Weather/OR Not…Learning is Fun!

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This curriculum unit is recommended for:
Science, Elementary School, 5th Grade

Keywords: science, fifth grade, weather, lesson plans, weather, water cycle

Teaching Standards: See Appendix 1 for teaching standards addressed in this unit.

Synopsis:

During the Doing Science CTI Seminar, the cohort experienced many different working science labs at the University of North Carolina Charlotte. Based on what I learned during the lab visits, I learned more about the scientific process and how scientists work in the real world. It is my objective to take the new understanding back into the classroom to provide students with a more authentic science experience. The objective of this unit is to incorporate games, classroom visitors, and hands-on activities for students to learn the Weather concepts of 5th grade Essential Standards. Students will learn the Essential Standards of the Weather Unit. The end result will be 80% of the students mastering (80% or higher) the Weather Essential Standards on the Weather Common Assessment and End of Grade Science Test.

I plan to develop this unit during the coming year with 90 students in fifth grade science and implement the curriculum next year to approximately 90 students in fifth grade science.

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Tracie Dawn Cooper

Introduction

I was honored to be a part of the Charlotte Teacher Institute for the 2017 year. In the seminar, "Doing Science" with Dr. Susan Trammell, we were able to experience several research labs at the University of North Carolina Charlotte. As a group, we would debrief what we learned and how we could incorporate what we learned from the different experiences into our classrooms at the different levels. The theme seemed the same, even though it was shown in many different disciplines and in many different ways.

It was extremely interesting to experience the different labs. All of the labs were different, but they all were using the scientific method. They were making lots of mistakes to come up with a new way of doing things. The perseverance of the students in the labs is remarkable. The students were able to find new ways of doing things that had not been tried before. There are lots of trial and errors and many hours of dedication to come up with something new or a new way of doing things.

Background

I teach at Hidden Valley Elementary, which is in the Northeast Learning Community in the Charlotte Mecklenburg school district. As of November 20, 2017 Hidden Valley currently has 918 students in grades PreK – 5th. Forty-three percent are African American, 54% are Hispanic and 3% other. Forty-one percent of students receive English Language Learner (ELL) services and 16% of students receive Exceptional Children (EC) services. Hidden Valley employees 96 teachers. There are 12 languages spoken in the school. The school is 100% below the poverty rate where all students receive both free breakfast and lunch. Students mainly come from single parent homes or live with grandparents. In the fifth grade classroom there are approximately twenty-eight students per classroom. There are six fifth grade classrooms and the classes are broken into teams of three. Students are assigned three teachers; literacy, math, and science. Students receive ninety minutes of instruction daily in each of their block classes.

Rationale and Content Background

The purpose of this unit is to give students a hands-on learning experience to help them master the weather standards in a fun and exciting way. Ensuring students are engaged with the activities will help students understand the concepts instead of memorizing facts. Students should be able to accurately predict the weather when given weather data or collecting weather data. Students should be able to understand patterns in weather and how that relates to climate.

The water that is here on Earth today is the same water that was here when the dinosaurs roamed the Earth - yes we bathe in water that the dinosaurs bathed in. Water CANNOT be created. We destroy water with pollution and waste. Water is filtered/cleaned by the water cycle process. The water cycle process takes liquid water from the surface of the Earth to the atmosphere and back to the surface of the Earth. This is a cycle that NEVER ends. It has no beginning and no end. Water can be "stuck" in one of the steps for a VERY LONG time, or for a very short time. The sun is the energy source for the water cycle. Without the Sun, the water cycle does NOT happen. The sun heats the water on Earth by radiation. Energy carried by the sunlight is converted to the kinetic energy (energy of motion) of the water molecules. The water molecules heat up and spread out, causing them to turn into a gas called water vapor. This process is called evaporation. Water vapor is the gas form of liquid water. IT IS STILL WATER, the molecules have not changed, they have just spread apart. Water vapor can also come from green plants. Water that is released from plants into the atmosphere is called transpiration. The hotter it is the more transpiration and evaporation will occur. The amount of water vapor in the air is called humidity. As water vapor rises to larger heights in the atmosphere, the water vapor cools and starts to condense. Condensation is when the water vapor molecules turn from a gas into the liquid state of water. THE MOLECULES DO NOT CHANGE COMPOSITION, JUST THE STATE! Clouds form from the condensation. Once the clouds become saturated, full, precipitation can occur. Precipitation is the process that returns water back to the surface of the Earth from the atmosphere. Precipitation can occur in four main states: rain, sleet, snow, or hail. For the purpose of this unit and the standard it is not necessary for the students to understand how the different forms are created. It is important for students to understand that it must be below 32 °F for snow to reach the ground. Once precipitation reaches Earth it starts to seep into the ground. Water that seeps into the ground is called ground water. Once the ground has become saturated, or when it rains too fast for the water to percolate into the ground, water may flow over the land. Water that flows over land is called runoff. Water runs into rivers, lakes, streams, or the ocean. Puddles can be created. Puddles are pockets of water that are on top of the surface of the Earth.

Clouds are a form of condensation. The main clouds that the students must learn for the 5th grade Essential Standards are cirrus, cumulus/cumulonimbus, stratus/nimbostratus, and fog. Cirrus clouds are made of ice crystals and do not produce precipitation. They indicate that a change may be coming in the weather. Cumulus clouds look puffy/cotton-ball like. These clouds indicate fair weather and may change to cumulonimbus clouds later in the afternoon. Cumulonimbus clouds are tall with dark bottoms. These clouds produce quick, heavy rain showers, normally later in the day. Lightening, thunder, and hail are associated with cumulonimbus clouds, also known as thunderheads. Lower clouds are stratus clouds. Stratus clouds are blanket-like layers and are often gray in color. Nimbostratus clouds are stratus clouds that produce light, long-lasting rain showers. Low-lying stratus clouds are called fog. Clouds form near fronts, which we will learn about later in the lesson.

