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Our Sun: The Myths, the Facts, and Superman

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Introduction

For kids Superman exists. Blue suit, red cape, able to leap tall buildings in a single bound. "You will believe a man can fly."[1] I teach kindergarten and I know with an amount of certainty that my students whole-heartedly believe in Superman, much in the same way that many of them believe Santa Claus will fly in with Rudolph in December and leave presents if they have behaved themselves. They know Superman is out there somewhere keeping an eye on the world. Despite the fact that I explain to the kids the difference between fiction and non-fiction (with regards to super-heroes, NEVER with Santa Claus!) my students carry Superman in their hearts. To be honest, so do I. The world is a brighter place with the man of steel flying the skies.

At Kathleen Wilbur Elementary School in New Castle, Delaware we believe in the power of wearing a cape. Wilbur is a large school of almost 1,200 students. Our 1,200 come from diverse backgrounds. They come from mansions, motels, and everywhere in between. I teach in one of the nine kindergarten classes at this school. In each of these nine rooms you will find students of varying skill levels. Some have grown as they attended years of preschool. Some have learned much from Sesame Street, an older sibling, or an inspired parent. While some other students may never have held a book before. Throughout last year my class ranged between 20 and 22 students. As the year closed, I had 21 students on my roll. I had an almost even split between male and female students. My class was predominantly of African-American descent (59%). The rest of my class was pretty evenly split between Caucasian, Hispanic, and Asian backgrounds. Three of my students were pulled out during the day to receive English Language support and two of my students were regularly pulled from class to receive additional academic support. These numbers are pretty common among kindergarten classes at Wilbur, and I anticipate a similar class makeup in future years.

Rationale

Being a kindergarten teacher is wonderful. Five-year olds arrive to school with tears in their eyes because mom isn't in the next room over, but those tears fade and their inquisitiveness takes over. Kindergarten students love school, they love to learn, they are curious about everything, and they lose their minds over

superheroes. Superheroes equal engagement. Highly engaging content comes with a massive boost in the relevance of a lesson. When students find themselves connected and caring about a lesson, the learning of the material comes easier. Engaged students are less likely to lose focus, or have a behavioral issue during learning. And I believe, engagement also aids in the retention of new information.

Much like two and three-year olds, kindergarteners love the word 'why'. Their inquisitiveness and curiosity drives them to notice things and wonder about those observations. They should absolutely love science class, however science classes can be very hit-or-miss ¾ not because of the students but because of its presentation. Sadly, in elementary schools around the country, reading is king, mathematics is the queen, and science and social studies are probably like dukes or barons or worse. They really do not measure up, and you rarely hear about them. Science gets taught for about 30 minutes a day in my school. But that does not happen everyday because that precious half hour also houses social studies too. Science education also suffers because the content feels very disconnected. I start the year teaching about trees and plants. I teach about the types of trees, their structures and the functions of those structures, and their basic needs. We also explore how trees change throughout the seasons. At some point in the fall, the trees take a back seat and our focus shifts to the weather. We learn about different types of weather and we track our local weather throughout the school week. We also touch on the Sun a bit as we explore patterns in our weather daily and throughout the seasons with regards to temperature. At some point in the winter (when weather has great potential to be exciting in Delaware) we put weather on the shelf next to our tree unit and begin to study force and motion. Our units are very disjointed. So the question is, how do I increase the level of excitement for science class? How do I make it relevant to my students? How do I keep the kids engaged and excited for our science lessons? This sounds like a job for… a certain Superhero that my students love and have faith in. Not the one with the reindeer, the one with the cape.

Essential Questions

How did Superman get his powers (energy)?

How do plants, animals, and people get energy from the Sun?

How does the Sun affect weather?

Who were the 'Supermen' before Superman? In other words, what are some other myths concerning the Sun?

Unit Content

The Origin of Superman

"On November 5, 1939, a new hero flew onto the pages of Sunday newspapers across the country."[2] Superman was the brainchild of two young comic creators Jerry Siegel and Joe Shuster. Seigel and Shuster were inspired by the detective stories found in comic books or on the funny pages of their youth. They

developed a hero with powers greater than the average man. A hero who was able to outrace a locomotive, and leap a tall building in a single bound. They decided that their hero would be an immigrant, but instead of traveling across an ocean, he would cross the stars. Superman became the first superhero. Although he began in comic strips, he has since been featured in radio serials, television, movies, video games, and a wide variety of merchandise. Superman is also likely responsible for the ruining of many red towels and sheets that became capes for children wishing to fly! He is as recognizable a character as Mickey Mouse and known throughout the world.

So, what is the story? Kal El was an infant born on the planet of Krypton. Krypton was a dying planet revolving around a red star on the other side of the universe. In an effort to save their infant child, Jor El and Lara El loaded Kal into a rocket and launched him into space before the destruction of Krypton. Kal's rocket reached Earth and landed in a corn field near Smallville, Kansas. Kal was found by Jonathan and Martha Kent, who named him Clark. They went on to raise Clark as their own. It wasn't long before Clark developed strange powers, far superior to ordinary men. Initially, Clark's powers included great speed and strength, as well as an ability to withstand great forces from clubs, bullets, even cars. Through the years Clark's powers have grown in the comics. He can now fly, including through space without a protective suit, he can also fire lasers from his eyes and also see into the X-ray spectrum. Clark grew up and moved to the city of Metropolis where he took a job as a reporter for the Daily Planet newspaper. However, when a crisis arose, Clark would don a blue and red suit emblazoned with a stylized 'S' shield on the chest and a red cape. He would become Superman and save the day, and he has been saving the day for more than 80 years.

According to the comics, Clark Kent has super powers because of the stars. Given a clear night without clouds and minimal light pollution, about 3,000 stars can be viewed in the night sky. But beyond the stars that we can see with our naked eyes, there are billions of other stars throughout the universe.[3] There are actually billions and billions of stars and these stars come in a range of sizes and colors. The specific star that powers up Superman is our Sun.

