Catching Water

Merry Ostheimer

Introduction

Water is life! It's everywhere! Water moves inside our planet, washes across Earth's surface, and floats in the atmosphere above us. Water is vital to all living things but sometimes there is a shortage of an adequate water supply which affects the number of people who can be supported and the amount of food that can be grown in areas that are susceptible to droughts. Approximately one percent of Earth's total water content is in the atmosphere as water vapor, precipitation, or clouds. What if we can take water vapor out of the air by collecting condensation? Could this be a viable source of water for areas that struggle with drought?

Since I graduated from University of Delaware in 1987, I've taught in Christina School District which is Delaware’s largest school district and serves more than 16,000 students. For sixteen years, I have had the privilege of teaching at West Park Place Elementary School. West Park hosts a number of programs that include English as a Second Language (ESL), Delaware Autistic Program, REACH (Realistic Educational Alternatives for Children with Disabilities), Accelerated Academic, and Montessori. According to the annual report generated by the Christina School District, about a third of our students are ESL and represent about twenty-five different countries. About forty-five percent of our student population are free/reduced lunch students. Our demographics are 19% African American, 17% Asian, 11% Hispanic/Latino, 47% White, and 7% Multi-Racial. I am a second grade, self-contained teacher and teach multiple subjects that include English Language Arts, Math, Science, and Social Studies. This year, my class has sixteen students, two of whom are Special Education learners, and another two who are English Language Learners.

Located about a mile from the heart of University of Delaware, West Park Place has a wonderfully diverse population of under 400 students. Many students have parents who work for UD or are visiting from other countries to teach or attend higher education UD programs. One great effect of a university campus, is that education is highly valued in our West Park Place community. In 2011, West Park Place received the National Blue Ribbon School designation from the United States Department of Education for consistent student achievement. Our instruction is aligned with Common Core State

Standards and Next Generation Science Standards. My fellow teachers work with our administrators collaboratively in Professional Learning Communities to analyze student data, set goals, monitor progress, and plan meaningful learning activities. Currently we look at beginning year data derived from IReady to respond to students' needs. Based on the Christina School District's annual report, West Park Place teachers are predominately Highly Effective and Highly Qualified and have many years of experience with most carrying at least one master's degree.

Rationale

My current struggle is making sure that science does not get squeezed out of the student school day. This year, Christina School District is beginning a new math program called Bridges in Mathematics. Last year, Christina School District adopted Writing Across the Curriculum. Both initiatives demand priority of teachers' attention. This means that we must commit to implementing these curriculums and attend regular professional development sessions. Science and Social Studies are pushed aside to accommodate these reforms. My underlying question is how can I find that balance between satisfying district mandates and not short-changing Science and Social Studies? One answer is to give a soft tippy-toed approach to trying to integrate Science and Social Studies into writing instruction. Another answer is demonstrating that a scientific inquiry-based strategy is a valid use of classroom time that will help young learners find the world interesting and thus motivate them to see their world as a puzzle to solve.

When I first read Joel Rosenthal's description of his seminar, *What Makes up the World Around Us?* I immediately thought of water and how it is everywhere. I thought it would be a great leap for my second graders to consider this same thought: where is water in the world around me? When I taught the third-grade water science unit, I saw how excited my students were to learn how ubiquitous water is: 75% of the water is covered with water, 97% of the planet's water is in its oceans, 2% of the water is frozen in ice caps and glaciers, and just 1% is usable fresh water, most of which is underground. People drink water, cook with water, and wash with water. In fact, each day humans must consume about two to three liters of water to survive. Water is vital to the life of every cell and regulates our internal body temperature by sweating and respiration. The carbohydrates and protein that our bodies use as food are metabolized and transported by water in our bloodstream and body waste is flushed from our bodies through our urination. In addition to lubricating our joints, water forms mucus and acts as a shock absorber for our brain and spinal cord. The bottom line is water is the major component of most human body parts.[1] Water is life.

Then I saw a video that featured the Warka Tower as an alternative water source. I was riveted by this simple solution that could change the lives of people who live in rural areas that face challenges in accessing drinkable water. This water tower pulls moisture out of the air and channels it down to a reservoir. There are about twenty-five gallons of water collected each day. I thought to myself, this would be such a cool project for my students to study and learn about water conservation.