In order to accurately predict the weather, we must learn about the tools that meteorologists use. Rain Gauges measure the amount of rain that falls. This is measured in cm. Barometers measure air pressure. The lower the air pressure, the more chance of rain. Wind Vanes or Wind Socks show the direction the wind is coming FROM. Anemometers measure wind speed. The greater the difference in air pressure the greater the wind speed. Thermometers measure temperature; how hot or how cold something is. Meteorologists use this data to predict the

weather. Weather is the condition of the atmosphere at a given time and place. An average of the precipitation and temperature taken over a long period of time determines an area's climate. It is important that students understand the difference between climate and weather.

Air pressure is measured using a barometer. If the pressure is high, you can expect clear skies and dry weather. As the barometer "falls", low pressure, clouds may form and rain can be expected. The lower the pressure the more chance of rain you will have. If there are differences in air pressure, there will be wind. The greater the difference in air pressure, the greater the wind speed.

Air is moved in currents. As the Earth's surface warms the air rises. As the warm air rises into the atmosphere, it cools. This is what causes air circulation. Warm air rises and cold air sinks. At the beach there are sea breezes. The breezes cool the air on the beach. During the day, the wind comes in off of the sea cooling the land. This is called a sea breeze. During the night, wind blows from the land towards the sea. This is a land breeze. The change occurs due to land and water heating and cooling at different rates. During the day the land is warmer than the ocean and the air above the land will rise. This creates a region of lower pressure so the air flows into this region from the air over the ocean. The opposite occurs at night when the air over the ocean is warmer than the air over the land. Wind is named from the direction it is coming from. For example, a sea breeze is a breeze that comes from the ocean towards the land. A land breeze is a breeze that comes from the land towards the sea.

Wind currents drive our weather. The prevailing westerlies drive the weather in the United States. The prevailing westerlies drive the weather from the west towards the east. The jet stream is a current of air high in the atmosphere. The jet stream brings cool and dry weather from the north as it dips towards the south and brings warm, wet weather from the south as it rises towards the north. The jet stream causes boundaries between air masses. Air masses are large areas with similar temperatures and air pressure. The boundary caused by the jet stream is called a front. On one side of the front there is a warm air mass and on the other side there is a cold air mass. When the warm air mass is replacing the cold air mass you can expect wind at the front, as well as cumulonimbus clouds with possible thunderstorms, lightening, rain and hail. After the front passes, the weather will become warmer and more humid This is called a warm front. A cold front is when the cold air mass is replacing a warm air mass. As the front passes you can expect wind, as well as stratus clouds, which bring light, long-lasting rain showers. Once the cold front passes, the weather will become cooler and dryer. These are the only two fronts that are discussed in fifth grade.

Lines of latitude help determine the temperature of an area. The farther away from the equator you are, the cooler the temperatures will be. The closer to the equator you are, the warmer the temperatures will be. For advanced students you can discuss the effect of elevation. You can be on a mountain close to the equator and still have snow. Why does this happen?

Hurricanes: Hurricanes form over warm ocean water. As hurricanes come over land they began to die out. The reason hurricanes die out is due to the lack of warm ocean water. Hurricanes bring storm surge. Storm surge is when the level of the ocean water rises. A rush of ocean water comes onto land.

There are currents in the ocean that affect our weather. The Gulf Stream has an influence on the weather on the east coast of the United States. The Gulf Stream brings warm ocean water

from the Gulf of Mexico up the east coast. This causes the water in the ocean near the coast to warm. The warm water warms the air above it and blows onto the land. This causes a milder climate along the coast.

Vocabulary (See Appendix 2)

Water cycle, evaporation, condensation, precipitation, runoff, groundwater, transpiration, aquafer, saturation, peculation, condense, evaporate, heat energy, atmosphere, collection, Earth's surface, water vapor, clouds, cirrus, cumulus clouds, cumulonimbus clouds, stratus, nimbostratus, fog, nimbo/nimbus, rain gauge, thermometer, barometer, wind vane, wind sock, anemometer, humidity, hurricane, storm surge, gulf stream, latitude, equator, land breeze, sea breeze, wind, air pressure, low air pressure, high air pressure, warm air mass, cold air mass, jet stream, front, boundary, warm front, cold front, rain, sleet, snow, hail.

Instructional Implementation

Materials Needed: Guest Speaker List, Glass Aquarium, Food Coloring (Red/Blue), Access to Hot Water/Hot Plate, Beakers, Graduated Cylinders, United States Maps (Dry Erase if possible), Markers (Blue/Red), Colored Pencils (Various Colors), Cups (8 oz. cocktail/plastic), Thermometers, Pipe Cleaners, Beads (Yellow/Clear/Light Blue/White/Dark Blue/Brown/Orange/Green), Index Cards, rubber bands, plastic wrap, pipettes, ice/ice trays and freezer, microscope slides, clear bowls, celery, plant clippings (with the stem), packing tape, student computers, Quizlet, Kahoot, Science A-Z, Vocabulary A-Z, Edmodo, Study Jams, large glass jar match, candles, metal bars,

Timeline: 6 Week (90 minute classes, 5 days per week) Unit

1 week – Water Cycle (Lessons 1-4)

1 week – Water Cycle/Clouds (Lessons 5-10)

1 week – Weather Instruments (Lesson 11 – Multiple Days)

1 week – Weather Instruments/Data (Lesson 12-14)

2 weeks – Data/Weather Patterns (Lessons 15-16)

In order to determine my 5th graders' background knowledge prior to starting any of the units, I administer the 5th released version of the NC Science End of Grade test. I am able to break down the data to determine where the students are in each of the standards. Weather has been the standard that students seem to perform the lowest in both the released version that I administer at the beginning of the year, as well as all of the Common Assessments that I administer throughout the year. This is not only a school wide concern, but a district wide concern as well. Due to the way I choose to spiral my lessons it is more helpful for me to collect the data on the students in this way instead of giving the students pretest prior to each unit. This way also saves instructional time during the year. See Appendix 3 for the link to the assessment.