Superman's great powers are attributed to Earth's yellow Sun. As much as Superman is fictional, there is some basis of science to the story. Krypton journeyed around a red star. A red star is less hot than a yellow star (of which our Sun is one). Betelgeuse is a red star. The approximate temperature of Betelgeuse is 3000 Kelvin (K). Kelvin is a temperature scale similar to Fahrenheit or Celsius, but Kelvin is an absolute temperature scale used for scientific calculations. 0 Kelvin is -273 Celsius, but otherwise 1 Kelvin is 1 Celsius. Kelvin can be converted to Celsius by adding 273. Our Sun, has an approximate temperature of 6000K. It is interesting that Seigel and Shuster made their character much more powerful as a result of traveling from a home world with a relatively cool star to a new home on a planet revolving around a star that burns about twice as hot. Just imagine how powerful Kal El could have been had his rocket landed on a planet near a blue star. Blue stars (like the star Spica) have an approximate temperature of 25,000K.[4] That would have made him a Super-Duper Man. Red stars are the coolest burning stars. After the red, come the orange stars, the yellow stars (like our Sun), the white, and finally the blue stars which burn the hottest.

Our Sun not only makes it possible for Superman to fly, but it also makes life possible on Earth. The Sun is a middle-aged, low-mass star, that is made primarily of hydrogen and helium. Thankfully, it is a stable star. The Sun is about 4.6 billion years old. Typically, stars similar to our Sun last between 9 and 10 billion years. As important as the Sun is to us, and Superman, it is not the biggest star. It has a diameter of 860,000 miles, that's 109 times larger than that of the Earth.[5] To give some sense of the scale of those figures; if the Sun were represented by a basketball, the Earth would be the size of a single grain of sand.[6] When compared to the Earth, the Sun is very large. However, compared to some red supergiant stars, the Sun comes off as much

smaller. For example, if a red supergiant star were represented by a tennis ball, then the Sun would be a little smaller than a ping pong ball. Yet when we gaze into the night sky all the stars appear as tiny twinkling lights, even the red supergiants. During the day, our Sun dominates the sky. It is very large to our eyes. That is a matter of distance. Our Sun is 93 million miles from Earth. The next closest star to us is called Proxima Centauri which is approximately 25 trillion miles away. Even though many stars in the sky are much larger, and many stars in the sky are much brighter than our Sun, for us it outshines them all because it is so much closer. The distance between Earth and the Sun is fortuitous ¾ it is in the "Goldilocks zone". In kindergarten terms, the three bears would have said Venus is much too hot. Mars is much too cold. Earth is just right. Just right to support life as we know it.

The Sun Energizes Plants, Animals, and People too.

The fictional Superman is not alone in receiving energy from the Sun. Every living thing on Earth receives energy from our nearest star. All animals and people receive their energy from digesting food. Food chains typically start with plants. Herbivores eat plants. An example could be either grass or leaves. Carnivores feast on herbivores, or smaller carnivores. People typically eat both plants and animals. Plants do not eat food. They must make their own nutrients to get energy. Take a tree for example (which is convenient since we talk so much about them in kindergarten science), a tree's leaves collect sunlight. The tree then transforms this light energy into chemical energy. Basically, trees use carbon dioxide, water, and minerals to change the light energy into oxygen and energy-rich organic compounds that it can use to live and grow.[7] Without the Sun's light, plant life would die. Without plant life, herbivores would die. Without herbivores, carnivores would die. And without plants or animals to eat, humans and probably even Superman too, would also die. Without the Sun, there is no life on Earth.

In kindergarten science we explicitly teach about the needs of plants. We discuss the role of sunlight in the life and growth of trees. One of the core disciplinary ideas of the Next Generation Science Standards (NGSS) are that plants have needs and that one of those needs is light.

The Sun and the Weather

The Next Generation Science Standards (NGSS) mandates students to observe and describe noticeable patterns in the natural world. In kindergarten many of these observable patterns that students tend to notice on their own relate to weather and weather is related to the Sun.

The extreme heat of the Sun drives the weather systems on the planet Earth. The Sun's energy travels through space, 93 million miles, in about 8 minutes to reach our planet. Earth's atmosphere reflects about a third of that energy back to space. The other two thirds pass through the atmosphere and reach the planet's surface. Sunlight heats the ground, and the ground in turn warms the air at the surface. The atmosphere now traps most of this heat for the planet. This is called the "greenhouse effect". The Sun and the atmosphere combine to make the Earth habitable in the way that we know it. A little cooler and an ice age would ensue. That could cover much of the Northern Hemisphere in ice. A few degrees hotter and the polar ice caps could melt and flood many coastal lands. Big changes would occur with just a small change in temperature.[8]

Temperature

Robert Heinlein wrote in his novel *Time Enough for Love*, "Climate is what we expect, weather is what we get'. Climate and weather are strongly linked when considering a specific geographical region. As Heinlein says 'Climate is what we expect". I expect the summers in Delaware to be hot with temperatures between 80 and

90 degrees Fahrenheit.Thing cool off throughout the autumn, and come winter I would expect the temperature to be in the 30s or low 40s. In the spring the temperatures will begin to rise again until the summer heating resumes. Weather is not so easily predicted. Typical Delaware weather follows the trends of the climate, but on any given day we may not get what we expect. It is not uncommon to experience temperatures above or below what is expected on any particular day. When introducing the weather unit to the students one of the things I do is to connect the weather to the daily calendar activities that are part of the kindergarten routine. We record the temperature each morning and we can use this data to examine how the temperature changes over the course of the school year. By the time we reach the spring, we have data that has shown the fall of temperature from August to January, and shortly thereafter the daily temperatures begin climbing.

We also explore the pattern of temperature throughout single days. This is also fairly predictable but it is important to remember that predictable is not a certainty. Typically, in the early morning the temperatures start out low, those temperature rise with the Sun and generally continue to rise throughout the day and late afternoon. Toward the evening it could be expected that the temperatures drop as the Sun dips below the horizon. The actual numbers associated with the temperature vary due to the season but the general rise then fall trend can be expected every day due to the warming from sunlight. There are of course days in which this trend does not hold. If a low-pressure system moves through in the middle of the day the temperature can certainly drop much earlier than would be expected.

