

A Sky System- Sun, Earth, and Moon

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Overview

I have always been fascinated by space – the final frontier. It began with my favorite song from my toddler days: *Twinkle, twinkle little star. How I wonder what you are. Up above the world so high, like a diamond in the sky.* From this song I learned the first principle of doing science, “to wonder”, and the second principle, to “ask a question.” I learned that stars were above the Earth and appeared to twinkle. The allure to the cosmic continued, into my young teens. I was glued to every episode of *Lost in Space*, which was replaced in my mid-teens with *Battlestar Galactica*. Forty years later, I still vividly recall watching Neil Armstrong take the first step on the Moon! What an impression that made on my life! This attraction to the extraterrestrial continued with *Star Trek* and *Star Wars*. Even today, I enjoy watching a good movie about space travel, or simply sitting on my back deck, looking up in awe towards outer space.

As an educator I want to share the excitement and magnetism of our world, its moon and the Sun with my students. I want my students to feel the same thrill I felt as I watched the first man walk on the Moon, to feel the wonder of our sky system, and for them to grasp a lifelong appreciation and quest to learn more about the Sun, Earth and Moon.

While attending the "Exploring the Solar System" seminar lead by Dr. Susan Trammell, I have learned several ways to make the Sky System come alive to my students. In this curriculum unit I will include many of the objectives and strategies I will use to help my students discover our slice of the Universe.

Introduction

Reid Park Elementary School serves students K-5. The school is located in Charlotte, North Carolina in the urban school district of the Charlotte-Mecklenburg School System, which is the nineteenth largest in the nation. The school serves 550 students with the majority of the population being African American. We have 27 English as Second Language (ESL) students. The school also serves some students with special needs including physical, mental and behavioral. Ninety-eight percent of the students receive free or reduced lunch qualifying the school for Title I funds. Many of the students live in government housing complexes that are located near the school. Due to previous low state test scores, Reid Park was designated a strategic school two years ago. Many changes have occurred since that time, including a new principal and several hand selected teachers being hired at the school. The current principal was given freedom by the school district to try new strategies to raise state test scores. One of these strategies was to hire a full time Science Facilitator, which is the position I now hold.

As the full time Science Facilitator at the school, I have created and established a Science Lab. The Lab has 5 tables for group experiments and cooperative working groups, as well as, a

Media Viewing Space (rugged area where a computer is connected to a Smart Board and an overhead and TV are located). The Science Lab experience is considered a “Special” on the same level as Art and Computer classes. Every student (550) in the school comes to the Lab during the school year for a forty-five minute lesson one time a week. Most of our students have had very little exposure to science, science concepts, or science vocabulary outside of school.

This year I am establishing Science Clubs for the third, fourth and fifth grade students. We meet on Fridays for 45 minutes. Students select the science club from a list of clubs, so the students in each club are self-motivated to learn more about science. I am working with two local universities to bring guest speakers to meet with the clubs. I am also creating a monthly Science Newsletter to go home with the students. The newsletter will cover the science topics we are studying, vocabulary students need to know, and a few simple science experiments that parents and students can do together at home. My goal is to create an excitement about learning science starting with the students and staff and growing to include the parents.

I teach Science using the North Carolina Standard Course of Study (NCSCoS) (see attachment) as well as, teaching methods, resources and strategies related to designing effective science learning experiences for my students. For most lessons I use the Five E’s (*Explore, Engage, Explain, Elaborate, and Evaluate*) in planning interactive lessons. I have discovered many excellent interactive science web sites where students can perform virtual experiments. Viewing these web sites as a group has had a real impact on student learning. Many of the students are lacking in life experiences and the use of the computer gives them background knowledge to be able to perform their own discovery experiments.

The district is providing Discovery Education, an online educational media provider, for our use. I am striving to take full advantage of this teaching tool to pre and post test my students, to differentiate instruction through individual assignments and for students to self direct their learning through choice of assignments.