Prior to formally starting the unit I want to ensure that the students have some important background knowledge to help them understand the concepts in the weather unit. I spend two or

three days, depending on the students, reviewing the states of matter and how they can go from one to the other, how heat transfers, and the vocabulary that they were taught in second grade.

I start the Weather Unit with the Water Cycle. This was taught in second grade however, students rarely remember much about it. I open the first lesson with the Water Cycle Song. This is sung to She'll be Coming Around the Mountain. I change the last part to "it runs off". I teach my students hand motions, which help my EC and ELL students.

To give students a hands-on experience with the water cycle, I have the students make Water Cycle Boogie bracelets. I use different colored beads to put on the pipe cleaner. Each bead color represents a part of the water cycle. As we sing the song we add the process, colored bead, to the pipe cleaner. The pipe cleaner is what the beads go on and can be twisted on and off of their arms. Students enjoy wearing their bracelets and it helps remind them of the steps as well as some of the vocabulary.

A great demonstration to explain the water cycle to students is "A Pot of Water Cycle". I pose the question, "How does this demo relate to the water cycle?" This is a lesson that I Googled, but have added my own twist to it. I want my students writing about their learning and making connections to concreate examples. I bring the students around the "demo table". I use a large beaker instead of a pot so that the students can see the water circulating (convection). We discuss what the hot plate represents in the water cycle (the heat energy from the Sun). The beaker of water represents the ocean, or any collection area. I draw the experiment during this discussion to teach the students my expectations of journaling and labeling. I have a tin pie plate with a baggie of ice. As we discuss the water cycle and the different parts, the students start noticing the water droplets forming on the pie plate. I relate this to the cloud forming and how the water droplets have to have something to form on. This is typically dust, pollution, etc. in the atmosphere, but could be grass or the mirror in the bathroom or a soda can you pull from the fridge. The students began hypothesizing about what is going to happen next. I allow it to start precipitating. We talk about the four types of precipitation and how snow is special. Snow is special because it has to be below 32 degrees Fahrenheit to occur. It "rains" on a small sponge. The sponge represents the land and groundwater. I purposely have conducted the demo on a desk that has a slant. This way the students see the water "flowing" over the land. This is when I discuss runoff. I do this over a larger tin pan so that the water also has a place to collect. I send the students off to their desk to draw and label the demo, showing the different materials that we used and labeling them with what each represents as well. They then write a summary about the experiment.

Students are in groups to conduct the Water Cycle in a Bag experiment. Students draw the water cycle on a clear quart size baggie. I dye the water blue and place it in the baggies. We tape the baggies to the window to watch the water cycle happen. This only works if you have a window that gets lots of sun.

Students make a water cycle foldable to ensure they understand the vocabulary we have discussed. See the Appendix for a picture example. Students fold corner to side to make the paper square. They cut off the excess piece to make the paper square when opened. You will now have a triangle. Fold the two corners along the "fold" to the point they meet. Once you open the square, fold the corners to the center. Each small triangle will be labeled with one of the steps, in order, of the water cycle; evaporation, condensation, precipitation, and runoff. When you open the triangles, you will see a description/definition of that step.

Check Out Plant Transpiration! Is the next lesson. Do green plants give off water from their leaves? Can I conduct an experiment to see evidence of transpiration? This is when I began to introduce the concept of cause, evidence, and effect. The "cause" is the heat energy from the sun. The "evidence" will be the water in the baggie once the plant sweats. The "effect" is transpiration. In this experiment you must either start it in the morning and check in at the end of a hot day, or start it one day and check on it the next, if you do it outside. If you choose to do this outside, you will use a tree or other green plant. If you choose to do it inside, a geranium plant works well. You will make sure the plants leaves are dry. Use a paper towel to gently dry the plant if necessary. This way the students do not think that is where the water comes from. Then, tie a baggie around the leaves. Then, you wait. If you are doing this outside on a hot day, either check it at the end of the day or the following day. You will see light green tinted water in the baggie. This is the plant sweat, or where the leaves have released water into the atmosphere. If you choose to do this inside, a twist that I like to add is to tie one baggie on one plant and one on another. One plant I put under my grow light to provide more heat and the other is just sitting on a table in the room. I use this to show the students that the hotter, or more sun the plants receive the more transpiration will occur. This helps explain to the students that plants perform more transpiration in the summer or on hot days. This can be related to the same thing happening with evaporation.

At this point, the majority of the students have mastered the water cycle concept. This does not mean that they are able to read and answer the questions, but they can pick out the key words and discuss the concept. Due to the reading level of the students, I have met with students in small groups at least twice a week to teach reading and understanding questions. During this time we work on picking out key vocabulary and terms that we have learned.

Students must learn the six clouds; cirrus, cumulus, cumulonimbus, stratus, nimbostratus, and fog. They need to be able to know the cloud, the description, and the weather associated with the cloud. To peak the students interest I have the students do research. Get Your Head Out of the Clouds was adapted from the lesson written in The education Center, Inc. – Science in a Box, TEC1749. I adapted it in order to focus on the clouds that my students needed to know and the information that is expected they understand. I give students 8 index cards. Students research each cloud type listed to find its Latin meaning, what it looks like, and at least two additional facts. On one side of an index card, write the name and draw a picture of each cloud. On the back of the corresponding card, record each cloud's Latin meaning and the researched facts. Students research to find the definitions of nimbo and nimbus. They record each word and its definition on separate index cards. Once the cards have been completed, transfer the information to a chart in their notebooks. I always have the students start with cirrus, because they are the high clouds, and work their way down to the fog level. After the students have completed this activity we practice with "Wipe Out". This is an activity that I learned at PEAK Training. I have a chart on the Promethean board. We read it together. I then start "wiping out" parts of the chart. I do this until the students are stumped. I will do this sporadically throughout the year so that the students have constant review. The students get farther and farther as we go through the year.