Temperature, whether over the course of the year or the course of a single day, is driven by sunlight traveling to us from 93 million miles away and the atmospheric conditions that it produces.

The Water Cycle

Along with recording temperature daily on our class calendar, the class also records the type of weather each day. The students will record the weather in picture form ¾ a Sun for a sunny day, a cloud for a cloudy day, raindrops for a rainy day, or snowflakes for a snowy day. This is a very simplistic way of considering the world, but is pretty typical, and is developmentally appropriate for 5 years olds. A danger of allowing this simplistic view of weather is that students could connect any non-Sunny weather to a lack of the Sun. For example, they could believe that the Sun is uninvolved in the weather when it’s a grey and rainy day. Of course, nothing could be further from the truth, and my job will be to dispel such misconceptions.

As the Sun warms the Earth, it also warms bodies of water. From the oceans to a puddle on the playground the Sun warms water. When the water warms sufficiently, it evaporates, turning from a liquid to water vapor, a gas. The water vapor rises into the sky until it cools sufficiently to condense into clouds. It then precipitates and falls back to the Earth again. Without the energy of the Sun there would be no rain. It is important for students to know that rain is not the absence of the Sun in the sky, rain is because of the Sun in the sky.

Day and Night

To a kindergartener, day and night are simple. Day is when the Sun is out, night is when it is not (though sometimes they willl say it is when the Moon is out). One of the most obviously natural patterns to observe is the ‘movement’ of the Sun across the sky from sunrise in the east to sunset in the west. The misconception here is that the Sun is moving around the Earth. Though it can appear that way, we know that is not the case. Day and night occur because of the Earth’s rotation. To connect the idea of Earth’s rotation to the content from our force and motion unit, we can say that the Earth spins like a top. If the Earth were represented as that top, looking down on it from above, the top would be spinning in a counterclockwise direction. It takes 24 hours for the Earth to complete one rotation, one day. The Sun does not move relative to the Earth, the Earth

moves relative to the Sun. As the Earth rotates, the Sun, although stationary, appears to rise in the east. It will appear to move across the sky and set in the west. During the Earth's rotation the part of the Earth that is facing the Sun is encountering day. Once that part of the Earth rotates away from the Sun it enters night. Another thing to point out to students is that the daytime sky is also full of stars, we just cannot see them because the Sun is so bright. One last suggestion for young students: as I previously mentioned, some students have the misconception that the night is when the Moon is out. I highly recommend pointing out the Moon to the kids at some point when it can be viewed during the day. There are many myths and legends that attempt to explain the day and night phenomena, a few of which will be shared later in this content section.

Seasons

Kindergarten students have some misconceptions about the seasons. When asked about why summer is hot and winter is cold, students will respond with ideas like the Sun is further away in the winter, or that the Sun is hotter in the summer. Both of these responses indicate that something about the Sun (its relative position to us, or its temperature) changes in a cyclical pattern. While the Sun does move and even have cycles that it progresses through, the seasons are caused by the movement of the Earth and the fact that the Earth is tilted. The Earth's axis is an imaginary line that runs through the planet connecting the North and South Poles. The planet rotates (day and night) on this axis. This axis, however, is not perfectly straight up and down. It is standing at a roughly 23.5-degree angle. The actual number of degrees of the tilt varies a bit ranging from 22.1 to 24.5 degrees.[9]

In addition to rotating, the Earth is also always revolving around the Sun. Imagine the Sun had a hula hoop around it and the Earth traveled around the hula hoop, one lap on the trip around the hula hoop is one revolution and it takes about 365 days or one year. Because the Earth's axis is tilted the northern and southern hemispheres do not receive the same amount of energy from the Sun from day to day. When the Northern Hemisphere is on the part of the revolution in which it is tilted toward the Sun, the Southern Hemisphere is tilted away from the Sun. During this time the Northern Hemisphere is experiencing summer and the Southern, the winter. Six months later when the Southern Hemisphere is tilted toward the Sun, we in the North will be experiencing our winter. This means that every January when I am bundling up to head to school, some teacher in the Southern Hemisphere is enjoying wearing shorts and drinking cool drinks since they are experiencing summertime. In other words, while we in Delaware may be shoveling snow from our white Christmas, in the Southern Hemisphere they may be sweating on the beach. It should also be explained to students that not every region has seasons like we do in Delaware. The closer a place is to the equator, the less likely that place is to have large variations in temperature due to the planet's tilt. This is because the equator is minimally affected by the Earth's tilt, while the Poles are more greatly affected by the tilt.

Before Superman was Superman (Solar Myths)

It should not be surprising that Seigel and Shuster tied their superhero to the Sun. The Sun has been central to myths dating back to the beginnings of cultures throughout the world. The story of Superman is just one in a long line of stories tied to the Sun. Solar mythology has attempted to explain many natural occurrences that are linked to the Sun. Everything from the seasons, to day and night, to the East to West path the Sun takes across the sky have been explained through storytelling. Similarly, many facets of nature that that are linked to the Sun through modern science have been explained in engaging, interesting, and ultimately false ways through myths as well. Children love stories. Solar mythology is an opportunity to piggyback on their love of Superman and expose them to tales passed from generation to generation in cultures from around the globe.

Persephone and Demeter (Greece)

Persephone was the daughter of Demeter, who was the Greek goddess of fertility and the harvest. Demeter caused the Earth to produce new growth throughout the year. Fruits and vegetables were plentiful year-round and the Earth was never barren. Then one day, Hades the god of the underworld captured Persephone, as she was picking flowers, and returned to the underworld with her. When Persephone failed to return home, Demeter began searching for her. Eventually she learned that Hades had taken her daughter to the underworld. Upon learning of that, she became very sad and allowed the world to wither away. Joy had left the land and in the absence of crops people began to die. Soon people began praying to Zeus (the king of the gods) to make things right. Zeus demanded that Hades return Persephone to Demeter. However, before she could leave the underworld, Hades tricked her into eating some pomegranate seeds. According to ancient law that bound even the gods, anyone who ate food in the underworld must remain there forever. As a compromise, Persephone would return to her mother for part of each year (spring and summer). The other half of the year (autumn and winter) she would return to the underworld and stay with Hades. While she was with Demeter, the Earth would be covered with plants and crops. During the half of the year that she was with Hades in the underworld. Demeter would miss her daughter and neglect her duties. The Earth would become barren and devoid of crops until Demeter had her daughter back.[10]

This myth was an attempt to explain the cycle of the seasons, particularly in regards to plant life. In the summer the Earth is rich with growth. In the fall (when Persephone returns to the underworld), the crops die and leaves fall. The Earth lays barren throughout the winter. Finally, in the spring (when Persephone returns to her mother) the Earth reawakens and new growth begins. Of course, in actuality, the tilt of the Earth toward or away from the Sun are the cause of the seasons.