Rationale

Students are naturally curious about the world around them. In North Carolina the focus for third grade is on identifying systems and patterns in systems. A system is an interrelated group of objects or components that form a functioning unit. Third grade students learn to identify portions of a system to facilitate investigation. Throughout the year students will study plant growth, soil properties, the form and function of the skeletal and muscle systems of the human body and the Earth/Moon/Sun system. As we study each of these subjects, it is my job to help the students understand how each of the components work together as part of an overall system. The overarching unifying concept of third grade is for students to gain the ability to think about the whole in terms of its parts and, alternatively, about parts as they relate to one another and to the whole.

The main components in our “sky system” are the Sun, Moon, planets, stars and space. The competency goal is to make observations and use appropriate technology to build an understanding of the Earth/Moon/Sun system.

For the last few years, I have taught the Earth/Moon/Sun system by having students study the system from books, draw the system and use computer assisted models. This approach has been marginally successful in the past.

My students deserve a “stellar” unit! Students need hands-on and minds engaged opportunities to help them make sense of the world they observe. As a reflective teacher, I was searching for an approach to help the students study this goal in a highly motivational way.

Dr. Trammell challenged the fellows to keep an observation journal of the night sky throughout the summer and to discover patterns for ourselves. Carefully observing the patterns in the sky and the changes over time helped me to understand and see for myself some of the mysteries of the night sky. I want to create a unit where my students will be challenged to make their own discoveries, observations and have their own “aha” moments as they view the Earth, Sun and Moon in new and creative ways.

Using this goal and the following objectives as a base, I have created a curriculum unit that will focus on students making their own discoveries through observations and experimentation. This curriculum unit will be focused on being highly engaging for the students through the use of hands-on activities and an inquiry-based approach.

During the course of the unit the students will observe that light travels in a straight line until it strikes an object and is reflected, refracted and/or absorbed. They will also observe that objects in the sky have patterns of movement including, the Sun, Moon, Earth and stars. Using shadows, the students will follow and record the apparent movement of the Sun in the sky during the day. The students will also use appropriate tools to make observations of the Moon. Students will observe and record the change in the apparent shape of the Moon from day to day over several months and be able to describe the pattern of changes.

Strategies

The first strategy is to bring my students to the understanding that our Earth, Moon and Sun form a system in the sky. This strategy begins with simple observation of the day and night sky. I will start with my student’s own questions and personal curiosity about the objects in the sky and the events encountered in their daily lives. As part of this strategy each student will create a “Sky System Science Journal,” which will be kept at school. The students will first use this journal to ask questions and record their observations. The questions they formulate after their initial observations will be used to guide the unit. As the unit progresses, they will write about and diagram their experiments and write a synopsis of the ideas they are learning. New vocabulary words, hands-on activities and reflections on their learning will be kept in these journals. Our Science Journals will also be used for student-generated annotated sketches or concept sketches (1). These sketches will be used for learning and sharing.

Students will use a second journal, called an Observation Journal, at home. In the Observation Journal the students will draw what they observe in the sky at night or early in the morning. The students will share their Observation Journals with the class towards the end of the

unit.

The sky system has at its center the Sun, a star which is our light and heat source. Our Earth revolves around the Sun while it rotates on its axis. The Moon orbits Earth, as Earth orbits the Sun. To help my students with this concept they will use simple models. Models help students understand things that are too large or too small. We will explore this system to gain an understanding of the world in which we live through a variety of activities.

Another strategy is to help my students understand the relative motions or patterns of the Sun, Earth, and Earth's Moon through role playing. They will reflect on how the Earth, Moon and Sun form a sky system. Building upon student's experiences of night and day, seasons, and observations of objects in the sky, we will explore how the parts of the system fit together and operate.

Students are familiar with many of these patterns such as seasons of the year and that the Moon "changes shapes" but they do not comprehend how or why these events occur. Student will explore the patterns in systems, which will allow them to understand basic laws that explain how things work in our world. The students will become aware that the Earth's position within the Solar System helps make the planet uniquely able to support life as we know it. They will also study the phases of the Moon and how the Moon compares to the Earth.

Through the use of mini-simulations, misconceptions such as the Sun rises in the east, moves across the sky, and sets in the west and that the seasons are caused by the Earth coming closer to the Sun will be exchanged for scientific explanations and a deep understanding of how the system creates the patterns.

