Climate, Climate Types and Global Climate Change

Deirdre Carney, Washoe Innovations High School
Grade Level – High School

Climate Change Classroom Project

Summary
The targeted scope of the lesson is to bring students to a significant understanding of the nature of Global Climate Change and how it may impact their experiences of natural phenomena in the northern Nevada area. It will personalize the experience of Climate Change in order to facilitate their understanding of the topic.

First a series of lessons beginning with an understanding of weather and weather patterns is completed early in a new fall semester. Introducing climate and climate types, exploring Global Warming & Climate Change is next. Finally students undertake to complete research of local impacts attributed to Global Climate Change (see Appendix A).

Science Lessons Incorporating the Science Inquiry Cycle
This project involves a coordinated series of lessons that would both satisfy Earth Science Standards as well as prepare students for a specific lesson on Climate and Climate Change. A series of lessons contains foundational information about the Earth's atmosphere and the water cycle. After, the focus shifts to local impacts of Global Climate Change. Prior lessons address students' lack of familiarity and knowledge of local climate patterns. Students are asked to describe their knowledge of Truckee Meadows/Washoe County/ Lake Tahoe weather patterns. Lessons are developed so that students will easily describe when to expect the most precipitation nor relate common minimum or maximum temperatures and when they normally occur. The "Normal Climate Patterns" lesson is adapted from one online that would serve to allow students to become more familiar with what climate patterns occur in their local area. This allows for making connections with changes in weather patterns due to Global Climate Change and current or expected patterns. The expectation is that by the middle of the school year students explore how Global Climate Change is manifested in the local region. A solid understanding of the Greenhouse Effect is essential that the subsequent lessons on the mechanics of Global Climate Change. Lessons on the Greenhouse effect and a more detailed introduction to how measurements of CO_2 levels and Global Temperatures are part of the sequence of introductory unit.

<u>Lessons Presented Prior to "Climate" lesson</u>:
Earth's Atmosphere

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Water in the Atmosphere – Clouds
Water in the Atmosphere – Humidity
Earth's Surface – Freshwater & Water Cycle
Weather and Weather Patterns
Climate Types
*Normal Climate Patterns
Greenhouse Effect
Evidence of Global Warming

Integration of the Nature of Science into Lessons

The lesson, "Normal Climate Patterns" is designed to address students' perceived lack of knowledge about climate patterns in their city. The major objective is to allow students opportunities to access graphs for interpretation of data. These lessons are consistent with the following Nevada state standards:

Atmospheric Processes and the Water Cycle (Earth and Space Science Unifying Concept A)

Earth systems have internal and external sources of energy, both of which create heat. Driven by sunlight and Earth's internal heat, a variety of cycles connect and continually circulate energy and material through the components of the earth systems.
E.12.A -Students understand heat and energy transfer in and out of the atmosphere and influence weather and climate.

Scientific Inquiry (Nature of Science Unifying Concept A)

Scientific inquiry is the process by which humans systematically examine the natural world. Scientific inquiry is a human endeavor and involves observation, reasoning, insight, energy, skill, and creativity. Scientific inquiry is used to formulate and test explanations of nature through observation, experiments, and theoretical or mathematical models. Scientific explanations and evidence are constantly reviewed and examined by others. Questioning, response to criticism and open communication are integral to the process of science.
N.12.A - Students understand that a variety of communication methods can be used to share scientific information.

<u>Questioning & Theorizing</u>

- Student teams state their predictions about some of the following:
- What months have the most rain and/or snow during the year?
- What is the average precipitation for the year?
- What month has the highest temperature?

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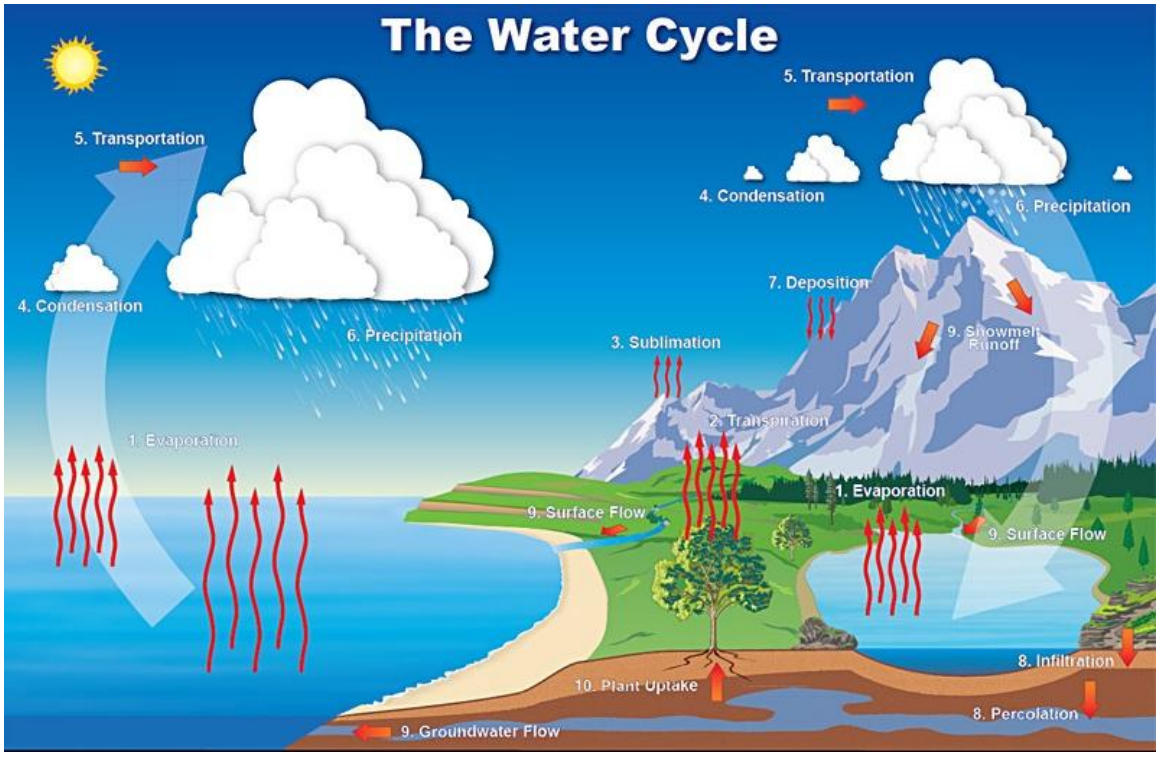
- What month has the lowest temperature?