This curriculum unit will trigger curiosity by investigating the hydrologic cycle and the unique properties of water. The intended audience for this curriculum unit is elementary students in second and third grades. By the end of this unit, students will understand the hydrological cycle deeply enough that they will be able to design and implement strategies to catch water that is in the air. The students will participate in four modules. First, we will learn about the molecular structure of water. An oxygen atom is covalently bonded to two hydrogen atoms and consequently has an angular shape. Oxygen is highly electronegative so it more strongly attracts the electron pairs of each covalent bond. Water naturally exists in three different state which are liquid, solid, and gas. Next, we will explore the water cycle which includes evaporation, transpiration, condensation, precipitation, and collection. Then, we will study ways of collecting water vapor by examining how water vapor cools on a condensation surface and then can be collected from the condenser surface to a water storage container. Afterwards, we will examine models of successful devices that enhance dew condensation and harvest potable water from the atmosphere. Finally, we will use the Engineering Design Process to build a dew extractor. Students will exercise their curiosity by asking themselves how can I catch water out of the air, imagine what this would look like, plan and create their device, test it, and improve it by questioning, “How can I make this better?”

This unit will be taught in a pedagogical manner that fosters asking questions, using hands-on learning, interacting collaboratively, reflecting upon findings, and researching to enhance understanding. Next Generation Science Standards that will be targeted include *2-PS1 Matter and its Interactions* where students will plan and conduct investigation to describe and classify different kinds of materials based on their observable properties. Different kinds of matter exist and many of them can be either solid, liquid, or gas depending on temperature. Matter can be described and classified by its observable qualities. Heating or cooling a substance may cause changes that can be observed. In addition, students will construct an argument with evidence that some changes caused by heating or cooling can be reversed while others cannot. Another Next Generation Science Standard is *2-ESS2-2 Earth Systems* where students will develop a model to represent patterns in the natural world. The Engineering Design Process that will be used is the Five-Step Process that Engineering is Elementary (EiE) created to simplify the steps and use terms that children can understand. Ask: What is the problem? Imagine: What are some solutions? Plan: Draw a diagram and list materials you need.

Create: Follow your plan and create something, then test it out. Improve: Reflect on what worked and what did not work and brainstorm how it can work better.

Background Content

Water Chemistry Basics and Why Water is So Unique

> *"If one were to name one feature of the Earth among the many that make it a hospitable place to live, it would be water. Water, H_2O, a molecule with a deceptively simple formula, but one with remarkably complex properties that make it the medium in which life can exist."*[2]

Liquid water has no color, odor, taste and occurs in the solid state as ice and in the gaseous state as steam or water vapor. It is composed of an oxygen atom bonded to two hydrogen atoms. In other words, one oxygen atom sticks together to two hydrogen atoms. The chemical formula of water is would be very simple, except for the fact that the water molecular structure does not have the H-O-H atoms all in a straight line. Rather the two bonds between H and O atoms form an approximate right angle such that the two H atoms are on the same "side" of the central atom.[3]

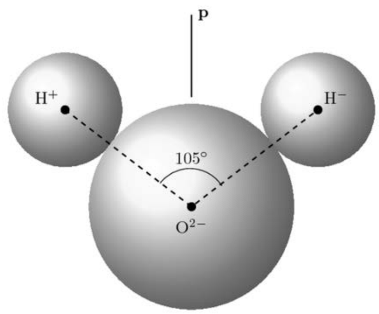


Fig. 1: The angular nature of the water molecule. Image credit: TeXample.net

The molecular structure of water is one that has the outer shell of eight electrons in the O atom configured as four pairs of electrons. Two pairs of these electrons are in the covalent bonds between the H and O atoms and the other two pairs are not involved bonding. These two pairs of unshared electrons and two pairs shared electrons all repel each other so they tend to be arranged in the imaginary tetrahedron around the O atom to be as far from each other as possible. Khan Academy's explanation of hydrogen bonds are that they are weak interactions that form between a hydrogen bearing a partial positive charge and a more electronegative atom such as oxygen.