Another strategy will be the use of technology. Through videos, explorations, and virtual experiments found on Discovery Education, BBC and other sources my students will be exposed to the major concepts of the Earth/Moon/Sun System. I will enlist the help of our technology specialist to facilitate the use of some of these programs, since students have access to the computers while in the computer labs.

A science center will be one strategy I will use. The science center will contain fiction and non-fiction books, posters and articles about our Earth, Moon and Sun. I will place a 3-D model of the Solar System in the center. I will encourage students to contribute to the science center. Student will also be encouraged to read about the sky system on their own, use the books for their Accelerated Reading test and to research their own interests in the sky system. Each student will be responsible for reading at least one book and either writing a book report, or choosing a creative way to share what he/she learned from the book. This may take the form of a book chat, a commercial or communication of the students' choice. This strategy helps students take responsibility for their own learning and also creates an avenue for an in-depth study on a topic of their choice.

One of the most exciting strategies I will use for this unit is to invite experts to come and share with my students. We are very fortunate to live in a city that houses a major university. I have arranged for Dr. Trammell, a local astronomer, to bring her telescope early one morning so

that my students can see for themselves the wonders of the Moon, or perhaps, even a planet. We will hold a star gazing party, complete with hot chocolate!

We are also blessed to have a local NASA representative, Judy Walker, who will come and speak. If her schedule permits I will ask her to speak to all third grade students at one large assembly, followed by spending twenty to thirty minutes in each class room to answer students' individual questions.

I am currently looking for funding for the Starry, Starry Night program presented by Discovery Place (our local science museum) so that every student at our school will be able to have the experience of Starlab Planetarium and witness the wonder of the universe. The Starlab is a huge blown-up black bubble that students can walk-in and sit while a person from the museum explains the patterns they see.

A strategy that I have discovered works well with my students is the use of multi-sensory teaching techniques. These are "mini" performances which engage the body and mind to help students remember important vocabulary or concepts. The students and I will work together to create these "mini" performances based on the materials covered in this unit.

The next strategy is the use of cooperative learning and experimentation. Working collaboratively helps student work more efficiently, and feel more positive about their learning experience. This strategy also helps students work on their interpersonal life-skills and to work like a scientist. In this strategy, students will work in table groups to perform experiments and engage in hands-on activities. In each of these activities they will work and function as a group, sharing their own ideas, challenging ideas of others and learning the lifelong skill of working together. This is one of the most important strategies because the subject we are dealing with is very abstract to the students. Through the use of this strategy, students will be able to visualize, make models, and relate their own experiences with the system of the Sun, Moon and Earth. Cooperative learning teammates will remain in their groups of 4 or 5 for the entire unit. Each group will come up with their own name and they will divide the tasks for different activities

A new strategy that I will use in preparation for this unit is a program by the Museum of Science, Boston called Optical Engineering: Designing Lighting Systems. The five lessons that I will teach in conjunction directly before this unit are centered on guiding students to explore how optical engineers use their knowledge of science (behavior and properties of light) to design and test technologies that solve problems related to light and optics. During these related lessons the students will explore the field of optical engineering as they design a lighting system for the interior of a model ancient Egyptian tomb. Reflection, refraction, transmission, and absorption of light will all be taught as they explore ways to light up the "tomb". I will then use their first hand knowledge of these concepts to help explain our Earth/Moon/Sun system.

The last strategy will be for students to participate in a project that is of high interest to them. Students will select from a list of suggested mini- projects or come up with their own ideas on how to share their new found knowledge with others. Some ideas would include making a brochure, drawing a poster, creating a book to educate younger students about their favorite planet, or writing a story about a trip into space using the ideas gained from the unit.

Instructional Content Background

The Sun – Our Dynamic Star

The Sun is a massive shining sphere of hot gas. It is a medium-sized star that appears brighter and bigger than any other stars because it is so close to our Earth. Our sun is approximately 93 million miles away from Earth. Light from the Sun takes about eight and a half minutes to travel through space and reach the Earth. It is by far the largest object in the Solar System, and contains more than 99.8% of the total mass of the Solar System. Its strong gravitational pull holds Earth and the other planets in the Solar System in their paths around the Sun (their orbit).