Helios (Greece)

Helios, the sun god, rides his golden chariot drawn by horses across the sky. As he passes by overhead, he lights up the world, makes seeds grow, heats up the winter, and makes grapes delicious. Helios lives with his sisters Eos and Selene. He never gets to see his sisters though. Eos is the dawn and always travels across the sky ahead of his arrival. Selene is the Moon and leaves as soon as he arrives. Helios had a son with a mortal woman. She named him Phaethon. When Phaethon grew up he wanted to meet his father. Phaethon traveled to the eastern edge of the Earth. There he found the palace of Helios. Helios greeted his son and offered him whatever he wanted. Phaethon expressed his desire to drive the chariot across the sky. Helios told him that he would not have the strength to tame the horses. Helios explained that during his flight he would have to do battle with the monsters of the sky; the great bull, the scorpion, and the bear. Phaethon would not be deterred and eventually Helios agreed to let him take the chariot. The next morning, Phaethon took the reins and drove the horses into the sky. When he was attacked by the monsters of the sky the horses would not be controlled they soared into the sky tearing the night. Then they bolted downward where they brushed the northern parts of Africa, turning the land into a vast desert. During the turmoil Phaethon fell from the chariot and died. Helios was struck by grief and since that day no one but Helios himself rides the chariot bringing light to the world.[11]

There is a lot to unpack in this myth. Helios' chariot represents the Sun. At a most basic level, the myth addresses the reason there is day and night. Though, unlike many myths, it also incorporates sunrise and the Moon in the characters of Eos and Selene. Specifically, mentioned in the story was the idea that the Sun provides light and heat. It also refers to the fact that the Sun is responsible for plant growth. Helios mentions the monsters of the sky. These monsters directly relate to the constellations. The great bull is Taurus, the scorpion in the sky is Scorpius, and the bear is Ursa Major. If the students are interested in the constellations

there are many more opportunities for storytelling to be found. The tear in the sky left by the chariot refers to the Milky Way. It is also interesting that the chariot brushing Africa was used as an explanation for the Sahara Desert.

Ra the Sun God (Egypt)

Ra, the Egyptian Sun god lived in a palace to the east of the sky. Every morning Ra would board his solar barque (a kind of boat), and set off to the west. This would bring about sunrise. Ra would ride his barque through the sky providing light and warmth for those on the Earth below. He traveled through all 12 hours of the day. At the end of his journey, Ra dies. His death brings about sunset, darkness, and night. In his dead form, Ra travels through the underworld back to the east when he comes upon Apep, the snake demon. Ra and Apep do battle in the underworld, and Ra defeats his foe. After vanquishing the demon, Ra returns to life in the East, brings about daybreak, and begins his journey by barque across the sky again.[12]

Ra is the Sun god and his daily trip across the sky represents the Sun's apparent movement across the sky from east to west. The myth also reinforces the idea that the Sun provide light and warmth to the world. His trip begins at daybreak and concludes at sunset. Ra's journey through the underworld in the myth explains his return to the eastern sky for the following morning.

Why Do Trees Lose their Leaves? (North America, Cherokee)

This happened long ago in the days when the animals, birds, and plants would speak together. Every year, the birds flew south for the winter to keep warm throughout the long cold winter days. One year Sparrow injured his wing and was unable to make the long journey south. As winter began to take hold and the cold moved in Sparrow approached Oak Tree and asked to take shelter from the cold in his branches. Oak Tree was old and crusty and told Sparrow to find somewhere else because he did not wish to spend his time with the bird. Sparrow left and went looking for shelter for the winter. He approached Maple Tree and asked to take shelter from the cold in his branches. Maple Tree, though a sweet tree, did not like the idea of having company for the winter and he sent Sparrow on his way. Sparrow continued asking every tree he met for help but he was always told 'no' and sent on his way. Sparrow now very cold would not give up and he continued looking for shelter. He approached Pine Tree (the last tree left) and asked to take shelter from the cold in his branches. Pine Tree was an unpopular tree as his leave were pointy needles instead of beautiful full leaves. Pine Tree said that he did not have beautiful leaves only little needles, but that Sparrow was welcome to stay in his branches throughout the winter. Sparrow and Pine Tree did spend the winter together and Sparrow healed enough to meet the other birds when they returned from the south. The Creator heard about Sparrow and Pine Tree and called a meeting of the council of trees. The Creator chastised the trees. You have all been given so much, yet you could not help Sparrow in his time of need. From now on when the winter winds blow all of your leaves will wither, die, and blow away. Creator then turned to Pine Tree and told him that he alone, who had so little to give, honored him by giving shelter to Sparrow. The Creator decided that Pine Tree alone would not lose his leaves in the winter. To this day, pine trees are the only trees that remain ever green throughout all of the seasons.[13]

In the Northern Hemisphere, trees lose their leaves in preparation for the cold temperatures of winter. The winter season is due to the lessening of the intensity of sunlight when the Earth's tilt points the Northern Hemisphere away from the Sun. Students typically know that trees lose their leaves in the winter. They probably have no idea that leaf loss is actual related to the Sun and the seasons.