> *"The hydrogen atoms involved in hydrogen bonding must be attached to electronegative atoms, such as O, N, or F. Water molecules are also attracted to other polar molecules and ions. A charged or polar substance that interacts with*

and dissolves in water is said to be hydrophilic: hydro means "water", and philic means "loving." In contrast nonpolar molecules like oils and fats do not interact well with water. They separate from it rather than dissolve in it so they are called hydrophobic: phobic means "fearing."[4]

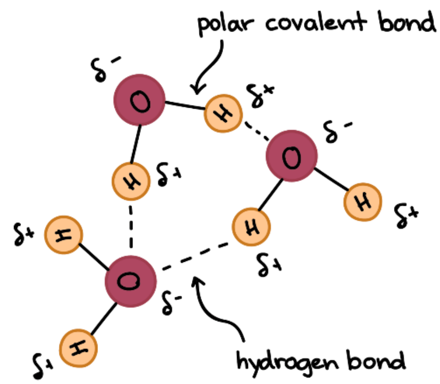


Fig. 2 Hydrogen bonding of water molecules. Image credit: khanacademy.org

Covalent bonds are the bonds between the oxygen and two hydrogen atoms. They are a chemical bond involving the sharing of electron pairs between atoms. The two hydrogen atoms align themselves along one side of the oxygen atom, which is why the oxygen side has a slight negative charge and the side with the hydrogen atoms has a slight positive charge. So, when the positive side on one water molecule comes near the negative side of another water molecule, they attract each other and form weak non-covalent hydrogen-bond. This bipolar nature of water molecules gives water its cohesive nature which explains why water can form into drops and stick to surfaces. Its unusual properties, so vital to life on Earth, are a direct result of the H_2O molecule's shape, which basically gives the molecule sides or "ends."[5]

Hydrogen bonds occur when water molecules stick to each other. It is an electrostatic attraction between hydrogen atoms bonded to small, strongly electronegative atoms. Water molecules attract each other because of their polarity. The positive side of one hydrogen atom clicks with the negative end of an oxygen atom.

Cohesion refers to the attraction of molecules to other molecules of the same kind. Water molecules display strong cohesive forces due to their ability to form hydrogen bonds. Cohesive forces result in surface tension, the tendency of a liquid's surface to resist rupture when placed under tension or stress. Water molecules at the surface form hydrogen bonds that are stronger than those in the bulk of the fluid since there are fewer other water molecules to bond with. You see this when you have a glass of water that is filled to the top and then you slowly add a few more drops, to try to overfill the glass. The water swells up above the top of the glass, but it doesn't spill out. Surface tension causes the water to form a dome at the top. Surface tension happens when many water molecules join together and the surface forms a kind of skin that is tough, making it possible for insects to walk on top of the water. Because the molecules at the surface are only attracted downward and sideways, whereas all the other molecules feel attractive forces in all directions, water has a very high surface tension.[6]

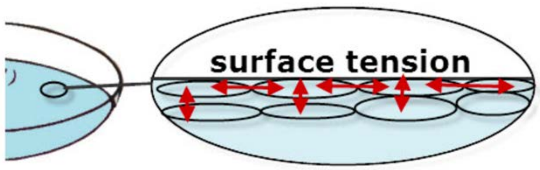


Fig. 3: Surface tension. Image credit: Janice Vancleave

Adhesion is the attraction of molecules of one kind to molecules of a different kind. Imagine you have a glass of water that is half-filled. When you put in a straw, you see the water starts to move up the straw. This upward motion against gravity is called capillary action which takes place because the water molecules are more strongly attracted to the glass than they are to the other water molecules.

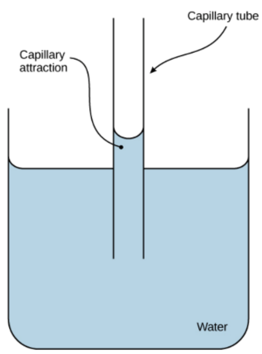


Fig. 4: Adhesion of water. Image credit: Lumen Learning

Another property of water is its ability to be a solvent. There are a couple of reasons why water is called the "universal solvent." Water molecules have a polar arrangement where on one side, there is a positive electrical charge and on the other side, there is a negative charge. This polarization allows the water molecule to become attracted to many other different types of molecules. With its ability to form hydrogen bonds and its angular shaper, water can dissolve other molecules and compounds. Water can become so attracted to a different compound, such as table salt (NaCl) that it can disrupt the attractive forces that hold the sodium and chloride ions in the salt compound together and, thus, dissolve it.[7] The significance of water's property of being an excellent solvent is that water can transport nutrients and wastes in biological systems. This is important to every living thing on earth. It means that wherever water goes, either through the ground, or our bodies, it takes along valuable chemicals, minerals, and nutrients.