Our Sun is considered to be an average star, meaning its size, age, and temperature fall in about the middle of the ranges of these properties for all stars. It is approximately 4.6 billion years old, with some of its material coming from former stars. The Sun is huge compared to Earth. In fact, if the Sun was empty, 1.3 million objects the size of the Earth could be placed inside of it.

The Sun's light and heat are produced deep in the interior. Through nuclear fusion reactions, the hydrogen gas that makes up most of the mass of the Sun is fused into helium. These reactions release an enormous amount of energy in the form of light and heat.

The Sun is classified by scientists as a main sequence star. The photosphere is the visible surface of the Sun (WARNING: Never look directly at the sun. The direct rays of the Sun can injure your eyes). The temperature of the photosphere is about 60 thousand degrees Fahrenheit. Above the photosphere are the chromosphere and the corona. These are visible during a total solar eclipse. The Sun's corona is made up of thin hot gasses that stretch outward for millions of miles into space.

The Sun is ever changing. Sometimes, we can see sunspots on the surface. They look like dark spots. Astronomers have observed a sunspot cycle with the number of sunspots changing over an eleven year period. During an active year as many as one hundred large sunspots can occur as compared to a quiet year when large sunspots appear very rarely. Solar flares occur when the magnetic forces in a large sunspot are released in a fiery explosion. An enormous amount of energy is released during these violent explosions. These sparks of energy can be as big as the Earth. They also can affect radio, television, and cell phone transmissions on Earth.

Without the Sun there would not be living things on the Earth. We depend on the Sun for our heat, light, weather and climate, and for a necessary ingredient for all plants to grow. Without the perfect position of our Sun to Earth we could not exist.

Planet Earth- Our Home

Our Earth is the third planet from the Sun. It is the fifth largest of the eight planets in our solar system. It is the only known planet that has the ability to support life. The Earth appears to be a perfect sphere when viewed from space, but in fact it is slightly oblate and flattened at the poles. Physically we can divide the Earth into three major parts; the atmosphere, the hydrosphere, and

the solid earth.

The atmosphere surrounds the planet and extends from the surface of the planet to more than 100km. The life-giving gaseous envelope is composed mostly of nitrogen (77%) and oxygen (21%) with traces of carbon dioxide, argon, and water. This gaseous layer protects us from the Sun's harmful heat and radiation, as well as, provides us with the air we need to breathe and to support life. There are five layers of the Earth's atmosphere

The first layer closest to the Earth is called the troposphere. This is where the air we breathe comes from and is also the place where our weather is formed (storms, rain etc.) This layer extends out 8 to 17 km.

The second layer is called the stratosphere and is located above the troposphere, extending about 50 kilometers above the surface of Earth. Jet Streams which play an important role in our weather are caused by the movement of air at this level. The stratosphere contains ozone that absorbs skin cancer causing ultra-violet radiation, protecting animal life on Earth.

The third layer of atmosphere is the mesosphere and extends about 80 kilometers above Earth. The air in this layer is very thin and the temperatures can be as low as -100 Celsius. It plays an important role in protecting life on Earth. It is in this layer that most small meteors that are headed to Earth are destroyed.

The fourth layer from Earth is the thermosphere. It extends from about 90 km to between 500 and 1,000 km above our planet. This is the layer where space shuttles orbit.

The fifth layer is the exosphere and extends from the thermosphere out to space. The layer of the atmosphere is very thin. It is mainly made up of hydrogen and helium, the lightest gases (there is also some carbon dioxide and oxygen).

Seventy-one percent of the Earth's surface is covered by water including oceans, lakes, rivers, groundwater, glacial and polar ice. All of the water found on Earth makes up the hydrosphere. Unique within the Solar System, the hydrosphere is essential to all life as it is presently understood.

The internal structure of Earth is divided into three zones, the crust, the mantle and the core. The crust is the outermost layer and is composed of rocks of varying thickness. The mantle lies below the crust and is divided into two parts; the upper mantle and the mantle. In the upper mantle the rock is somewhat like hot asphalt. This layer of hot rock is sometimes called the lithosphere. It is the movement of material in this layer that causes the plates of the crust to move.

