Water and Global Climate Change

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Grade Level: Elementary, Middle School

Summary
In the fifth century BC, the Greek philosopher Empedocles defined water as one of the four elements: earth, air, fire, and water. Water was thought to be the primal substance from which all other substances were made (Marks, 1998). At the end of these lessons students will be able to describe how water moves in a cycle, going through many stages and that these stages affect climatic patterns. Students will also be able to demonstrate knowledge of the fact that Earth's surface is made up mostly of water with the majority of that being salt water. Finally, the children will be able to describe the difference between weather and climate. The class will participate in many different activities to accomplish these goals. The students will be engaged with an activity, will explore the concept, will explain their findings, elaborate on the concept in a real world context and then be evaluated on the learning. These will be used as a springboard for many of the discussions, including the difference between weather and climate. These will be used later in the lessons as well. The class will use a Cognitive Content Dictionary for vocabulary acquisition. Students will examine maps and globes of the earth and complete a map that shows the oceans as well as the polar ice caps, continents and currents. An activity that demonstrates the world's water sources (see all the water in the world) will be completed along with an in-depth examination of the water cycle. Finally they will look at water pollutants and how they affect the water cycle. When finished they will engage in the "Drop of Water "game. The children will roll a die and it will land of one of six locations from which to begin their journey. Then they will describe their journey as a drop of water. If time allows students will do an activity to experience what happens when polar ice caps melt and discuss an article on the islands of Kiribiti and Maldives where the people may have to relocate due to water issues.

Science Lessons Incorporating the Science Inquiry Cycle
The focus of the sixth grade science curriculum is Earth Science. Many public schools have chosen to remove the emphasis on science in the general curriculum as raising reading and math scores took predominance with the No Child Left Behind movement. The sixth grade standards are drawn from the 8th grade standard documents. This lesson incorporates some from the 5th grade documents so as to ensure that students have the proper background information to be successful in this field of study. The concepts addressed in this lesson are as follows:

- The Water Cycle
- The percentages of water on Earth

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- Water as it relates to weather
- Water as it relates to Global Climate Change
- Water as essential to the Earth and life on Earth
- Climate vs. Weather

Nevada State and Washoe County School District Standards

E.5.A.2 Students will know the processes of the water cycle, including the role of the Sun.

E.5.A.3 Students know most of Earth's surface is covered with fresh or salt water.

E.5.A.4 Students know the role of water in many phenomena related to weather (e.g. thunderstorms, snowstorms, flooding, and drought.)

E.8.A.2. Students know how the processes involved in the water cycle affect climatic patterns.

E.8.A.3 Students know the properties that make water an essential component of the earth system.

E.8.A.5 Students know the difference between local climate and regional weather.

N.8.A – Students understand that scientific knowledge requires critical consideration of verifiable evidence obtained from inquiry and appropriate investigations.

N.8.A.1 – Students know how to identify and critically evaluate information in data, tables and graphs.

N.8.A.2 – Students know how to critically evaluate information to distinguish between fact and opinion.

N.8.A.3 – Students know different explanations can be given for the same evidence.

One of the things this lesson focuses on is the integration of climate change standards into the science lessons. The Concept Statement that students will be able to identify is that, after careful study, the climate of the planet is changing. Students are able to identify the role of water as it relates to earth in general and the climate specifically. At the end of the unit the children should have had experience with all of the applications identified in the above standards.

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Basic Procedures

Observation charts are placed around the room. The lesson begins with groups of children moving from poster to poster writing their observations on the charts. This can be anything at all that they would like to take note of. These will be referred to all through the lessons. Because this poster will only allow for so much information, one example is given below, the "Polar Ice Melt" lesson. "All the Water in the World" lesson will be completed first.

1. Questioning and Theorizing

"What would happen if the polar ices caps, which hold 2% of the world's water, melted?"

2. Forming Hypotheses

The classes will typically divide with their hypotheses into two main groups: 1) that the water level would rise and cause flooding; 2) that the ice, because it is expanded water, takes up more room than water so there would be no change in the water level.

Basic Demonstration/Activity

The children fill a pan with half sand and half water.
They measure the depth of water in the pan.
They compute the depth of a block of ice.
They compute the area of the water surface.
They check the ice, water and sand hourly, continuing to make measurements.

Investigating our Hypotheses

Instead of 30 pans of water scattered about a small room, have the class do one model, or up to four models. This can be a challenge, because they will all want to be involved, so be sure divide up assignments fairly. Have groups of two take turns with each assignment, each group of children filling out the forms together. Round the decimal numbers to the easiest form to keep the math in control. Keep the focus on the science rather than on complicated math.

To analyze the data, have two children take turns checking the pan every hour. They should all report that the ice block is getting smaller and that the sand is becoming wet. The water level in the pan should rise slightly. The sand under the ice block will be cold, but not especially wet. The sand that was not under the ice block begins to become saturated.

The students will be constantly up looking at the progression of the ice melt. They will comment about who is right and who is wrong because of the high interest level. A lot of new questions may arise as a result of this experiment: What would happen if we used a different type of sand?