Water exists in all three phases of matter: solid, liquid, and gas. Water changing from a solid to liquid is called melting. When it changes from liquid to the vapor phase, it is called evaporating. When water changes from a vapor to a liquid, it is condensing. All these phases are temperature and pressure dependent. When water changes directly from a solid to the vapor phase, this process is called sublimation. At 0° Celsius and under normal atmospheric conditions, water freezes and at 100° Celsius water boils. This relatively large temperature range between water's freezing and boiling points enables water to exist in its liquid form in most places on the Earth, including regions having extreme temperatures. As ice warms up, it turns to liquid. When liquid water is warmed up more, it becomes a gas. Water as a solid (ice) is in a lattice-like structure where there is not much movement between individual H_2O molecules. Once kinetic energy or heat is added, the lattice starts to break apart as the water molecules start to move or vibrate. This is where water turns to a liquid state because the water molecules are sliding apart from each other. When more kinetic energy or heat is added, the water molecules move very quickly and transform into gas as water vapor.

Earth's Hydrologic Cycle

The total amount of water on this planet has not changed over time. Energy from the sun and the force of gravity drive the hydrologic cycle, which is the endless circulation of water between the land, oceans, and atmosphere. In this cycle, water changes forms from gas to liquid to solid.

> *"Heat from the Sun evaporates water from the oceans into the atmosphere, winds powered by solar heating of the atmosphere carry water vapor over land, and purified water falls to the surface, eventually flowing into the oceans to start the whole cycle over again. Some of the water percolates below Earth's surface where it accumulates as groundwater."*[8]

It is important to have this understanding of the hydrologic cycle to help students understand the part heat and cooling plays in the evaporation and condensation processes. When I plan to have my students "catch water," I need them to understand the concept of condensation—condensation is the phase of water where molecules transform from water vapor to liquid water. Questions that may come up are "Can you control when and how vapor condenses? Can you control the temperature to force condensation? What kinds of things can you do to draw out water from the air?"

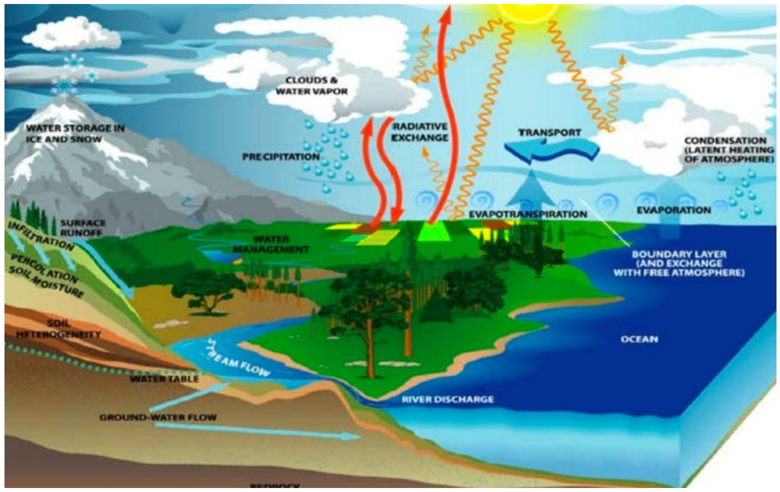


Fig. 5: The Hydrological Cycle. Image credit: SlideShare

The air around us can contain between 0 to around 5% water vapor, which will condensate on surfaces when the surface temperature reaches the dew point. The dew point is the atmospheric temperature below which water droplets begin to condense and dew can form. Dew is a common term for water droplets that form on exposed surfaces in the morning or the evening. As the exposed surface cools by radiating its heat to the nighttime sky, atmospheric moisture condenses. This forms dew, water droplets that collect on the surface such as grass, leaves, railings, and car roofs. Good conditions to collect dew are when there are clear night skies with little water vapor in the higher atmosphere and sufficient humidity in the air. Dew formation happens in the morning through heating by solar radiation and in the evening through cooling by infrared emission. During daylight hours, direct or indirect heating by the sun is greater than radiant cooling, causing evaporation to exceed condensation. During the night, without heat from the sun, the collecting surface cools which allows condensation to occur.

