was affected by human greed and decided to take a stand to plant several trees which started the Green Belt Movement. Because of her heroic efforts and community outreach, she received the Nobel Peace Prize in 2004.

Another fantastic literacy component to integrate is *The Good Garden* by Katie Smith Milway. This story shows how a family in Honduras struggles and works hard to grow their own food to meet their basic needs. The story depicts a true story of farm transformation and how good gardens are able to grow. Through this story, students are able to see how they can also make a difference in their own community.

There are several other children's books that can be used to help support the Environmental Condition project for students including: *The Lorax* by Dr. Seuss, *Freshwater Habitats* by Laurie Toupin, *Tree of Life* by Rochelle Strauss and many more (See Appendix B). Many of the selected books highlight a specific place in our diverse world. Have students locate the main setting on a world map and use that location to help build their ecosystem.

They will research plants and animals found in that particular environment and show how environmental

conditions can affect the growth and survival of their organisms. For this activity, each group will need a large sheet of poster board, paint and craft supplies. They must first decide on their location by using countries and continents around the world. The top of their poster will reflect the country and the specific plant found in that country. For example, in Seeds of Change, Wangari plants several mugumo trees to replenish the ones that were chopped down. After viewing pictures of mugumo trees, students can create their own with paint and craft supplies.

As students conduct their research, they will answer five main questions, to be included on index cards, on their poster:

As you research, be sure to include the following in your results:

- What type of plant are you researching?
- What environment is it mostly found in? (ecosystem, habitat, landforms)
- Describe the process of how your particular plant gets energy.
- What environmental conditions affect your plant? (pollution, deforestation, human impact, etc.)
- What role does the sun play in the balance of your ecosystem?

Students will present their research to the class to increase their communication skills and knowledge learned. Students will use a graphic organizer to fill in information from the presentations. Once students present to their class, they will have an opportunity to present to other grade levels and parents in an Ecosystem Explo. They will set up their area with their poster and research materials as observing participants rotate through each station to learn more about the Sun's role in our Ecosystem.

Appendix A

Unit Goals and Standards

This unit will target 2 main science goals, math goals, reading goals and writing goals. Most states have adopted the Common Core Curriculum and Essential Standards. This unit will address those goals and areas familiar with most state curriculum. Exploring Ecosystems all over the world also provide a globe aspect for international studies. In the first science goal, *students will recognize Earth's Systems, Structures and Processes.*

- 3.E.2 Compare the structures of Earth's surface using models or three-dimensional diagrams.

- Compare Earth's saltwater and freshwater features (including oceans, rivers, lakes, ponds, streams and glaciers)

- Compare Earth's land features (including volcanoes, mountains, canyons, caverns, and islands) using models, pictures, diagrams and maps.

Students will use this goal when learning about Earth's ecosystems and the plants that thrive in each. When they engage in the Ecosystem Explo by researching, they will discover the landforms significant to their area of study. To compare the various land and water features, students will present information to their

classmates and they will use a graphic organizer to compare at least two of the landforms or water features presented.

In the second science goal, students will understand how plants survive in their environments.

- 3.L.2.1 Recognize the function of the following plant structures as it relates to the survival of plants in their environment.

- Roots

- Stems

- Leaves

- Flowers

- 3.L.2.2 Explain how environmental conditions determine how well plants survive and grow.

With this goal, I plan to use plant activities that show the function of each plant part. For example, to show the function of stems, we will use celery and food coloring. By placing the celery in a cup of water (*add food coloring), students will be able to see how water travels up the stem of the plant over a time period. To understand how environmental conditions affect plant growth and survival, place plants in various conditions and record the growth and observations in a science journal. Possible environmental conditions include placing them dark places so they don't receive sunlight, such as the inside of a desk, the freezer, closet, etc. Students will compare the growth of all plants and evaluate what all plants need to survive. With the math goals, students will graph and collect data to enhance their critical thinking and problem solving skills. Science and math are closely related and students will have several opportunities throughout this unit to relate energy to graphing, measurement, and basic arithmetic properties.

Reading is a fundamental portion of academic development and what better way to immerse students in science than by connecting it to content rich text! With reading goals, students will ask and answer questions to demonstrate understanding of a text referring explicitly to the text as the basis for the answers (CCSS.ELA-Literacy.RL.3.1). Students will also explain how specific aspects of a text's illustrations contribute to what is conveyed by the words in a story (*CCSS.ELA-Literacy.RL.3.7). Foundational skills from reading will also be incorporated by decoding words with common Latin suffixes and decoding multisyllable words.