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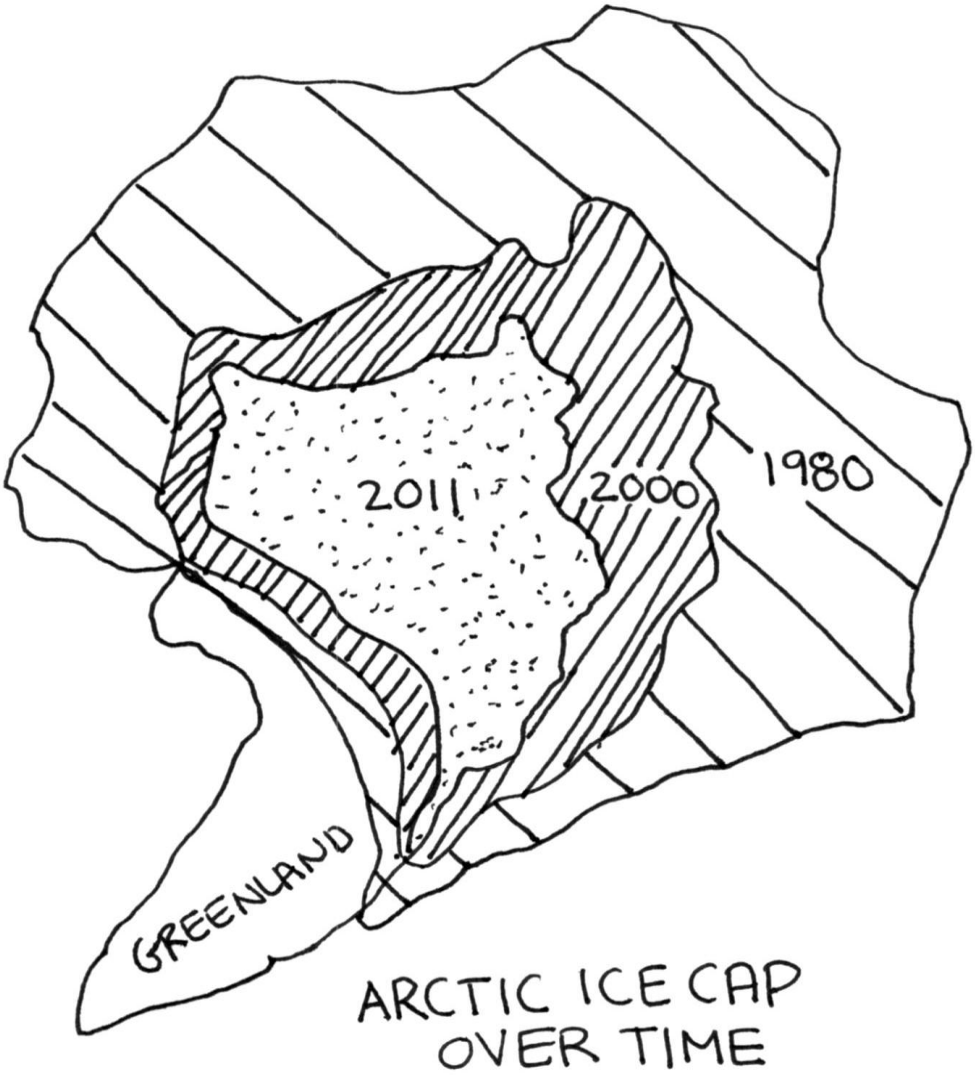
Should we have used more water and sand? Should we have used a bigger ice-block? Be prepared to re-investigate this many more times.

What ends up happening next is that the kids wanted to do it again and again. Use this teachable moment to emphasize that scientists repeat their experiment to see if the results are the same.



Incorporate a discussion of what might happen as a result of the fresh water mixing with the salt water. The fact is that this one little activity sparks so much enthusiasm that you will be able to re-visit material related to it all year long and use it as a reference for all other climate, weather and earth science activities.

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Differentiated Instruction

Use of the Guided Language Acquisition Strategies (GLAS) to meet the needs of ESL and SPED students specifically, and as an aid for all students who may struggle with the concepts is extremely beneficial. Tools suggested include: maps, pictorial input charts, poems and chants, cognitive content dictionary observation charts, and process grids.

Assessment Strategies

- Assessment tools and methods
- Pre-assessment to access prior knowledge and to get an idea of what children already know about this topic.
- Formative assessments, journals, and discussions to measure the learning that is taking place.
- Student work samples
- Worksheets

References:

Project G.L.A.D. (n.d.). Guided Language Acquisition Development. National Training Center Project GLAD, Costa Mesa, CA. Retrieved from: http://www.projectglad.com

United States Geological Survey. (1993). All the Water in the World Adapted from: Water: The Resource That Gets Used and Used and Used for Everything. United States Geological Survey, Reston, Virginia. Retrieved from http://www.epa.gov/region1/students/pdfs/gwa5.pdf

Erickson, S. (1987). When Polar Ice-Caps Melt. Aims Education Foundation. Retrieved from: http://www.utmsi.utexas.edu/k12/When%20polar%20ice%20caps%20melt.htm

Great Basin Outdoor School. (n.d.). The Water Drop Game. Retrieved from: http://greatbasin-os.org/

Marks, T. (1998). Elemental: The Four Elements from Ancient Greek Science and Philosophy to Ancient Sites Poetry. Retrieved from: http://www.webwinds.com/myth/elemental.htm

Woodward, J. (2009). Eyewitness Books: Water. DK Publishing; Har/Com edition.

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Additional Resources

www.drinktap.org/kidsdnn/Portals/5/story of water/html/earth.html

This site takes children to some simple reading material and follows up with a quiz. The quiz can be taken again and again and offers immediate feedback. It is accompanied by an easy to understand map of the water cycle.

http://news.mongabay.com/2005/1124-reuters.html

This has information of the islands in the Pacific that are disappearing and the resulting refugees.

http://www.kidzone.ws/water/

This shows the water cycle and has activities (better for younger children).

WWW.epa.gov/safewater/kids/gamesand activities.html

Use this site for a more activities if needed.

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