Water Vapor Harvesting Models

When I first started thinking about this unit on catching water, I saw a video that featured the Warka Water Tower. Used in Ethiopia, this model offers a solution to the universal water scarcity issues that affect huge numbers of people. Harvesting water vapor is an alternative water source for rural populations that face challenges in accessing drinkable water. Warka Tower's architect is Arturo Vittori who considered the plight of 768 million people around the world who do not have access to safe water. He designed thirty-foot tall towers that harvests atmospheric water vapor. They are a lightweight, easily constructed, and infrastructure-independent system that harvests about ten to twenty gallons of drinking water every day.

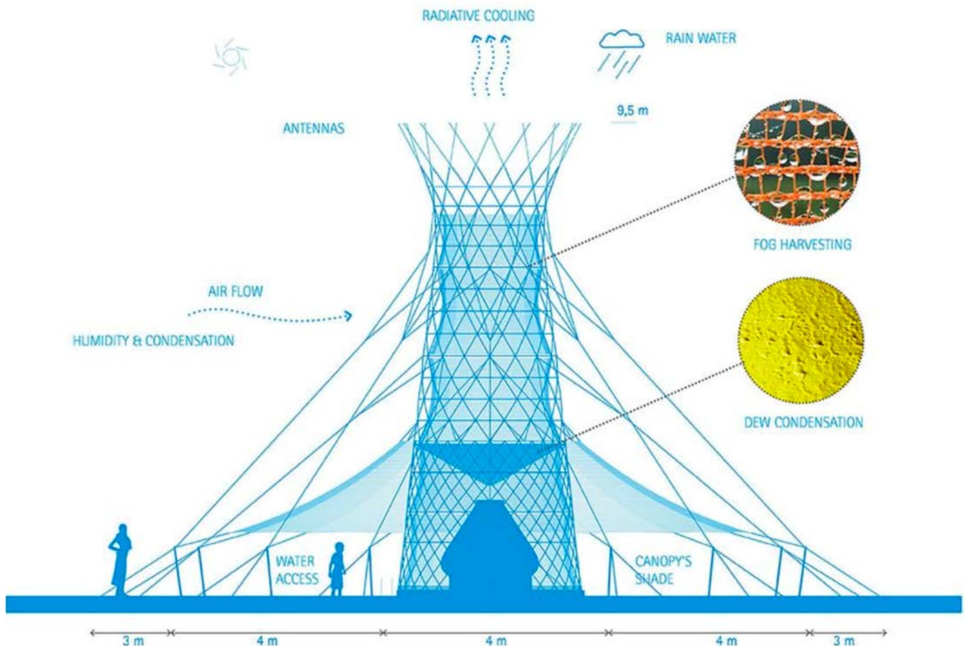


Fig. 6: Warka Tower. Image credit: Dazeen.

Using bamboo, polyester mesh, polyester cable, and hemp rope, Warka Tower can be constructed in four weeks and erected in one hour with a team of 16 people. The design was influenced by studying the Namib beetle's shell, lotus flower leaves, and spider web threads to enhance dew condensation. There are two sections to the tower: a semi-rigid exoskeleton built by tying stalks of bamboo together and an internal plastic mesh which has nylon and polypropylene fibers that act as a scaffold for condensed dew droplets to run down the mesh into a basin at the base of the tower.

The Warka Tower team studied the Namib desert beetles and how they get water from dew by using their body surface, which is covered with micro-sized grooves or bumps. These bumps and grooves on the beetle's hardened forewings can help condense and direct water toward the beetle's awaiting mouth, while a combination of hydrophilic (water attracting) and hydrophobic (water repelling) areas on these structures may increase fog-and dew-harvesting efficiency.[9]