Clouds of Cotton is a hands-on activity using poster board, 8"x11" and cotton balls for each student. Students divide their paper up into three columns and six rows. The first column is where the students place the cotton balls and the cloud name. The second column is for the description and the third column is for the weather associated with the cloud. The students use their pencils to scribble-scrabble on a piece of notebook paper. They rub the nimbo and nimbus

cotton balls on it to cause a dark color on the cotton balls. See Appendix 4 for a picture of this activity.

The Weather Patterns lesson was taken and adapted from The Education Center, Inc. – Science in a Box – TEC1749.

On the Front Line is a lesson that I developed based on my students' love, and mine, for football. We simulate a front, warm air mass, and cold air masses using football terminology and demonstrations that we act out.

Cold Front Demonstration that engages students and explains the fronts. This demonstration uses vegetable oil and cold "blue" water to represent warm and cold air masses. The students then go to their seats to draw and label and summarize the demo.

To better understand land breezes and sea breezes, I use Land vs Sea Breezes lesson from Discovery Ed, 2004 Alan Seals. This lesson is used to explain the reason that the direction of the air (convection) changes direction between day and night is because land and water cool at different rates. This shows that water heats and cools more slowly than land.

One of the most difficult concepts for my students to understand is the effect of the Jet Stream going north or south of North Carolina. The misconception is that if it goes north it will get cooler and if it goes south it will get warmer. Students have a difficult time understanding that if the jet stream goes north it is pulling up the warmer and more humid air from the south, and if it goes south it is pulling down the cooler, dryer air from the north. This lesson gives students a visual of this concept.

Weather Stations will be set up to allow students to practice reading weather tools and weather maps. Stations will be set up with various maps showing fronts, as well as barometric pressure readings, temperatures, and other collected data. Students will rotate between the stations to collect data on the various cities. The students will then write weather reports to present to the class.

One of the ways that I spiral in what we have already learned in weather is by puzzles. I take charts that we make, see appendix for picture examples, and cut them into puzzles. I have them laminated so that they can be used by all of my classes throughout the year. When students enter the classroom, I give them a baggie. The students race to see who can be the first to get the puzzle together correctly. Sometimes I give students a specific time limit to complete the puzzles. If the students do not complete it, or they do not complete it correctly, they are to use their notes to finish or fix their puzzle.

Appendix 1: Teaching Standards

5.P.2.1: Explain how the sun's energy impacts the processes of the water cycle (including evaporation, transpiration, condensation, precipitation, and runoff).

Students know that the sun provides the energy that is a driving force for most biotic and abiotic cycles on the surface of the earth. Students know that the sun's energy fuels the water cycle and impacts different aspects of the water cycle.

5.E.1.1 Compare daily and seasonal changes in weather conditions (including wind speed and direction, precipitation, and temperature, and patterns.

Students know that weather can change from day to day, and that many factors are measured to describe and predict weather conditions. Ex. Wind speed and direction, precipitation, temperature, and air pressure. Students know that in different latitudes and hemispheres there are different (and sometimes opposite) seasonal weather patterns.

5.E.1.2 Predict upcoming weather events from weather data collected through observation and measurements.

Students know that one can collect and compare weather data in order to predict the likelihood of a particular weather condition occurring. Students know how to read basic weather instruments: thermometer, barometer, anemometer, wind vane, and arin gauge. Students also can identify atmospheric conditions (presence and type of clouds), and fronts that are associated with predictable weather patterns. Students can make basic weather predictions using these skills.

5.E.1.3 Explain how global patterns such as the jet stream and water currents influence local weather in measurable terms such as temperature, wind direction and speed, and precipitation.

Students know that local weather conditions are influenced by global factors such as air and water currents. The jet stream is an air current in the upper atmosphere, located over North America that has a powerful influence on the weather conditions there. The jet stream flows from the west to the east and changes location depending on global conditions. The Gulf Stream is a warm water surface current in the Atlantic ocean that moves from south of Florida up the eastern seaboard and then across the Atlantic. The Gulf Stream moderates weather along the eastern seaboard, warming the air and the land there during the cooler months. In the Pacific, there is an oscillation of water temperatures known as El Nino/La Nina. This oscillation impacts the climate of North and South American for long periods of time. Hurricanes are major storms that form over warm ocean water and are caused by global weather patterns.

Appendix 2: Vocabulary

Water Cycle – the process in which water travels from the Earth's surface, to the atmosphere and back again

Evaporation – the process in which heat energy causes liquid water to change its state to a gas called water vapor

Condensation – the process in which a loss of heat energy causes gas (water vapor) to change back into liquid water

Precipitation – process in which water returns back to the Earth's surface; rain, sleet, snow, hail

Runoff – water that flows over the land

Groundwater – water that seeps into the ground

Transpiration – the process in which green plants control the water level in their leaves by changing the liquid water and releasing the water vapor into the atmosphere

Condense – to come together, to take up less space

Evaporate – to change from a liquid to a gas

Heat Energy – energy from the Sun

Atmosphere – the gases around the Earth

Collection – process in which water gathers into areas such as puddles, rivers, lakes, streams, oceans

Earth's Surface – land on the Earth

Water Vapor – the gas form of water

Clouds – when water vapor rises, cools, and condenses on dust particles in the atmosphere

Cirrus Clouds – ice crystals, wispy, thin, feather-like; fair weather

Cumulus Clouds – white, puffy, cotton-ball like; fair weather

Cumulonimbus Clouds – tall, dark; thunderstorms, lightening, hail, quick and heavy showers

Stratus Clouds – blanket-like layers; heavy cover during the day causes cooler than expected temperatures, heavy cloud cover during the night causes warmer than expected temperatures

Nimbostratus Clouds – grey, blanket-like layers; light, long-lasting rain showers, drizzle

Fog – low-lying stratus clouds

Nimbo/nimbus – rain or precipitation

Rain Gauge – the instrument used to measure rainfall

Thermometer – the instrument used to measure temperature

Barometer – the instrument used to measure air pressure

Wind Vane – aka weather vane, wind sock, weather sock – the instrument that show the direction that wind is coming from