The core lies at the center of Earth and is composed of two distinct layers. The outer layer is liquid and the inner core is solid. Both core layers are thought to be composed largely of iron and nickel. The core makes up only 1% of the Earth's total mass.

It takes three hundred and sixty-five days (one year) for our Earth to revolve around the Sun and twenty-four hours (a day) for Earth to rotate one time on its axis. The Earth orbits the Sun at an average speed of 67,000 miles per hour. The Earth is inclined on its axis at an angle of twenty-three degrees.

The Moon - Our natural satellite

The Moon is a globe whose surface is studded with impact craters caused by asteroids, comets and meteorites and is strewn with rocks and dust. There is no atmosphere on the Moon to help protect it from bombardment. Also, there is no erosion or wind, or any kind of weather. The Moon is a silent place due to the lack of atmosphere because sound waves travel through air.

Most astronomers believe that the Moon was formed about four billion years ago when a large asteroid-like object, a planetesimal, crashed into Earth sending material into space. Some of the material came together and became the Moon. After forming, the Moon had many volcanoes on its surface. As the Moon cooled, a hard outer layer called the crust formed on the surface. Below the crust is the mantle and the center is called the core.

The temperature on the Moon can be extreme. During the day the Moon's temperature can be as high as 225 degrees Fahrenheit (107°C.). At night, the temperature can go as low as -243 degrees Fahrenheit (-153°C.).

The Moon is approximately 240,000 miles from Earth. The Moon revolves around the Earth in about one month. It rotates around its own axis in the same amount of time. The same side of the Moon always faces the Earth; it is in synchronous rotation with the Earth.

The Moon does not create its own light. It shines because it is reflecting the light of the Sun. As the Moon circles Earth, we see different amounts of the side of the Moon that is lit by sunlight. Certain points of this cycle are called phases. One cycle of phases takes twenty-nine days and twelve hours. Over this time we see more and more of the sunlit side until we see the whole disk at full Moon, then we see less and less of the sunlit side until the disk seems to disappear at new Moon.

Waxing and waning are terms used to describe the phases of the Moon. A waxing Moon is becoming full while, a waning Moon is becoming a new Moon. The eight terms to describe the Moon phases are; waxing crescent, waxing half Moon, waxing gibbous, full Moon, waning gibbous, waning half Moon, waning crescent and new Moon.

A total of twelve people have landed on the Moon. Neil Armstrong and Buzz Aldrin were the first to walk on the Moon in July of 1969. The last man to walk on the Moon was in 1972. Each of the individuals to walk on the Moon has been American- born and citizens of the United States.

Classroom Activities

Before the unit begins, I will conduct a mini-lesson on how to use an observation journal. Using pictures of the sky we will practice writing and drawing what we observe in our journals. In their observation journals I want them to describe patterns, such as the placement and shape of the Moon. I would like for my students to focus their attention on really studying the night sky through the use of the observation journal.

Lesson 1

Content Blast

Some materials let light rays pass through them easily such as air and glass. Some materials block light rays. These materials are called opaque. Some materials “bounce” light or reflect light (as in a mirror). Some materials cause the light to refract. Refract means to bend. Refraction is demonstrated in eye glasses, camera lenses and in the introduction to the lesson below.

Materials needed:

Sets of flashlights, classroom materials- such as paper, wax paper, plastic wrap, aluminum foil, large balloon, or any material the students can experiment with. Have enough sets so that each cooperative learning group can each have a set. Science journal, pencil to record observations, a glass jar and a spoon will also be used.

Introduction:

We depend on light daily! Demonstrate for students a glass container with a spoon placed in it. Next, ask the students to talk about what they see. (The spoon will appear to look broken because the light is refracted). Light travels in a straight line, but some materials can bend light (refract). Ask students to think about, and then share their ideas with a friend on why the spoon appears broken. After a discussion have students sketch the demonstration and write in their journals why the spoon appeared to be broken.