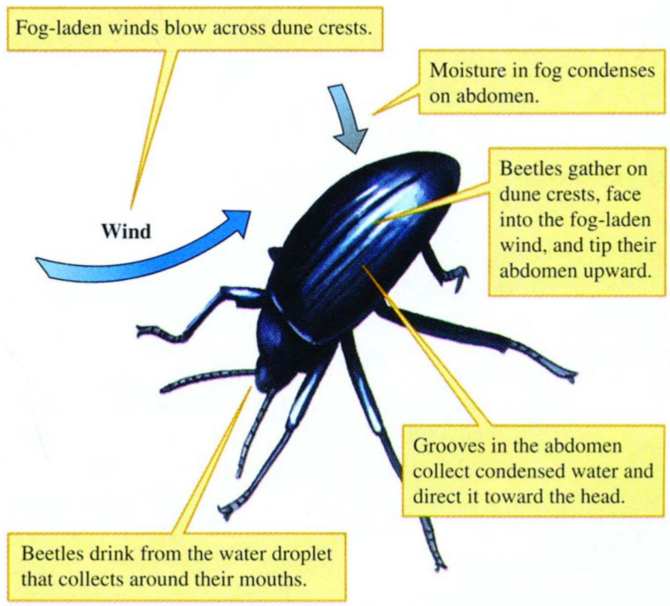


Fig. 7: Namib beetle. Image credit: Biomimicry Project

Lotus flower leaves were also studied to get ideas about how to collect water vapor. Lotus plants have superhydrophobic surfaces which means that water drops fall onto them, bead up, and then roll off. Combining the ideas of lotus flowers and spider webs, the Warka Tower simply uses a polyester mesh that covers the bamboo frame to condense water vapor and direct the trickle of droplets down to its base. No electricity is required and the tower can be easily moved.

Another source of dew harvesting ideas I found is The International Organization for Dew Utilization (OPUR). OPUR has widely standardized the characterization of dew collection by establishing the methodology, instrumentation, and data obtained from in-field experimental test studies.[10] There are some materials that could be used to harvest water from dew. Radiative Dew Condensers (RDCs) are dew specific collectors that use different types of foils and supporting structures (shape, tilt, etc.). There are standard materials that are made of a special white low-density polyethylene (PE) foil, two of which are black PE foil (BF) and white standard foil (WSF). These materials cover flat pans that are tilted at a 30° angle. You can buy polyethylene foil at home improvement stores and they are used for masonry, construction, and landscaping projects.

Teaching Strategies

Cooperative Learning Teams

The use of Cooperative Learning Teams is a strategy I use in my classroom daily for every subject. Students who learn at varied levels work in teams of four. They sit face to face and shoulder to shoulder. The goal is to actively engage each student through activities that shift between direct-instruction by the teacher, teamwork, and pair-work. I instruct my class to "Make sure that everyone knows...," "Work with your face-partner," and "Turn to your shoulder-partner." This friendly atmosphere builds speaking and listening skills. An inherent benefit is that students are continually practicing effective leadership skills by checking each other's understanding.

The last two years, I have used Colleges and Universities to name my teams and this year there are Alabama University, University of Kentucky Wildcats, Tulane University, University of Delaware Blue Hens, and Oberlin College. This exposure to higher educational institutions elevates my second graders belief that college is in their future. My students think of themselves in a different light than in past years when I used the colors of the rainbow to name their team. The Blue Group is just not as inspiring as "Go, UK Wildcats!"

Engineering Design Process

According to the Next Generation Science Standards website, "Science and Engineering Practices describe what scientists do to investigate the natural world and what engineers do to design and build systems." Through this inquiry-based practice, my students engage in activities that build and deepen understanding of a concept and then apply their knowledge of core ideas and cross-cutting concepts to create solutions to problems.

The first step in the Engineering Design Process is to ask, "What is the problem?" In this phase, we keep a journal of our inquiry. The second step is to imagine what are some solutions to this problem? We will research to find out more about our topic. Then the teams will brainstorm methods to solve the problem. The third step is to plan by drawing a picture of the solution. The teams need to include what supplies are needed and jobs each player needs to do. The teams also will make a list of the steps they will take to create the solution. The fourth step is to make the device that follows the team's plan. Collaboration is key as the team works steadily. The great part of this step is testing the design. The teams have invested their brain power and now are eager to find out what happens! The fifth step is to improve their design by learning from their mistakes. The team makes their design even better and retests it. The final step is to present their devices to the class. A lot of times, the teams want to "go back to the old drawing board" once they see each team's solutions.