Appendix B

Student Resources

Suggested Book List for Students

Living Sunlight by Molly Bang

Seeds of Change by Jen Cullerton Johnson

The Lorax by Dr. Seuss

The Good Garden by Katie Smith Milkway

Tree of Life by Rochelle Strauss

What's so Bad About Gasoline? by Anne Rockwell

The Curious Garden by Peter Brown

Just a Dream by Chris Van Allsburg

Suggested Websites for Students

- The Great Plant Escape http://urbanext.illinois.edu/gpe/index.cfm Kid friendly site that lets students explore the parts of a plant through webquests.

- Meet the Greens http://www.meetthegreens.org/ Kid friendly site about looking out for the planet with videos, activities and links to research sites.

- Monster Sciences http://www.monstersciences.com/ Teaches science experiments in a fun friendly way.

- Energy Kids http://www.eia.gov/kids/ Basic forms of energy and activities.

Appendix C

The Sun gives us energy to survive

*(Figure 3)

(Chanted to the rhythm of "This is the House that Jack Built")

This is the Sun……..

This is the Sun that shines on plants…….

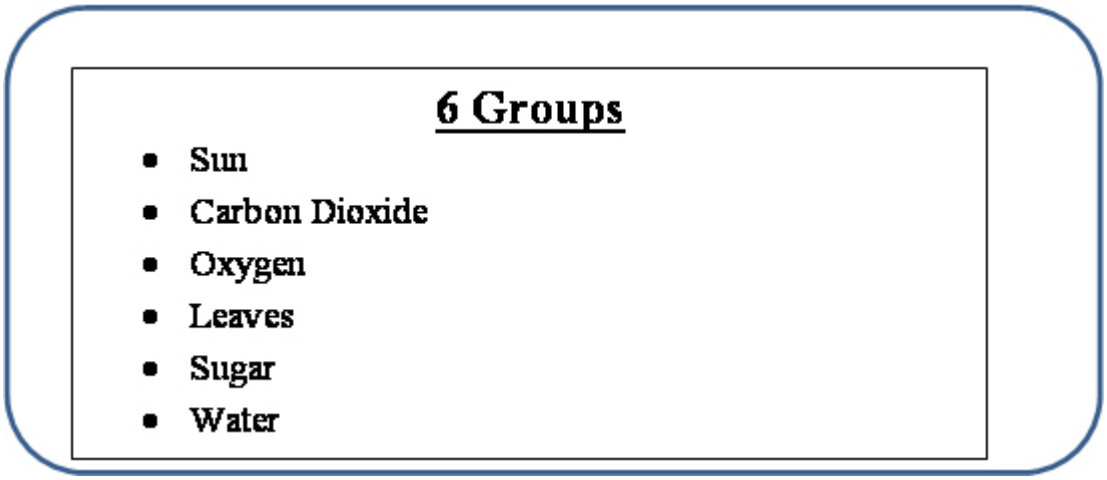
This is the Sun that shines on plants that make their food…….

This is the Sun that shines on plants that make their food that give us oxygen……

This is the Sun that shines on plants that make their food that give us oxygen to help us breathe. ……..

This is the Sun that shines on plants that make their food that give us oxygen to help us breathe to work and play……..

This is the Sun that shines on plants that make their food that give us oxygen to help us breathe to work and play to survive everyday.



Appendix D

Teacher Background Reading List

"Try This: Falling Leaves - Science Experiments for Kids." Netplaces. http://www.netplaces.com/kids-science-experiments/biology/try-this-falling-leaves.htm (accessed July 14, 2013).

This website gives information on how to set up a science experiment that explains pigmentation in leaves.

"Biology of Plants: Introduction." MBGnet. http://www.mbgnet.net/bioplants/main.html (accessed July 14, 2013).

This website if fairly new and explains the biology behind plants including plant part functions, how they make their own food and how they adapt to their environment.

"Effects of the Sun on our Planet Lesson Plans." Stanford Solar Center. http://solar-center.stanford.edu/activities/space-weather.html (accessed July 11, 2013).