Directions:

Students working in cooperative learning groups (4-5 students) will first make a list of different sources of light. The group will list as many as they can in 4 minutes. Share the list with the group and discuss which light sources are natural light sources and what is not a natural light source.

Ask students to divide their next journal page into fourths. In the first section they will list the materials and predict what items the light will pass through, which materials will form a shadow,

and which materials will allow some light to pass through. The students will then explore on their own using the flashlight as a light source and the materials to see if their predictions were correct. The students will then use the materials to create their own experiment. Encourage students to change the materials in some way for their experiment (double the paper over, crumple the wax paper). They will use a section of the paper to write up their experiment. In the third section of the paper the students will diagram their experiment. Have the students share their experiment with other groups, asking the other groups to comment on the experiment (give feedback) in the fourth section.

Lesson Two

Introduction:

The Moon revolves around Earth and Earth revolves around the Sun. Earth also rotates every 24 hours giving us our night and day. Sometimes the movements of the Earth and Moon block the Sun's light from reaching each other. When the Moon blocks the Sun from our view, we have a solar eclipse. A lunar eclipse occurs when the Moon passes through Earth's shadow.

Materials needed:

Golf balls covered in aluminum foil, apples, and flashlights, science notebooks and pencils.

Directions:

Ask students to review with you what they know about the objects in the sky and how the Sun, Moon and Earth interact with each other. If no one uses the words eclipse, phases, and rotation ask the students if they know the meaning of these terms. Explain if needed.

Students will write in their journals what they think the arrangement of the Sun, Moon, and Earth would look like to create a solar eclipse. When they have completed this task, ask them to sketch the arrangement of the Sun, Moon, and Earth to form a lunar eclipse. Students will then break into their cooperative working groups to make a model of the Sun (flashlight), Earth (apple) and Moon (golf ball covered in foil) to demonstrate a solar eclipse and a lunar eclipse. Using their own arrangements/sketches the students will test each of their original diagrams as they had predicted the arrangement. Did their predictions work? If not, students will sketch the arrangement of the Sun, Moon and Earth that does work into their journals. Students will then compare their first sketches with the sketches drawn based on the experiment. How were they alike/different?

This lesson will be extended several times to show students different aspects of the system. Students will use their models again and this time pay attention to the lit up parts of the Moon (golf ball) as it rotates around the Earth. These are called phases of the Moon. These same models can also be used to focus on why day and night occur on the Earth. Students can pick a place on the “Earth” apple and adjust the model to show the tilt of the Earth to help understand the seasons we go through on the Earth.

Lesson Three

Content Blast:

The Moon is a satellite of Earth. The same half of the Moon always faces the Earth. The Moon is a sphere, but it appears to change shape because you see different amounts of its lighted part (reflection from the light of the Sun) as it orbits the Earth. The positions of the Sun and the Moon make the Moon seem to change shape. These changing shapes are called the Moon’s phases and it takes 29 days for the Moon to pass through all of the phases before the phases repeat.

Introduction:

Think, pair and share what you know about the Moon. Does it appear to change? What have you observed about it? What is the light source of the Moon? What is it like on the Moon? Today we are going to use Oreo cookies to make a model of the phases of the Moon and we will label the phases so that when you make your own observations you will be able to call the phase by its scientific name.

Materials needed:

Oreo cookies- enough for 8 cookies per cooperative learning group, Strip of tag board for students to glue the cookies on, glue, scissors, plastic knives, and markers, example with phases correctly labeled for students to see.

Directions:

Students working in cooperative learning groups (4-5 students) will first take the Oreo cookies apart. They will then create the phases of the Moon by taking off some of the white icing to duplicate what the Moon looks like in each of the eight phases. They will glue the cookie phases on the tag board and label each phase. Have students use the models to correctly name the phases the Moon is going through each night for several weeks. Students will use the webpage

HYPERLINK "http://home.hiwaay.net" home.hiwaay.net (see bibliography) for examples of correct names of the phases of the Moon.

After the students have gained a basic understanding of the phases of the Moon, I will ask the students to create a Moon Calendar in their observation journal where they will record what they observe about the Moon.