Ipads

I am very happy to report that I have access to eight Ipads every day in my classroom. We use this technology to do a lot of reading books on Epic. There are thousands of digital books available for free during the school day from 8:30am to 3:00pm. Get Epic offers a great selection of non-fiction books that my students use to research topics.

I just found out about is The Kentucky Virtual Library. By using a gameboard as an interface, the process presents students with concrete steps to support their planning, searching, taking notes, and writing about a subject. This website has clearly articulated steps, logical progression, and embedded strategies.

Claim-Evidence-Reasoning

CER is a three-part assessment strategy that requires students to make a claim, supply evidence, and explain why the evidence supports the claim. The first step is to make a scientific claim or to argue a specific point. The claim is like the answer to an investigation problem. The evidence backs up the claim by providing appropriate and sufficient data that supports the claim. Students may produce evidence from a variety of sources. Finally, reasoning ties the claim and the evidence together and is the conclusion of the investigation. Essentially, it is the explanation for why the evidence supports the claim using scientific principles.

CER meets the K-2 standards for the Next Generation Science Standards Practice: Engaging in Argument from Evidence. Students will practice how to analyze why some evidence is relevant to a scientific question, while some are not. They will need to listen actively to arguments to indicate agreement or disagreement based on evidence. Second graders will really benefit from this approach that helps them distinguish between opinions and evidence when they explain their findings.

Learning Activities

Building the Foundation

I will teach this unit using ReadWorks articles, picture books and video clips. To lay down the foundation of water science, I use collections from ReadWorks Article-a-Day. By setting a goal to read one article a day, my students are building personal vocabularies, becoming stronger readers, and increasing their stamina. After reading an article, my students complete entries in their own "Research Guide" where they write two facts that they learned and an "I wonder" statement, followed by an illustration that will stretch their understanding of a concept. Some articles that I plan to assign include *Water. Three Kinds of Water, The Water Cycle, Facts About Fog, A Clean Drink of Water, We Need Fresh Water, Living Things & Ecosystems Need Water, Water's Impact on Earth, Protecting Our Water, The Amazing Water Molecule, and Oceans, Rivers, and Lakes*.

Picture books that I will read and set out include are *The Magic School Bus At the Waterworks* by Joanna Cole and Bruce Defen, *A River Ran Wild* by Lynne Cherry, *Follow the Water from Brook to Ocean* by Arthur Dorrow, *Hydrology: The Study of Water*, by Christine Taylor-Butler, *Saving Our Earth* by Peggy Hock, *Water Cycle* by Monica Hughes, My *World of Science: Water* by Angela Royston, *A Drop of Water* by Walter Wick, and *You Wouldn't Want to Live Without Clean Water* by Roger Canavan.

Video clips I will use are GoNoodle's *Water Cycle* by Blazer Flash, Brain Pop Jr.'s *Water Cycle, Solids, Liquids, and Gases, Changing States of Matter, Chemistry Now: Chemistry of Water: H_20, Claim, Evidence, Reasoning, Claim, Evidence, Reasoning… in 5 minutes or less,* and *CER-Claim Evidence* Reasoning.

H_2O Headbands

For teaching the concept of H_2O molecules, my students acted out how the molecules transform through the states of matter. I made headbands in three different colors: yellow to represent heat, blue to represent oxygen, and red to represent hydrogen. First, I introduced the molecular structure of water and then we discussed how the molecules move differently in different temperatures. Solid particles move in a tight pattern in a restrictive space. Liquid particles are loosely clustered and move more freely at a medium speed than solid matter. Gas particles are far apart and move very fast and freely. Heat changes the speed of the movement of molecules.

For my class of sixteen students, I had student wear the yellow heat headband, five students wear the blue oxygen headbands, and ten students wear the red hydrogen headbands. To find out what role to play, students drew out color tiles that corresponded to the headbands. Then, the different colors would move to a different corner of the room. I explained that the oxygen atom bonds to two hydrogen atoms. So then the students formed their own H_2O molecule by hooking arms and moving together.

When the students adjusted to moving together, I told a story.