Forming Hypotheses

- Students discussed their responses to the questions above.
- Generalizations about what the climate data would demonstrate and whether their perceptions of Reno weather patterns were accurate or not. (as a class).

Investigating a Hypothesis

- Students use data from the NOAA website to create temperature and precipitation graphs for multiple years of data.
- Students produce graphs from the data and then interpreted the results.
- Students make notations in their Science Notebooks recording their interpretations of the data for temperature and precipitation.

Synthesizing

- Students conduct a Think-Pair-Share activity to discuss measurements that they find unusual.
- Call to their attention prior years that have spikes in precipitation that seem outside the norm.

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- Students discuss how last year's data was consistent with their experiences that last winter was "dry" or "wet" and bring to bear their personal histories.

Extending Our Theories

- Suggest that students look at nearby weather patterns in California or explore weather patterns like El Nino or La Nina that might be connected to an unusual increase in precipitation for a particular range of data.
- One offshoot of the lesson will be an increase in the students' discussion of the local weather forecast.
- How are meteorologists able to use satellite data and computer models to forecast weather?
- Use computer modeling to help see how forecast of the landfall of Hurricane Sandy was accomplished.

Differentiated Instruction

With a diverse student population be sure to provide content in several ways. One way is to give a lecture to students on some portion of the content. Some students prefer to listen to the content as they complete notes in their notebooks.
Students that have difficulty following auditory instruction can access the presentation of the content via Edmodo pages set up ahead of time for each class. These presentations include video clips or hyperlinks to related information to deepen the instruction. This is an effective way to reach non-traditional learners. Students may also complete notes in their student notebooks.

Students always have a component of the lesson designed to allow them to work with a partner to read additional information and discuss their questions or findings. Most students work cooperatively and make good use of partner activities.

The students can share their findings with their teams, table groups or lab partners. The expectation is that all students will update their Science Notebooks as a method to demonstrate their interaction with the content and as a tool to use during quizzes. If some students struggle to keep their Science Notebooks up to date, they have access to instructor or classroom aides on a regular basis during the week. Modification of both assessments: the Science Notebook and quizzes to accommodate students that require oral response. Allow students to modify their quizzes by making corrections to incorrect answers with demonstration of textbook notations that support their corrected answers. This has been especially useful in allowing students to understand the content a bit better

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by researching the correct answers and then explain how their original answer was incorrect.

Assessment Strategies

Informal Assessment

Students are monitored for their level of understanding of the concept. Students are observed during their Think-Pair-Share activities for their types of questions and responses. Particular attention is paid to how they explain aspects of the content. Are they demonstrating a good understanding of the concept and able to express that using academic vocabulary?

Formal Assessment

The Science Notebooks are used to evaluate the ability of students to take adequate notes and make thoughtful responses where necessary. Students are encouraged to capture their thoughts or questions without feeling self-conscious. (I have found students often are reluctant to ask questions or share thoughts because they fear looking foolish). A Rubric is used to score the notebooks.

Quizzes are given three to five times during each quarter to assess students' understanding of the content. These assessments include multiple choice questions and some short answer questions. Students may use their Science Notebooks to answer the questions. This is also to support the use of the Science Notebook as both an assessment tool for the teacher and as a resource that students will use.

Presentations and Peer Teaching methods include students demonstrating knowledge of the content through peer instruction. This will be a way for students to become an "expert" in one aspect of the content. The "experts" will teach 2-3 other students a particular topic and groups will reassemble and rotate over a few class sessions. Students are assessed on their presentation skills, content knowledge, and their own abilities as an audience member.

Their Science Notebooks should be collected and reviewed frequently during the unit. Bell Ringer assignments are graded on days when given.

Teacher Notes on Implementing the Lesson

The school wide changes include implementing "Blended Learning" strategies and PBIS (Positive Behavior Implementation) strategies in the classroom to name a few. This makes it challenging for me to ascribe changes in the student response to simply implementing this way of teaching science. I have an intuitive sense that incorporating a more research based and inquiry method of teaching has enlivened my teaching. Incorporating more opportunities for students to direct the exploration of the content seems to allow my students to learn about topics that they may have an interest in. It is

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interesting to me, however, to note that many of my students are struggling with my expectations that they will increase their level of participation and interaction with the content. It is my opinion that while there is an expectation that activating student interest in content is inherently positive students are not always prepared to increase their level of demonstrating competency or mastery. It is also my opinion that the student population that I have in my classes seems to be challenged more to write and express their understanding of the content more than in the past. Modifying lessons wherein students will be more responsible for outcomes creates an environment in which students take ownership of the material and become more accountable for their own learning. My initial sense is that by reducing the level of teacher control the amount of student learning increases.

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