"Energy Sources | Energy4me." Energy4me | Essential Energy Education: issues, careers, classroom resources. http://www.energy4me.org/energy-facts/energy-sources/ (accessed July 12, 2013).

This website gives information on renewable and nonrenewable resources, and also includes a chart listing the pros and cons of each source.

National energy education development project. "Energy from the sun." Sun family guide. http://www.fi.edu/PECO/sun-guide-family.pdf (accessed June 29, 2013).

This is a PDF file with lessons and activities on how the sun provides energy for plants and animals.

"Energy, photosynthesis, and Energy conversions in plants and animals - from FT Exploring." Science and technology education from Flying Turtle Exploring. http://www.ftexploring.com/me/me2.html (accessed June 28, 2013).

This website shows examples of the food chain and how plants get their energy from the sun.

"Fun Energy Facts for Kids - Solar Power, Wind, Kinetic, Potential, Motion, Joules, Laws." Science for Kids - Fun Experiments, Cool Facts, Online Games, Activities, Projects, Ideas, Technology. http://www.sciencekids.co.nz/sciencefacts/energy.html (accessed June 28, 2013).

This site includes facts on solar, wind and heat energy.

"Law of Conservation." Railroad Commission - Energy Education Programs - Energy Curriculum. http://www.energyeducation.tx.gov/energy/section_1/topics/law_of_conservation/index.html (accessed July 9, 2013).

"MBGnet." MBGnet. http://www.mbgnet.net/index.html (accessed July 14, 2013).

This is a fantastic website that explains the various biomes and ecosystems of the world so that students can research the type of plants and animals that live there.

MortensonConstruct. "Kids' World of Energy Festival, May 2009 - YouTube." YouTube. http://m.youtube.com/watch?v=x8rGWZbloow&feature=related (accessed June 28, 2013).

This is a great example of Energy Festival that teaches students about solar, wind and heat energy.

"Photosynthesis Activity Project for School." Bright Hub Education Provides Teaching Tips & Lesson Plans, Homework Help & Study Guides, Homeschooling Advice & Much More. http://www.brighthubeducation.com/middle-school-science-lessons/85578-photosynthesis-activity-project-for-the-classroom/ (accessed July 13, 2013).

This website gives ideas and suggestions for photosynthesis at a younger age including kinesthetic movement and drama.

Ray, Andrew M., and Paul M. Beardsley. "Overcoming Student Misconceptions About Photosynthesis: A Model-And Inquiry-Based Approach Using Aquatic Plants." *Science Activities: Classroom Projects and Curriculum*

Ideas 45, no. 1 (2008): 13-22.

This article provides insight to how students often perceive the process of photosynthesis and activities for middle to upper grade students. This article also provides insight to the 5E learning cycle model.

Schinittka, Christine, Randy Bell, and Larry Richards. "Save the Penguins." *Science Scope* 34, no. 3 (2010): 82-91.

This article is an excellent overview of how fossil fuels affect the environment and the animals. It gives suggested activities that primary students can use to help conserve energy and learn about energy transfer.

Stockley, Corinne. "REAL TREES 4 Kids! - Let's Eat!." Welcome to REAL TREES 4 Kids!. http://www.realtrees4kids.org/sixeight/letseat.htm (accessed July 11, 2013).

This website gives a quick easy guide to the process of photosynthesis.

"The Energy Story - Chapter 1: Energy - What Is It? ." Energy Quest Room. http://www.energyquest.ca.gov/story/chapter01.html (accessed July 9, 2013).

This is a great resource site for students and teachers to explain the basics of energy and the forms of energy.

"Trapping the Sun's energy - Earth's energy resources - Earth & beyond - Sun|trek." Sun|trek. http://www.suntrek.org/earth-beyond/earths-energy-resources/trapping-the-suns-energy.shtml (accessed July 11, 2013).

This website shows a world map and the countries that receive the most amount of sunshine each day. It gives an explanation of solar power and discussion of solar cells.

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Notes

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1. Law of Conservation, Railroad Commission

2. The Energy Story, Energy Quest Room

3. Bill Nye the Science Guy

4. Light and Photosynthesis in the Aquatic Ecosystem, John Kirk

5. Energy Quest

6. Gary Brudvig Seminar

7. Trapping the Sun's Energy

8. Real Trees for Kids

9. Green Student "U"

10. Examining Multiple Perspectives in Literature, Elfie Israel