Lesson Four

Introduction:

Students know that it's warmer in the summer and colder in the winter. Something changes as Earth revolves around the Sun. This experiment will help the students explore what that change is and what it has to do with the seasons and temperature.

Materials:

Each cooperative working group will need a piece of graph paper, ruler, tape, flashlight, clay, small piece of straw, pencil and a thermometer.

Directions:

Have each cooperative learning group follow the directions to create this experiment. Tape the flashlight to the ruler at the six inch mark with the light facing the one inch mark. Make a small round ball of clay, place the straw in the middle and then attach the ball of clay with the straw standing straight up into the middle of the graph paper. Hold the flashlight attached to the ruler perpendicular to the paper. Darken the room and then trace with a pencil the circle of light created by the flashlight that is shown on the paper. Have a student count the number of squares inside the outlined area. Place the thermometer on the surface of the paper and record the temperature every minute for five minutes as the light continues to shine upon it. Next, take the ruler and place it at an approximate 23 degree angle to the paper. Again, trace the outline of the light, count the number of squares and record the temperature every minute for five minutes. Compare the data. What can you conclude from this experiment? While the students still have the materials ask the students to create their own explore activity.

Explore Activities

Explore Activity 1

Explore how shadows change by taping a circle of construction paper onto a sunny window. Find the shadow of the circle and place a large piece of paper under the shadow and use a pencil to circle the shadow. Record the shadow's position every 15 minutes for two hours. How did the shadow's position change? Have students predict where it will be four hours after they began.

Explore Activity 2

Compare the times of sunrises and sunsets over a period of time. Are the days getting longer or shorter? What effect does that have on the temperature and weather?

Explore Activity 3

Place a flour/cornstarch mixture into the top of copy box lid that has been placed upside down. Drop marbles, small balls, and steel balls into the mixture (to simulate a meteor hitting the surface). Observe what happens. Discuss why we still see where meteors hit the surface of our Moon. What happened to the evidence of the meteors that hit our Earth?

Conclusion

As scientist, what we know today about our sky system is likely to be added to, changed or even disproved. One of the latest examples is the status of Pluto being changed from a planet to a "dwarf planet." Our students will learn more in their lifetimes about space than I can even imagine so I must do my best to help prepare them to develop inquiring minds. It is my hope that this unit will begin a life-long love affair with "space- the final frontier!"

Bibliography

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Simple text, easy read, great pictures!

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This is a great site for elementary students. Includes research links various sites focusing on the Solar System. Please note- several of the links are no longer available, but still is a great resource!

Children's Reference. London: Arcturus Publishing, 2008. Planet Earth- Learn About Our World. Great pictures. Good explanation of the Earth's atmosphere.

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Exploring Planets in the Classroom was a long-running summer workshop in Planetary Geosciences offered at the University of Hawai'i at Manoa for the state's K-12 educators and librarians under the direction of Dr. G. Jeffrey Taylor. Hands-on activities in this course were developed and/or tested by the Hawai'i Space Grant Consortium in cooperation with educators statewide. Great links to Educational websites on the Solar System.

"HiWAAY Information/Internet Services | Home." HiWAAY Information/Internet <http://home.hiwaay.net> (accessed November 7, 2010).

This website has an awesome graphic of how the Moon, Sun and Earth travel in respect to one another. It also has great descriptions of the phases of the Moon.

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The movie show a journey through space and time, witnessing the birth of the sun and travelling to the outer limits of the solar system. This "journey" includes visits to Earth's close neighbors in space.

"FUNdamentals." Under Construction.

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Great way for students to explore the sky system using an interactive program.

Fowler, Allan. *So That's How the Moon Changes Shape!* . Chicago: Childrens Press, 1991.

Easy read and nice pictures. For struggling readers.

Fowler, Allan. *The Earth is Mostly Ocean* . Chicago: Children's Press, 1995.

Great pictures, an easy read for struggling students.

Gibbons, Gail. *The Planets*. 3 ed. New York: Holiday House, 2008.

Discusses the movements, location, and characteristics of the nine known planets of our solar system.

JOHN, LEWELLEN. *MY EASY TO READ TRUE BOOK OF MOON SUN AND STARS*. New York: Grosset & Dunlap, 1954.