Anemometer – the instrument used to measure wind speed

Humidity – the amount of water vapor in the air

Hurricane – caused by low pressure; fueled by warm ocean water

Storm surge – a rise in ocean water

Gulf Stream – a warm stream of air originating in the Gulf Coast

Latitude – measures the distance from the equator, this affects temperature

Equator – the imaginary line around the middle of the Earth that separates the Northern Hemisphere from the Southern Hemisphere

Land Breeze – wind that flows from the land towards the sea

Sea Breeze - wind that flows from the sea towards the land

Wind – movement of air caused by differences in air pressure; uneven heating of Earth's surface

Air pressure – the weight of the air

Low air pressure – cloudy, rainy, stormy weather

High air pressure - clear, dry, sunny skies

Warm air mass – a large area of warm air

Cold air mass – a large area of cold air

Jet stream – a high current of air that causes the boundary between warm and cold air masses

Front – the boundary between warm and cold air masses

Boundary – where two air masses meet

Warm Front – when a warm air mass is taking over a cold air mass; stratus and nimbostratus clouds; light long-lasting rain showers, and then warmer and more humid weather are associated with this front

Cold front – when a cold air mass is taking over a warm air mass; cumulus and cumulonimbus clouds; quick and heavy rain showers, thunderstorms, lightening, and hail; and then cooler and dryer weather are associated with this front

Rain - liquid water returning to the surface of the Earth (a type of precipitation)

Sleet – solid water returning to the surface of the Earth (a type of precipitation)

Snow – solid water returning to the surface of the Earth (a type of precipitation that requires temperatures to be below 32 degrees F)

Hail – solid water returning to the surface of the Earth (a type of precipitation)

Appendix 3: Teacher Resources

Weather Channel: https://weather.com/

Study Jams: http://studyjams.scholastic.com/studyjams/index.htm

Quizlet.com: https://quizlet.com/

Kahoot It!: https://kahoot.com/welcomeback/

Edmodo: https://www.edmodo.com

Charlotte Newspapers

CMS Elementary Science Wiki: http://elementaryscience.cmswiki.wikispaces.net/

NCDPI: http://www.dpi.state.nc.us/curriculum/science/scos/

Local News Channel

Discovery Education

Discovery Place (In-house field trips): http://www.dpi.state.nc.us/curriculum/science/scos/

Fifth Grade Science EOG Released Version:

http://www.ncpublicschools.org/docs/accountability/testing/releasedforms/g5scipp.pdf

Water Cycle Song: http://www.proteacher.org/a/12048_Water_Cycle_Song.html

A Pot of Water Cycle: http://www.proteacher.org/a/123560_Water_Cycle_Lesson_Plan.html

Water Cycle Foldable:

http://1.bp.blogspot.com/-R7w79IWq5eg/VNf613qdgHI/AAAAAAAABac/rInkUI6Zy14/s1600/water%2Bcycle%2B3.JPG

Check Out Plant Transpiration:

http://reachoutmichigan.org/funexperiments/quick/transpiration.html

Transpiration Baggie: https://water.usgs.gov/edu/gallery/watercyclekids/transpiration-bag.html

Appendix 4: Lessons

Lesson 1: I start the Weather Unit with the Water Cycle. This was taught in second grade, however, students rarely remember much about it. I open the first lesson with the Water Cycle Song. This is sung to She'll be Coming Around the Mountain. I change the last part to "it runs off". I teach my students hand motions, which help my EC and ELL students.

Water Cycle Song

Water Travels in a Cycle, Yes it Does,

Water Travels in a Cycle, Yes it Does,

It goes up as evaporation,

Then forms clouds of condensation,

If falls down as precipitation,

It runs off.

Lesson 2: Students will enter the room to the "Water Cycle Boogie" song. Have students write everything they know about the water cycle. This should only take about five minutes. Display the ""Water Cycle Boogie" words on the Promethean Board. As you go through each stanza, students will add that color of bead to their pipe cleaner. Each color represents a water cycle process.

Water Cycle Boogie

(Sing to the tune of Skip to My Lou)

Sun a shining from its birth,

Dries the water, dries the earth.

A YELLOW bead shows its worth,

Water Cycle boogie.

Evaporation, water's gone,

To a vapor, won't take long.

Choose a CLEAR bead, can't go wrong,

Water Cycle Boogie.

Condensation, water's here

No more vapor, give a cheer.

A LIGHT BLUE bead, like a tear,

Water Cycle Boogie.

Precipitation, rain and snow,

Shows us water on the go.

A DARK BLUE bead, don't you know,

Water Cycle Boogie.

See the water moving fast,

Runoff on the ground at last.

BROWN bead also joins the cast,

Water Cycle Boogie.

Infiltration in the ground,

To aquifers the water's bound.

A bright ORANGE bead now is found.

Water Cycle Boogie.

Transpiration from a tree.

Water vapor you can't see.

GREEN bead shows it all to me.

Water Cycle Boogie.

Lesson 3: "A Pot of Water Cycle"

Students enter the room while The Water Cycle Boogie is playing. I hand students a card with one of the water cycle vocabulary words and definition or example on it. Students are to find their "match" after putting their materials on their desk. This is to gauge what they remember from yesterday and get practice reading the different vocabulary words.