The Rainbow Snake (Australia, Aboriginal)

The aborigines are indigenous peoples that inhabit parts of Australia. In Aboriginal mythology, rainbows are gigantic, malevolent serpents that inhabit the sky or the ground. During the dry season the rainbow serpent retreats to deep waterholes. Some tribes believe the rainbow snake sucks up all the water during the dry seasons. This causes drought. When the dry season comes to a close the rainbow snake takes to the sky and spits all of the water it had consumed out across the lands. This bring about the rain and the wet season in Australia.

Rainbows in nature connect to sunlight. The light is refracted as it passes through water droplets in the air. The refraction produces the multi-colored rainbow. The rainbow snake explains the dry and wet seasons in Australia. They also explain where drought and rains come from. In actuality drought and rains both connect to the Sun through evaporation and the rest of the water cycle.

Teaching Strategies

KWL Chart

A KWL chart is a way to organize information about a particular subject. The ‘K’ stands for 'know', as in ‘what do we already know’. My class will be completing KWL charts frequently throughout the unit. Students will share the ideas that they already have in place about these topics. Upon the completion of the ‘K’ we will dive into the “W’ portion of this graphic organizer. ‘W’ stands for ‘what do we wonder about, or want to know’, about the topic. This portion of our chart will be filled with questions the students may have regarding our areas of study. These two parts of the chart are completed prior to any class readings or discussions about the topic. This is a useful way to begin the lesson as it provides me with an idea of my students’ exposure to the topic. The KWL chart also allows any misconceptions about the topics to rise to the surface. This is certainly useful as it affords me the opportunity to address incorrect ideas prior to them impeding the learning of my students. The final portion of the chart, ‘L’ is all about ‘what did we learn’. Completed after the readings and discussions, it is a nice way to summarize our learning and to highlight any information that I feel is especially important. These completed charts will be posted in the room for the duration of the unit. It will be a useful touchstone for where we started and where we are in our learning at the end of the lesson.

Non-Fiction Text

There is a push in education to have students interacting with more non-fiction text. As my students move from kindergarten into the high-stakes testing grades they will encounter more and more informational writing on a variety of subjects. I feel that I am performing an important service for the third grade and up teachers in my school by giving my students a wealth of experience with non-fiction texts. Reading non-fiction requires different skills than enjoying a story. Students will be utilizing skills like finding a main idea and supporting details. Identifying the author’s point of view and purpose, and using graphics like charts and maps to gather information. A non-fiction text teaches facts and is a way to activate a student’s brain into high-level thinking.

Vocabulary Acquisition

Vocabulary is a massively important piece of comprehension. At the kindergarten level, I have found it most

effective to use images, whenever possible, in the presentation of new words. For this unit, as I introduce new terms, I will find pictures that highlight the concept. I will then have my students talk and discuss what all of my pictures have that is the same. Through these commonalities we will derive a working definition for each new word. By teaching vocabulary in this manner, my students will develop a mental image of the word. They can then supplement this mental image with our 'homegrown' definition. This combination of the visual with the linguistic is more likely to be remembered than a dictionary definition that was delivered to the students.

Cooperative Learning

In kindergarten especially, it is extremely important to practice cooperative learning in class. My students need many opportunities to practice critical skills that are a prerequisite of teamwork. Being a good listener takes practice and repetition. Simple skills like facing the speaker, making eye contact, and being quiet when listening, are not a given for kindergarten students. Many activities such as playing a game, also require students to take turns and share materials. Again, it cannot be taken for granted that these skills are locked in with five- or six-year-old students. My students will be involved in a variety of activities in which they will share ideas with one or more partners. Sharing ideas builds their proficiency at both listening and speaking.

Draw and Tell

Draw and tell is an app that my students use on our class iPads. This app is very aptly named. My students can either draw a picture on the device or they can create their art on paper and import a photo of their work into the program. Once the art is complete, the students can add text or special effects to their image. The students can also tell their ideas to the iPad recording their voices to accompany their artwork. In the Common Core State Standards (CCSS), kindergarten writing is defined as a combination of actual writing, dictation, and drawing. A voice recording of a story is a form of writing as defined by the CCSS. This is beneficial to me on a few levels. The first benefit of this strategy is that it allows the students to record their ideas. Since many of their writing skills are fairly rudimentary, the students are more comfortable and willing to express themselves orally. Secondly, voice recordings like this make it easier on the teacher. I can review the students' effort on the iPads whenever I have time available, instead of sitting with each child during instructional time to aid them in the dictation of their ideas.

Notice and Wonder

Notice and wonder is a very useful strategy. It is particularly useful in conjunction with an anchoring phenomenon. Students make observations about an event or object and then share out what they notice. This is a valuable activity because it can often highlight misconceptions about a topic. In addition to sharing what they notice, students are also invited to share anything that they may be wondering about the phenomena or the focus of the observation. I will most always record student notices and wonders to be revisited later in the activity or unit.

Classroom Activities

Right from the start, every lesson that I teach about the Sun will be paired with the warning; 'Don't look right at the Sun'. While I intend to excite my students in learning about the Sun, I absolutely don't want them to hurt their eyes. I would recommend this advice be shared by any teacher discussing the Sun with small

children.