A "classic" book. I am planning on using this to show students what students were taught about his subject 50 years ago!

Lord, Suzanne, and Jolie Epstein. *A Day in Space*. New York: Scholastic, Inc., 1986.

Great NASA photos. Gives the students a taste of what it would be like to go up in a Space Shuttle.

Macmillan. *Activity Log. Unit 11. A System in the Sky. 1995 Edition*. New York: Macmillan, 1995.

Six in-depth lessons which include explore activities. Great resource for the unit. Filled with "kid friendly" pictures and explanations of how the Sun Moon and Earth system works.

Nelson, Nigel, Piers Harper, Bryan H. Bunch, and Jacqueline Mitton. *Reader's Digest Looking Into Space*. Surry Hills, N.S.W.: Reader's Digest Young Families, 1998.

Easy to understand answers to many questions young students as about space. Fun book with "see-through" windows.

O'Brien, Patrick. *You Are the First Kid on Mars*. New York: Putnam Juvenile, 2009.

Great story! Students will love the future thinking of this book. Students will have a chance to see what it might be like to travel to Mars.

Olson, Gillia M. *Phases of the Moon*. Mankato, Minn.: Capstone Press, 2007.

Great pictures and explanation of the Moon phases. Great read before the Oreo cookie activity!

Perez, Miquel, and Miguel Pierez. *The Earth and the Universe: How the Sun, Moon, and Stars Cause Changes on Earth*. Hauppauge: Barrons Juveniles, 1998.

Great book to have in your Science Center. This book will help students understand the Sky System.

Rau, Dana Meachen. *The Moon*. Minneapolis, Minn.: Compass point books, 2003.

Interesting pictures and text.

Rose, Susanna. *Earth*. London: Dorling Kindersley, 1994.

Great book to have in Science Center for students to refer to.

Ross, Linda, and Richard Max Kolding. *Under the Night Sky*. New York: McGraw-Hill School Division, 200.

Very easy leveled reader. Introduces stargazing.

Simon, Seymour. *The Sun*. 1st Mulberry Ed ed. New York: HarperTrophy, 1989.

Great pictures of the Sun. A must for this unit.

- Simon, Seymour. *Our Solar System (revised edition)*. Updated ed. London: Collins, 2007.
This book give an overview of the Solar System that students will find answers many of their questions.
- Stacy, Tom, Peter Bull, and Sebastian Quigley. *Sun, Stars & Planets* . New York: Random House, 1991.
Picture book of simple answers to the questions students ask most often about the Sun, stars and planets.
- Stott, Carole, and Steve Gorton. *Space exploration* . New York: Alfred A. Knopf :, 1997.
Great Eyewitness Book on space exploration. Students will enjoy the pictures and text.
- Wilkinson, Philip. *Spacebusters: The Race to the Moon*. New York, N.Y.: DK Pub. , 1998.
Awesome photographs! Armstrong's first step onto the Moon, the US flag, and Nixon talking with the astronauts are just some of the photographs. Great read for students.
- Winrich, Ralph. *The Moon* . Mankato, Minn.: Capstone Press, 2005.
Great pictures and illustrations! This book also has a Moon phase chart in the back. Students will enjoy the close up pictures of the Moon!
- Woolf, Alex, and Rebecca Gerlings. *Planet Earth* . London: Capella/Arcturus Publishing, 2008.
Many spectacular photos and extraordinary facts. *Chicago formatting by BibMe.org.*

When the Moon's shadow strikes Earth, people within that shadow see the Sun at least partially covered by the Moon; that is, they witness a solar eclipse. When the Moon passes into the shadow of Earth, people on the night side of Earth see the Moon darken in what is called a lunar eclipse. Let's look at how these happen in more detail. The shadows of Earth and the Moon consist of two parts: a cone where the shadow is darkest, called the umbra, and a lighter, more diffuse region of darkness called the penumbra. Today, we enjoy the sky show with a healthy appreciation of the majestic forces that keep our solar system running. How to Observe Solar Eclipses. A total eclipse of the Sun is a spectacular sight and should not be missed.