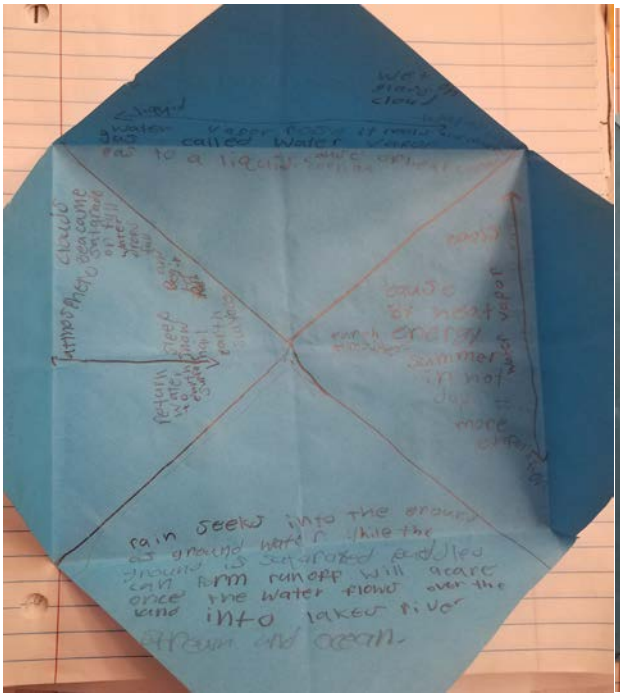
After the vocabulary review, I do the "A Pot of Water Cycle" demo. Place a pot of water on a hot plate. (It is best to do it in a clear pot so they can see convection, but any pot will do.) As the water is heating up, students will journal what they observe. Discuss how the hot plate is acting like the sun, the heat source. The sun will be our driving source for the water cycle process. Once the water begins to boil, ask the students what they are observing. They should start seeing the steam, or evaporation. They will draw and label their observations in their journal. Be sure to include liquid to gas, explain what is happening to the water molecules. Place the ice into the tin pie plate. Explain that it is representing how the air gets colder as you get higher into the atmosphere. They will begin to notice that the water droplets are forming on the pie plate. This is due to the water vapor coming into contact with the cold air. When water vapor comes into contact with cold air it changes from a gas (vapor) into a liquid. This process is called

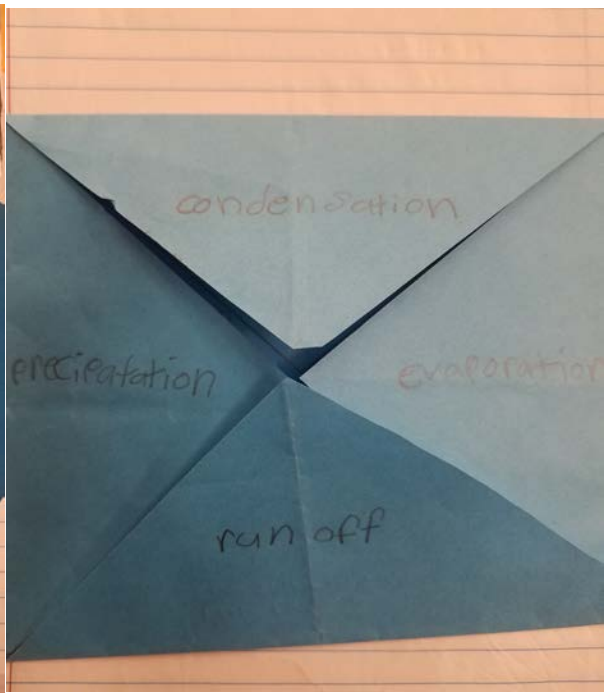
condensation. Once the clouds of condensation become heavy, they may start the process of precipitation. Precipitation is when the liquid water returns back to Earth's surface. Our example is "rain", however, it also can be sleet, snow (if 32°F and below), or hail. This process never stops.

Students then return to their desk and write a summary of their drawing explaining what materials represented the different processes and how the water traveled from the "ocean" back to Earth's surface. Their guiding question is; How does the demo relate to the water cycle?

Lesson 4: Water Cycle Foldable

Students will make a foldable showing the water cycle. Students fold corner to side to make the paper square. Cut off the "not square" piece and discard. You will now have a triangle. Fold the two corners along the "fold" to the point they meet. Once you open the square, fold the corners to the center. Each small triangle will be labeled one of the steps, in order, of the water cycle; evaporation, condensation, precipitation, and runoff. When you open the triangles, you will see a description/definition of that step.





Lesson 5: Check Out Plant Transpiration!

Do green plants give off water from their leaves? Can I conduct an experiment to see evidence of transpiration?

1. Use your ruler and pencil to measure and mar a rectangle from the cardboard piece to measure four by six inches. Cut out the rectangle.

2. With the sharp tip of the pencil, poke a little hole in the middle of the cardboard rectangle.
3. Break off a healthy leaf and stem from the geranium plant.
4. The leaf stem is called a petiole. Put the petiole of the leaf in the hole in the cardboard rectangle.
5. Fill one of the glasses three-quarters full with water.
6. Cut the cardboard on top of the glass with the water in it so the stem is down into the water and the leaf is on top of the cardboard – not in the water.
7. Take a little bit of Vaseline and put it around the hole. This is to keep evaporated water from the glass seeping up into the top glass.
8. Put the second glass upside down over the leaf resting against the together glass' mouth.
9. Put the glasses on a leader or table top near a window where there is a good source of sunlight.

*Watch what happens after 3 or 4 hours. Do you see little drops of water on the inside of the top glass? Where is the water coming from? If you plugged the hole around the stem, the water from the bottom glass shouldn't be getting up into the top glass. What is happening is called transpiration. This is the process whereby the leaves on green plants give off water they do not need. Look at the bottom of the geranium's leaves. You will see little dots which are called stomates. The stomates give off the excess water the plant doesn't need.

Lesson 6: Transpiration Baggie

Take the students out to look at leaves on a tree in the morning. If the leaves have water on them from rain or dew, wipe it off so the students can see. It is best to do this on a hot day. Take a baggie and place it over a couple of the leaves on the tree. Tie it tight so that it stays on and water can't get into the baggie. Go back to the baggie later that day. What is in the baggie? It will have water from the leaves in the baggie. The sun caused the plant to go through the process of transpiration. The hotter the day, the more transpiration. You could do this on a hot day and on a cold day to compare the data.