The Stars, The Sun, and Superman

I will introduce the unit by asking the students to tell me what they know about Superman. I will record their ideas on chart paper. I would anticipate that they will mostly report his powers. After activating their prior knowledge in this way, I will share with them a picture book that reveals Superman's origin story. I will be using *The Big Book of Superpowers* by Morris Katz as this book specifically mentions that Superman was born on a planet orbiting a red star and gained his powers when he was sent to Earth with its yellow star, our Sun. Following the read aloud, I will revisit what the students know about Superman and add any new information to our chart from before. If the students do not mention the Sun or the stars, I will ask them guiding questions to help them get there. This may be a good point to close the activity for the day, possibly by having the students draw the hero. The following day, I will introduce the students to a notice and wonder challenge. I will display a picture of stars for them. I would recommend googling the term 'field of stars' and selecting an image of many stars of differing colors and sizes, these images are readily available. I will then give the class a moment to study the image prior to asking them to share the things that they have noticed, as well as any questions they have that the picture brought to mind. A carefully chosen image should have students identifying stars of different colors. I would expect to hear about stars of blue, white, yellow, orange, and red. If the students should neglect to share one of these colors I would direct them to a star of that color in the image and guide them to including that color as well. I would also anticipate someone mentioning that some stars look large and other small. At this point, I will ask the students what star looks the biggest to us. They may point out the largest appearing star in the image. At that time I will put up a picture of the Sun and let the students know that the Sun is a star. I will then invite students to explain why our Sun looks so big. Is it the biggest star in the whole universe? This will lead to a discussion about how far stars are from the Earth, and the revelation that the Sun, is really just a medium-sized star but that it looks so big because it is by far the closest star to our home. This may be another good place to stop for the day. I may do so by having the students draw and label their very favorite star. I will follow up our lesson on the Sun being a star by reading *Sun! One in a Billion* by Stacy McAnulty. This book does a good job providing information about stars in general and specifically the Sun. Our final part of this activity will be to discuss the colors of the stars. Stars are different colors because they burn at different temperatures. Blue stars burn the hottest at around twenty-five thousand Kelvin, followed white stars which do not burn quite so hotly. The Sun and other yellow stars burn at around six thousand kelvin. Orange stars are next followed by red stars which are the least hot stars at three thousand kelvin. Even though they are the coolest of stars, red stars are still plenty hot. Rocks will melt between six hundred and thirteen hundred kelvin. We will then circle back to the 'Man of Steel' and discuss how his home star was a red star and our Sun is a yellow star. This means that our Sun is about twice as hot as the star that Krypton once orbited. Hence, superpowers! For our last bit of the activity, I will hold up some pictures of their favorite stars from the prior lesson. Many students will draw the Sun as a circle with straight lines emanating away from it, some may have drawn the 5-point star shape (though this is traditionally a real tough draw for K students). I will let them know that like the Sun, all stars are actually shaped like spheres, though when we draw spheres they look like circles. I will have the students draw 5 stars on a paper and have them color them orange, white, red, yellow, and blue. Once done I will ask the students to write the number 1 next to the hottest star on their page, the number 2 on the next hottest and so on. This will allow me to determine if they have retained our knowledge from the lesson.

The Sun Superpowers Our Weather

The Sun is already linked to weather in the minds of my students, but only in so far as to say that some days

are sunny and that the Sun is hot. My students have no concept that the Sun is not just one part of the weather. It is the driving force of all our weather.

Day and Night

One noticeable pattern that we observe is the changes in temperature throughout the day. Student can be guided to recognizing that the temperature generally starts lower in the morning, rises through the afternoon, and drops again throughout the evening and the night. In the past students have expressed to me that the Sun makes things hot when it is in the sky and that things are cooler when the Sun isn't out. To begin this learning experience, I will ask the students why we have day and night. I will then have them collaborate with peers (in groups of 3 or 4) to share their ideas for an answer to the question. These teams will then be challenged to select one of their ideas to share with the class. I will record these ideas on chart paper without confirming or denying any of their theories. The class will then vote on which of these ideas we would like to use as our official class theory. I will offer that there are ancient stories that explain why we have day and night. I will let the class know that they will be hearing a story about day and night that comes from ancient Egypt. I will then share with the class the myth of Ra, the Sun god. Following the story, I will ask the students if they prefer our class idea about day and night or if they think that Ra explains the phenomena more accurately. This would likely, be where I stop for the day given my typical daily schedule at school. The following day we will talk about what we notice about the Sun. Focal points would be that it is always outside our classroom (our class windows face the East) for morning classes, but that by lunchtime, the Sun cannot be seen through our window. When we go to recess the Sun is mostly always high in the sky. We will also mention that when we go to the buses to go home, the Sun is always on the other side of the school building away from our classroom window. I will express that I does seem like the Sun moves across the sky, just like Ra in his barque. I will then let them know it is time to learn what really makes day and night. I will read *On Earth* by Brian Karas. Though any book that explains the rotation of the planet as the cause of day and night will do. To drive home the point about the Sun remaining (relative to Earth) still, I will lead the students in a demonstration which models day and night because the Earth rotates. For the demonstration I will place a standing lamp without a shade in the center of our carpet. I will be using an incandescent bulb in the lamp as the shape of the bulb will appear somewhat spherical. The glowing bulb will represent the Sun. I will have each student stand around the edges of the carpet so that they can see our makeshift 'Sun'. I will have each student point their nose at the 'Sun' and explain to them that their head will represent the Earth. Our school will be on the tip of their nose. I will ask them to try and keep their eyes looking straight ahead and to raise their hand if they can see the 'Sun' (every student should have a hand up). I will ask the students to put their hand down when they cannot see the 'Sun' and to raise it again when the 'Sun' reappears. I will then have them turn slowly, very slowly, to their left (I recommend modeling this for the class). As there heads begin to face away from the bulb, they should lower their hands. As they spin back toward the lamp hands should be raised again. After a few rotations, I will provide challenges to drive home my focal points. Challenges will be along the lines of: stop spinning while your nose is in nighttime, stop rotating when your nose is at sunset, and sunrise. This modeling exercise should help the kids understand how day and night work. I will then connect it to the Sun heating us during the day and things cooling down when we are not facing the Sun. If time permits, Greek myth of Helios could be shared during this lesson. There is an opportunity to compare and contrast the Helios and Ra myths that would allow for some cross-curricular learning.

