Exploring the Water Cycle Teacher's Guide

Lesson Overview:
Students will observe/investigate the movement of water through the different stages of the water cycle and determine what drives this cycle. They will discover how changes in heat energy occur throughout the cycle. This lesson will take at least two 45-minute class periods to complete. The mini-project could be given as a homework assignment.

- *Engage*: Think-Pair-Share question and watch short (1:25) video (~10 minutes)
- *Explore*: Watch silent water cycle animation, complete capture sheet, check answers using PPT slides (~10 minutes)
- *Explain*: Teacher Demonstrations (~30 to 40 minutes- these can be split up and done on different days), then see video (6:31)
- *Evaluate*: Mini-Project to demonstrate understanding (~ 30 to 45 minutes)
- *Extend/ Elaborate*: Think-Pair-Share question and video, possible engineering design activity (~10 to 45 minutes)

NGSS:
ESS2.C: The Roles of Water in Earth's Surface Processes - How do the properties and movements of water shape Earth's surface and affect its systems?

3rd-5th grade: Most of Earth's water is in the ocean and much of the Earth's fresh water is in glaciers or underground.

6th- 8th grade: Water cycles among land, ocean, and atmosphere, and is propelled by sunlight and gravity. Density variations of sea water drive interconnected ocean currents. Water movement causes weathering and erosion, changing landscape features

Background Information:
Water is found almost everywhere on Earth, from high in the atmosphere (as water vapor) to low in the atmosphere (precipitation, droplets in clouds) to mountain snowcaps and glaciers (solid) to running liquid water on the land, ocean, and underground. Energy from the sun and the force of gravity drive the continual cycling of water among these reservoirs. Sunlight causes evaporation and propels oceanic and atmospheric circulation,

which transports water around the globe. Gravity causes precipitation to fall from clouds and water to flow downward on the land through watersheds.[1]

Additional Information:

- NASA Science/Earth: Water Cycle
- NASA GPM: The Water Cycle
- Earth Observatory Water Cycle Overview

Materials:

- Pre and Post Assessments – 1 each per student
- Water Cycle Capture Sheet – 1 per student
- Materials for Teacher Demonstrations (See Teacher Demonstration Instructions Sheet- Many of the demonstrations require advanced set up. Do read over these instructions at least a week before presenting these lessons.)

Engage:

1. Students will Think-Pair-Share an answer to the following question: "*What is precipitation*?" (slide 2) The teacher can record their answers on the board or chart paper.

2. Show the video, "The Freshwater Connection" (1:25) video (slide 3)
This is a short introduction to why it is important to study the water cycle.

3. After the video, have students Think-Pair-Share the question, "*Based upon what we just viewed, why is it important to study and understand the water cycle*?" (slide 4)

Explore:

1. Hand out the Water Cycle Capture Sheet. Students will use this throughout the rest of the lesson.

2. Show the water cycle video (slide 5). Students should be labeling their blank diagrams as they watch. This version of the water cycle is more complex than the one on their capture sheets. Students only need to copy the terms from the word bank.
The video has no narration so you will need to talk the kids though it, pausing as necessary.

[1] Authors: Achieve, Inc.; Next Generation Science Standards, Core Idea ESS2.C ; Publisher: Achieve Inc.; Copyright: 2013.

3. Here are some questions you will pose to guide their thinking as they work through the capture sheet:

- "*Which of the stages in the water cycle required energy from the Sun*?" (Evaporation and Transpiration.) Click on the diagram (slide 6) and the correct labels will be circles.
- Go to next slide. "*Which of the stages requires water to give off heat?*" (Condensation) (slide 7). Click on the diagram and the correct labels will be circles.
- Go to next slide. "*Which of the stages are driven by the force of gravity*?" (slide 8). (Precipitation, Runoff, Infiltration, Groundwater Flow) Click on the diagram and the correct labels will be circles.

Explain:

1. Teacher Demonstrations

Even though the procedures are long and preparation of materials needs to take place in advance, the demonstrations will only take about 30 to 40 minutes of class time. The demonstrations give the students a visual, concrete model of a relatively abstract concepts and processes. The understanding of the water cycle is important throughout their learning years and these demonstrations help to reinforce students' understanding.

If time permits, many of these demonstrations could be tailored to be hands-on activities.

2. Show the video, "Water, Water, Everywhere." (6:31) It ties together the concepts in the lesson and is a nice summarizer.

Evaluate: Universal Design for Learning approach

Students will complete a mini-project (slide 11) in which they describe one possible path that a water molecule can take through the water cycle.

1. They have the following choices in order to demonstrate their understanding:

Make a *mini-poster* with a diagram of the water cycle. (8.5" X 11" maximum)

- The diagram should not look just like the one we used in class. It should have the water molecule moving from one step to another.
- Each step in the cycle needs to have text that describes what is happening to the molecule. This text can be 'spoken' by the drop, or written as a caption near the drop.

Make a *comic strip* with a molecule of water as the main character.

- The comic must include text that explains what is happening in each frame.

- The text can be dialog 'spoken' by the drop, or written as a caption at the bottom of the frame.

Electronic Options for students who prefer to use a computer:

- Make a Glogster poster
- Make a computer-generated comic strip

2. Grade their projects with the rubric (slide 12) or set your own standards.

3. Administer the post-assessment as a summative assessment.

Elaborate/Extend:

- Have the students Think-Pair-Share answers to the question, "How do we measure precipitation?" Solicit and record responses. Be sure to add satellites to the list if the students left it off. Ask "*Which of these tools is the most efficient*?" Show the video For Good Measure (2:01) Tell students to find out how NASA's GPM (Global Precipitation Measurement) satellite mission is making precipitation measurements more efficient – even over the oceans.
- Engineering Design activity: Rain Gauge Design Challenge.
- Reading to Be Informed: Water's Family Tree: Where Did it Come From?

Additional Resources:

- You can find many additional educational resources and materials on our "Water Cycle" homepage.
- NASA's Scientific Visualization Studio: Water Cycle resources