Lesson 7: Water Cycle Challenger

1. Pour about a half inch of water into a bottom of the bowl.
2. Cover the bowl with plastic wrap. Secure the wrap with the rubber band.
3. Put two ice cubes at the center of the plastic wrap. The wrap should slope into the bowl, but it should not touch the water.
4. Place the bag of ice cubes at the center of the plastic wrap. The wrap should slope into the bowl, but it should not touch the water.
5. Predict what will happen to the ice in the bag and the water in the bowl when you place the bowl in the sun. On another sheet of paper or in your science journal, record your predictions.
6. Place the bowl in direct sunlight. Observe it every 20 minutes for one hour or until the ice has melted. Record your observations.

The sun's heat provides the energy for evaporation to occur. As rising water vapor meets cooler air or a cooler surface, it condenses into liquid form. (This process explains why an ice-cold glass of water will get "sweaty" on a hot summer day. The surface of the glass is much cooler than the air around it. As the warm water vapor hits the glass, the vapor condenses into liquid.) As more and more vapor condenses, some of the water drops eventually grow large enough to fall. What part of the water cycle does the water in the bowl represent? The ice in the bag? The plastic wrap?

Lesson 8: Water Cycle with Runoff

I modified a lesson about the water cycle to include a way to demonstrate runoff.

Place a cookie sheet on a flat surface. Place a sheet of construction paper on the cookie sheet. Fill the bowl with water and place it on the construction paper. Set the damp sponge on the cookie sheet near the bowl. Then use the aluminum foil to form a trough from the bowl to the cookie sheet as shown.

With the watering can, sprinkle evenly around the model. Observe what happens to the water.

Draw arrows on the diagram below to show the movement of water from the point it leaves the watering can.

Gravity plays a big role in the water cycle process. It pulls water from the sky (precipitation) and causes that water to drain through infiltration, or soaking into the ground, and runoff, or entering streams along the surface of the land, as it makes its way toward the lowest point, which is usually sea level, or the ocean.

The construction paper and the sponge represent types of soil. Which would be better farmland? Why? If the cookie sheet represents the ocean, what part of the water cycle does the bowl represent? What part of the water cycle does the aluminum foil represent? If the climate changed and the rainfalls topped, describe what might happen to the land represented by the model.

Lesson 9: Get Your Head Out of the Clouds

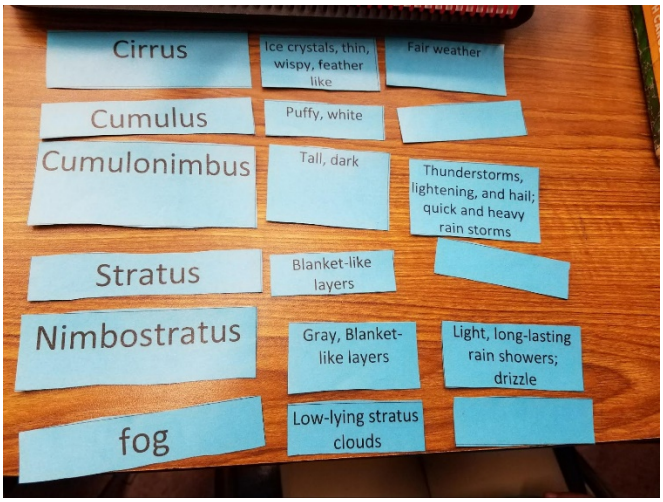
Research each cloud type listed in Box A to find its Latin meaning, what it looks like, and at least two additional fact. On one side of an index card, write the name and draw a picture of each cloud. On the back of the corresponding card, record each cloud's Latin meaning and the researched facts.

Research to find the definitions of alto and numbus. Record each word and its definition on separate index cards.

Use the cards to figure out the meanings of the clouds listed in Box B and also what type of weather they may bring. On another sheet of paper or in your science journal, record the name of each cloud and the information.

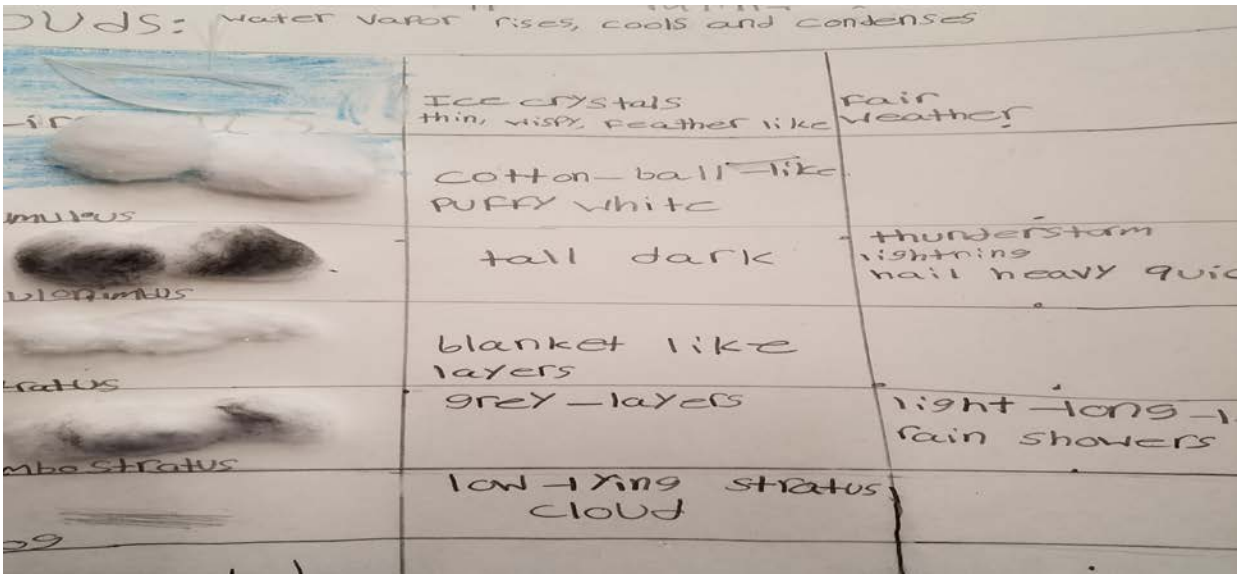
Knowing about the different types of clouds can help predict what type of weather will be in the area. Each type of cloud may signify that a particular type of the weather is on the way.