Seasons

Similar to how we traditionally explore temperature changes throughout individual days, we also work to understand the overall weather patterns that accompany the changing seasons in Delaware. Also similarly to

day and night, we do not really explore why we have seasons and the role that the Sun (or Earth's tilt in relation to the Sun) plays in our seasonal changes. I will start this lesson with an anchoring phenomena. I will be sharing a video of the seasons passing, through the use of time-lapsed photography. Videos of this sort are readily available by searching on YouTube. Following the video I will execute a quick notice and wonder related to the video. After recording their thoughts, I will place the students into groups of 3 or 4 and have them develop an explanation for why we have seasons. Much as in the day and night lesson, I will record each group's idea and have the students vote for which explanation they would like to use for our official classroom theory. Following that I will share a mythological explanation of seasons. Our season myth will originate in Greece; the tale of Demeter and Persephone. Much like before, I will ask the students if our class theory or the Greek myth seems more accurate. At this point we will wrap things up for the day. I will start the following day talking about the Sun and the Earth. I will remind the class that the Earth's rotation causes day and night and hint that the Sun causes the seasons too. I will then introduce the book *Seasons of the Year* by Margaret Hall. This book does a good job of not only describing the attributes of each season, it also explains how the tilt of the Earth causes the seasons to occur as it revolves around the Sun. I will then model the revolution of the Earth around the Sun, including the tilt so that the students can see that att different times of year, the Northern Hemisphere receives different amounts of sunlight. In the summer it receives a longer amount of daytime and more direct sunlight and in the winter, it receives less daytime and direct sunlight. I will also connect this to our experiences during the school year. Sometimes the Sun is going down shortly after we get home, other times it doesn't get dark until much later. Sometimes the sunrise is while we are getting ready for school and sometimes sunrise is much earlier than getting ready for school time. The Sun and the seasons also relate to plants which will I will teach during our unit on trees.

The Water Cycle

Kindergarten students do not connect the Sun to the rain. They see a day as sunny or rainy and when it is rainy the Sun is not around (in their heads). This activity will begin with an experiment. We will take two pie pans outside of the school. One of the pans will be placed on the side of the bus court in full sunshine. The other pie pan will be placed on the north side of the school building, a spot that has a bit of shade all day long. Into each of those pans I will pour the contents of 1 water bottle (12 ounces). The water bottles will be labeled 'bus court' and 'against the building'. Prior to pouring the bottles, I will show the students that they both hold the same amount of water. In the afternoon, we will return to the pie pans. I will pour each into the labeled bottle that originally held the water. Using disposable tin pans will allow me to easily bend them to make this pour a simple matter. We will then return to the classroom and examine our findings. Given enough time, the bottles should now have different amounts of water. It will then be time for the students to team up and explain why. I will handle this process just as I would have done in prior activities. I would anticipate that some students would relate the difference to one pan being in the Sun and the other the shade. I will offer them an alternative explanation from mythology. This myth is called *The Rainbow Snake* and it was spawned by the Aboriginal culture of Australia. Following the sharing of the myth, I will ask kids if they think their explanation or *The Rainbox Snake* offers a better explanation. I will then read aloud the book *Weather Wise: Rain* by Helen Cox Cannons. This is a very simple book mostly about the different types of rain from a drizzle to a downpour. Despite this, in kid friendly language the book does an excellent job of explaining the role of the Sun in the water cycle, which will relate to our findings in our experiment. I will have a small formative assessment for the students as this lesson closes. The students will draw a picture of a rainy day. When they turn it in they will be asked to verbally explain how the Sun connects to rain.

The Sun Supercharges Plants, Animals, and People Too

In our study of trees we discuss the needs of plants that allow them to live and grow. After our study the students are able to report that one of the things that plants need is the Sun. Kindergarten does not really do much with the process of photosynthesis, though I like to introduce the term because young students love 'big-sounding' vocabulary. They develop an understanding that the leaves collect sunlight and can use the light as energy to stay alive and grow. They also know or come to know that trees lose their leaves in the fall and do not grow new ones until the springtime. These two ideas aren't specifically linked in our current curriculum. Following the activity on seasons, I would like to challenge my students to determine why trees lose their leaves in the fall. I will give them the hint to think about what we've learned about the seasons. Once again students will collaborate to develop a theory, share their theory with the class, and elect an official classroom theory on the subject. And, once again I will provide another explanation found in mythology. This time the myth is of the North American Indigenous people; the Cherokee. I will share with the class the myth of *Why Trees Lose their Leaves.* Students can then decide which explanation about the falling leaves seems more reasonable; our class theory or the Cherokee myth. I will then read aloud the book *I Am the Sun* by Rebecca McDonald. This book does a nice job of explaining what the Sun provides to plants, and even extends that point to the animals and people that get their energy from eating the plants. In this way it is clear that not only Superman is powered by the Sun. This is another spot in the unit that could host the telling of the Helios myth as that myth refers to the Sun as making the plants grow.

Culminating Activity

As a way of wrapping up our study of the Sun I will assign the students a language arts assignment. I will ask them to chose one of the myths related to the Sun that we explored. Students will use the Draw and Tell app for our class iPads (though this assignments could easily be done using any number of apps or programs, or even paper and pencils) to create an illustration that goes with one of the myths. Then record their voice in the app to retell the myth in their words. I would then challenge them to add a second page to their project with a picture of the Sun, and the actual science behind the phenomena addressed by the myth.

Resources

Davey, Lizzie, and Andrew K. Johnston. *The Planets: The Definitive Visual Guide to Our Solar System*. NY, NY: DK Publishing, 2014.

Emmons, Scott, and Nikolas Ilic. *The Amazing Planet Earth (StoryBots)*. New York: Random House Childrens Books.

Fun picture book (kids love the Storybots) that presents information about the Earth and its relationships with the Sun and the Moon.

Fraknoi, Andrew, David Morrison, and Sidney C. Wolff. *Astronomy*. OpenStax, 2018.

Textbook the offers a great depth of understanding of the science of the Sun.

Garry Ancheta .f67943c9-aee5-4b4c-9cf0-7bd937c850f4{fill:#82b964;} Fact Checked by Jamie Frater, Garry

Ancheta, and Garry Ancheta. "10 Mythological Origins Of Day And Night." Listverse. June 21, 2014. Accessed July 12, 2021. https://listverse.com/2013/12/20/10-mythological-origins-of-day-and-night/.

Listing of myths about Day and Night from cultures around the world.

Gibbons, Gail. *Weather Words and What They Mean*. New York: Holiday House, 2019.

Useful book that presents weather vocabulary and images to aid students.

Hall, Margaret. *Seasons of the Year*. Mankato, MN: Capstone Press, 2007.

Good book that presents information about the seasons including the cause of seasons being Earth's tilt.

Hall, Matthew. *The Imagination of Plants: A Book of Botanical Mythology*. Albany: State University of New York Press, 2019.