> *Imagine that you are solid particles of a frozen pond. You huddle closely together because you are so cold. Soon, you almost stop moving all together.*
>
> *Gradually, the sun warms the pond and it begins to melt. As you get warm, you begin to move first at a slow speed. Then, you begin to gently bump into each other. The outside H_2O molecules feel the heat first and melt away. Then the core H_2O molecules begin to melt too. Now you are liquid water.*
>
> *As the heat from the sun intensifies, you begin bouncing as you start escaping from the pond. You are now a gas particle, speeding up, and traveling through the entire space as the water evaporates.*

Soon you float in the air, then start to cool off. As more of your friends cool, you start sticking to each other to form clouds. You float freely in the sky.

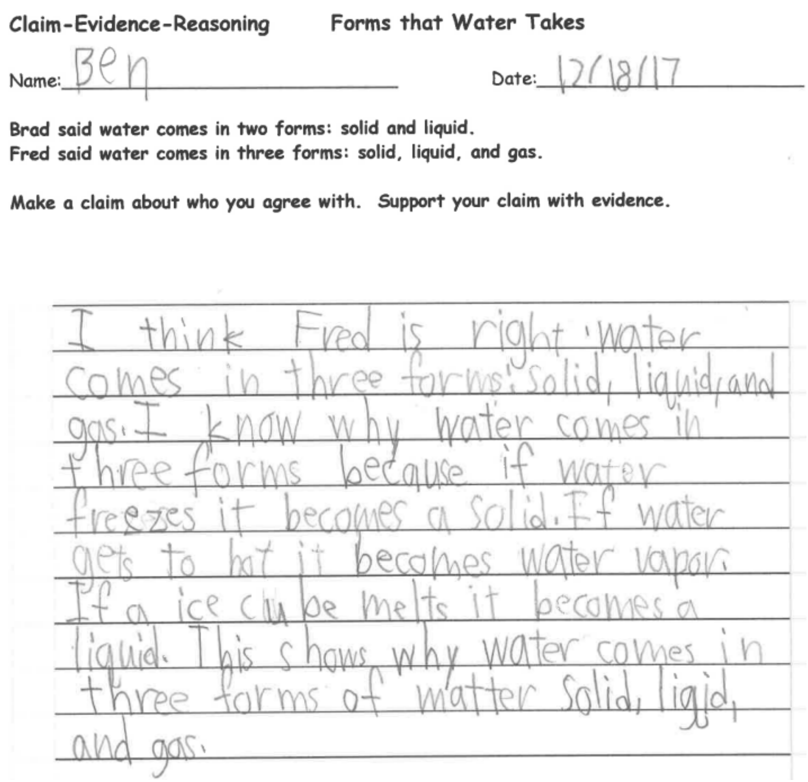
After a while, you and other water drops become too heavy to remain in the air as clouds. Gravity brings you down to earth as rain. Some rain drops seep slowly into the ground while others form tiny streams and others cling to plant leaves.

You cling on grass. As the sun goes down, you get cold and stop moving at all. Before long, you are a bit of frost on a blade of grass.

After listening and moving to this story, the students discuss what being an H_2O molecule is like in each of the states of matter. A nice follow-up activity is to use paper plates to show the water cycle: evaporation, condensation, precipitation, and collection. As the class works on this project, you can play soft water music and even retell the story.

CER

By using the structure of the CER framework, students can practice taking a stance on an issue, proving it with evidence, and explaining their reasoning. This skill is so universal, that it can stretch across content areas. On my first day of introducing CER, I used videos to help my students understand what I was asking them to do. Then I took a concept that they seemed firm on. I gave them about thirty minutes to us Epic to research and then another thirty minutes to write their response. Here is one example:



Claim-Evidence-Reasoning Forms that Water Takes

Name: Ben Date: 12/18/17

Brad said water comes in two forms: solid and liquid.
Fred said water comes in three forms: solid, liquid, and gas.

Make a claim about who you agree with. Support your claim with evidence.

I think Fred is right water comes in three forms: solid, liquid, and gas. I know why water comes in three forms because if water freezes it becomes a solid. If water gets to hot it becomes water vapor. If a ice cube melts it becomes a liquid. This shows why water comes in three forms of matter solid, ligid, and gas.

Fig. 8: CER Forms that Water Takes. Image credit: Merry Ostheimer

As we discussed their responses, the students began to understand that when they listen actively to arguments, they can discern when information is relevant or irrelevant. They can retell the main parts of an argument and be able to stay focused. Most importantly, the students felt empowered to speak about their ideas.

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Background on dew collection

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