I then use this puzzle, see below, to help the students learn cloud names, descriptions, and weather associated with each type of clouds that we learn. This is a great bell ringer or exit ticket.



Lesson 10: Clouds of Cotton

Each student will receive a piece of poster board, 8”x11” and six cotton balls. Students divide their paper up into three columns and six rows. The first column is where the students place the cotton balls and the cloud name. The second column is for the description and the third column is for the weather associated with the cloud. The students use their pencils to scribble-scrabble on a piece of notebook paper. They rub the nimbo and nimbus cotton balls on to cause a dark color on the cotton balls.



Lesson 11: Weather Stations

Set Up: Place pictures of different weather instruments showing the data for a certain time and place. Each station will have a rain gauge, thermometer, barometer, anemometer, wind vane, and hygrometer. Each station will be set up for a different city. Students will then log the data they collect from the different stations. Once the students rotate and collect all of their data, they will work in their teams to write a weather report for their cities.

Lesson 12: "Weather; Heat Rises and Cold Air/Water Sinks"

Fill the bowl about three-fourths full with cold water.

Place one drop of blue food coloring n the empty film canister; then fill it with cold water.

Holding the canister upright, slowly lower it to the bottom of the bowl.

Observe what happens to the blue water (cold air). Draw a picture of the results in the first box below.

Take the canister out of the bowl and dump the water out of both. Repeat Steps 1 – 3 except place red food coloring and warm water in the canister. Observe what happens to the red water (warm air). Draw a picture of the results in the second box below.

Lesson 13: Land vs Sea Breezes lesson from Discovery Ed, 2004 Alan Seals

We use two thermometers, two cups, one with water and one empty. We make sure that the temperatures of the water and air cups are the same. We then place them into the refrigerator. We check and record the temperatures every 10 minutes. This lesson is used to explain the reason that the direction of the air (convection) changes direction between day and night is because land and water cool at different rates. This shows that water heats and cools more slowly than land.

Does water or air heat up and cool down faster?

Put thermometers into two different cups.

Fill one of the cups with water that has been sitting out for a while.

Read both thermometers and write down what they show. The readings should be close to each other.

Now put both thermometers in a refrigerator.

Take readings every 10 minutes of both thermometers until both temperatures stop falling.

Now take both cups out of the refrigerator, set the on a counter.

Take additional readings every 10 minutes until the temperature stops rising.

QUESTIONS:

1. Which temperature fell fastest in the refrigerator?

2. Why should you not hold the refrigerator door open too long when taking readings?

3. Did both thermometers end up at the same temperature in the refrigerator?

4. When taken out of the refrigerator, which thermometer warmed faster?

5. Why was there a difference in how air or slow the water cooled and warmed?

6. What does this tell us about the climate of cities near large bodies of water?

7. What does this tell us about land and sea breezes?

Lesson 14: On the Front Line

I developed this lesson based on my students' love, and mine, for football. We simulate a front, warm air mass, and cold air mass. We switch the air mass side depending on if we are simulating a cold front or a warm front. We line up with the Offence being the Front and the Defense being the air mass we are moving out of the way. The line of scrimmage is the front. At the line of scrimmage is where "action" takes place. This is where I explain storms. You would not let the other team just walk on by, you would try to stop them. That is where the storms come in. The action on a front is wind, clouds, and possibly rain. The greater the difference in the offence and defense/air pressure, the greater the wind speed will be. I place different amounts of students on the line of scrimmage to represent the differences in air pressure. The more one team has than the other, the greater the difference in air pressure. If they are close, the winds will not be as great. The front that is coming in will move the other air mass out of the way. The cold air mass side have signs that say cooler and dryer and the warm air mass will have signs that say warmer and more humid. Once the simulation has been completed for each front, students will draw, label, and summarize.

Lesson 15: Cold Front Demonstration

I use a clear container for this demonstration so that the students can clearly see what happens during this demonstration. I use a few drops of blue food coloring to tint the water for a better visual ahead of the demonstration. Students come to the demo table. I pour vegetable oil into the container in front of the students. I pour a little under half full. I explain to the students that the vegetable oil represents a warm air mass is over the school. We have a discussion about what this feels like, warm and humid. But then, we hear that a cold front is approaching. The blue water represents the cold front that is approaching. I have the students get down so that they can see what takes place once the water (cold air mass) and oil (warm air mass) meet. They immediately notice that the oil starts having waves (wind) and bubbles (clouds). There is a distinct line (front) where the two meet. We discuss because this is a cold front we will notice cumulus and then possibly cumulonimbus clouds forming. Depending on the humidity level, we may experience thunderstorms, lightening, and hail. The precipitation will be quick and heavy. Once the front has passed, se see how the warm air mass (oil) was moved out of the way. It has been replaced with

the cold air mass, therefore cooler and dryer weather. The students then go to their seats to draw and label and summarize the demo.

Lesson 16: Jet Stream; North and South Movement

I print out a map of the United States to be glued into their journal in the middle of the page. Students label the north, south, east, and west. I give the students a piece of pipe cleaner, a piece of blue cellophane paper, and a piece of red cellophane paper. They attach the piece of paper to the pipe cleaner with tape to make sort of a flag. The blue goes on the top because of the cool air from the north and the red goes on the bottom because of the warmer air from the south. The students attach the pipe cleaner on the west side of the map, due to the fact that weather typically moves from the west to the east in the U.S. because of the prevailing westerlies. Have the students move the flag (jet stream) towards the south. They see that it pulls the blue cellophane paper down, which then covers North Carolina. This represents the cold air that is being pulled down. We then move the jet stream north of North Carolina. This covers North Carolina in red, which represents the warm air from the south.

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