Many interesting myths related to plants. Could be a good resource when teaching the trees and plants content.

Hughes, Catherine D., and David A. Aguilar. *First Big Book of Space*. Washington, D.C.: National Geographic, 2012.

Child friendly resource with information about the Sun. Goes into detail and suggests student connections to Earth's movements in relation to the Sun.

Karas, G. Brian. *On Earth*. New York: Puffin Books, 2008.

Another good picture book. Illustrates Earth's movement through space as well and natural patterns caused by Earth's movements in relation to the Sun.

Katz, Morris. *The Big Book of Superpowers*. Downtown Bookworks, 2016.

Origin stories of DC superheroes, including Superman.

Koenig, Viviane, Veronique Ageorges, and Daniel Hénon. *A Family Treasury of Myths from around the World*. New York: Harry N. Abrams, 1998.

This book includes some solar myths and beautiful artwork that is appropriate for children.

Kovach, Catherine. "5 Myths About Changing Seasons To Celebrate The End Of Winter." Bustle. March 15, 2016. Accessed July 12, 2021. https://www.bustle.com/articles/144199-5-myths-about-changing-seasons-to-celebrate-the-end-of-winter.

Multicultural myths about why we have seasons.

May, Brian, Patrick Moore, and Chris Lintott. *Exploring the Mysteries of the Universe*. New York: Rosen Publishing, 2017.

McAnulty, Stacy, and Stevie Lewis. *Sun!: One in a Billion*. New York: Henry Holt and Company, 2018.

An excellent picture book that will engage primary students while presenting information about the Sun.

McDonald, Rebecca, and James McDonald. *I Am the Sun*. Salem, OR: House of Lore, 2019.

Excellent book to provide easily understandable information on the Sun for primary grade students.

Morris, Neil. *Amazing Sun*. Columbus, OH: School Specialty Publ., 2007.

Full of good child friendly visuals and information about the Sun including its connections to weather and plants.

Pasachoff, Jay M. *The Complete Idiots Guide to the Sun*. Indianapolis, IN: Alpha, 2003.

Overview of the Sun in a way that is easily understandable.

PurePoint Energy. "Solar Mythology from Cultures Around the World." PurePoint Energy. May 25, 2016. Accessed July 08, 2021. https://www.purepointenergy.com/blog/2016/may/solar-mythology-from-cultures-around-the-world/.

A listing of myths related to the Sun from around the world.

"Rainbow Serpent: Myths and Folklore Wiki." Fandom. Accessed July 18, 2021. https://mythus.fandom.com/wiki/Rainbow_Serpent.

Myth of the Rainbows Serpent/Snake from Aboriginal mythology in Australia.

Simon, Seymour. *Weather*. New York: Collins, 2018.

Good resource for information about weather. Includes information on Earth's rotation and the Sun.

"Sky Tellers - The Myths, the Magic, and the Mysteries of the Universe." Lunar and Planetary Institute (LPI). https://www.lpi.usra.edu/education/skytellers/.

A good resource for basic information about among other things the Sun ad Earth. Information is presented in a way that young students could understand.

"Stanford Solar Center." Stanford Solar Center. http://solar-center.stanford.edu/folklore/Solar-Folklore.pdf.

Stille, Darlene R., and Sheree Boyd. *Motion: Push and Pull, Fast and Slow*. Minneapolis: Picture Window Books, 2004.

Good resource for force and motion. Covers gravity and Earth's movements through space.

Vale, Ronald D. "The Value of Asking Questions." Molecular Biology of the Cell. March 2013. Accessed June 24, 2021. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3596240/.

Thoughts about the importance of inquiry based learning.

"Why the Trees Lose Their Leaves." NORTHERN CHEROKEE NATION. Accessed July 18, 2021. http://www.northerncherokeenation.com/why-the-trees-lose-their-leaves.html.

The myth of Sparrow and Pine Tree. Why Trees Lose their Leaves.

YouTube. August 23, 2009. https://youtu.be/fKTu6B4Rgek.

This is a video that starts with our relatively small moon and shows the progression in size of object through our solar system and beyond.

YouTube. August 01, 2016. Accessed July 17, 2021. https://youtu.be/GoW8Tf7hTGA.

Video showing celestial bodies ranging in size from our Moon to a red supergiant star, UY Scuti.

Appendix on Implementing District Standards

K-ESS2-1. Use and share observations of local weather conditions to describe patterns over time.

This standard will be addressed during our activities related to day and night as well as seasons.

K-ESS2.D. Weather is the combination of sunlight, wind, snow, or rain, and temperature in a particular region at a particular time.

This standard will be address in the activities related to weather found in the unit.

K-LS1-1. Use observations to describe patterns of what plants and animals (including humans) need to survive.

This standard will be addressed in the Supercharging Plants, Animals and People portion of the unit. Specifically it will connect how all life on Earth is dependent on the Sun.

K-PS3-1. Make observations to determine the effect of sunlight on Earth’s surface.

This standards will be addressed in the activities related to weather, most specifically when we are experimenting with the evaporation of water.

CCSS.ELA-Literacy.RL.K.2. With prompting and support, retell familiar stories, including key details.

This standard is addressed in the culminating activity.

Notes

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[1] Salkind, A. (Producer), & Donner, R. (Director). (1978) Superman [Motion Picture]. United States. Columbia Pictures

[2] Superman: Sunday Classics 1939-1943 p.ix

[3] Catherine D. Hughes, *First Big Book of Space,* 93.

[4] Andrew Fraknoi, *Astronomy*, 596.

[5] Baron's Educational Series. *Our Star: The Sun*

[6] Stacy McAnulty, *Sun! One in a Billion.*

[7] Britannica.com (accessed July 14, 2021)

[8] Seymour Simon, *Weather 6.*

[9] Earthobservatory.nasa.gov (accessed July 16, 2021)

[10] Stanford Solar Center (accessed July 13, 2021)

[11] Vivane Koenig, *A Family Treasury of Myths from Around the World.*

[12] Stanford Solar Center (accessed July 13, 2021)

[13] NorthernCherokeeNation.com (access July 18, 2021)