

Weather R.A.T.S.

WE LIVE IN AIR: PRE-TEST, INTRODUCTION

Grade Level: 4

Lesson # 1 in unit

Time Required for Lesson: 1 hour

Time Required for Unit: 15 wks.

Unit Summary: This unit examines weather patterns in four different parts of the Weather RATS network: Puerto Rico, Oklahoma, Arizona, and Massachusetts. Students will learn how to measure and track daily weather readings and discover the global connections between weather events in the four places. They will investigate global weather connections via the Jet Stream and other factors. As part of this unit, students will also study global contrasts in the water cycle, as it exists in each area. They will uncover the issues and social problems surrounding severe weather events in each area. Students will investigate how weather impacts people living in these areas by communicating with peers via the discussion forum. They will notice that even though people's daily lives are impacted in different ways by local weather, there are fundamental connections between weather events in different geographic locations: that we all "live in air," and are joined together by the atmosphere that sustains us all.

Lesson Summary: This lesson introduces the unit, the weather station, and the Weather RATS web site. Its purpose is to establish a level of background knowledge and raise awareness and engagement with the issues students will be working on for the next 15 weeks. Students will get their first look at the technology that will allow them to collect weather data and interact with peers around the country. This lesson could be conducted in a classroom, science lab, or computer lab.

Unit Standards:

MA Science/Technology/Engineering:

- E6 Explain how air temperature, moisture, wind speed and direction, and precipitation make up the weather in a particular place and time.*
- E7 Distinguish among the various forms of precipitation (rain, snow, sleet, and hail), making connections to the weather in a particular place and time.*
- E8 Describe 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.*

MA Instructional Technology:

Standard 1. Demonstrate proficiency in the use of computers and applications as well as an understanding of concepts underlying hardware, software, and connectivity.

PreK-4 Exploratory Concepts and Skills

- 1.1 *Develop basic skills for using hardware and applications (e.g., open/close a file, navigate using scroll bars, arrow keys, special keys, and mouse).*
- 1.2 *Use correct terminology for basic components of a computer system (e.g., monitor, keyboard, disk, printer, mouse), and develop understanding of their basic functions.*
- 1.7 *Collaborate with classmates to use teacher-selected web sites.*

Standard 3. Demonstrate ability to use technology for research, problem solving, and communication. Students locate, evaluate, collect, and process information from a variety of electronic sources. Students use telecommunications and other media to interact or collaborate with peers, experts, and other audiences.

PreK-4 Exploratory Concepts and Skills

- 3.3 *Explore the use of content-specific tools to enhance understanding of curriculum content (e.g., environmental probes, sensors, robotics, simulation software, and measuring devices).*

Unit Learning Objectives:

K-12 General:

- Be able to track local weather and compare it to weather in diverse geographic locations.
- Use emerging weather measurement and instructional technologies as tools to examine and address real-world problem situations, such as data collection, tracking and analyzing patterns in weather events.
- Develop an appreciation for the global nature of the atmosphere.
- Collect, analyze, and graph daily weather data for an extended period of time.
- Use mathematics as a tool for making sense of weather data.
- Increase students' understanding of how local weather and climate patterns affect the course of everyday life for people living in those places.
- Increase students' understanding of peers living in different cultures and geographic regions by communicating with them.

Level-specific:

- We Live in Air: investigating weather and exploring its impact on different economies, cultures, and diversity within CASA network.

- Connect the dots: tornadoes, hurricanes, and floods in the CASA states: where does the weather go, and what does it do in different places?

CASA Connection:

CASA is concerned with understanding and monitoring atmospheric phenomena in different parts of the country. Like CASA, the students will detect and analyze weather data in the lowest part of the atmosphere and draw connections between local data and global patterns. They will use mathematics and graphing to make sense of the data. Like CASA, students will investigate the cultural impacts of weather. The instrument that students will use to investigate the weather in the four locations is not networked DCAS radar, but a network of wireless weather stations. Students will learn how this network operates and learn something about CASA and what it does. Teachers should remember that the Weather RATS network is, in a sense, a microcosm of the elaborate networked system of radars that CASA is developing.

Lesson Background and Concept for Teachers:

Weather is defined as the conditions of the atmosphere in a particular time and place. The jet stream is the high-speed upper-atmosphere wind current that blows west to east, dividing arctic air masses to the north and tropical air masses to the south. While local weather conditions will vary, there will be broader connections between the locations based on where the jet stream is at any point in time. Locations on the southern side of the jet will be warmer and more similar than locations on the northern side.

Students may encounter severe weather during this series of lessons, including hurricanes, wildfires, and drought. The causes of these are ultimately tied to the water cycle, which will receive attention in this unit. Students should refer to their data sets when investigating the water cycle and its forms as part of classroom or lab science. For further detailed background on the water cycle, visit the Hydrologic Cycle page from Jetstream, the Online Weather School: <http://www.srh.weather.gov/srh/jetstream/atmos/hydro.htm> . Further background on other weather concepts can be found at Jetstream's Topic Matrix: <http://www.srh.weather.gov/srh/jetstream/matrix.htm> .

The Davis Vantage Pro II wireless weather station is currently used at all Weather RAT schools. At some schools, the weather station is one unit. At others, the station is mounted near the ground and the anemometer is mounted on the roof. One or both parts transmit a low-frequency radio beam to the console receiver, which uploads data to the dedicated computer into Weather Link software. Weather Link uploads the station data onto the Weather RATS web site, where students can view the data.

The Davis weather station consists of a rain gauge, barometer, and thermometer in the main unit, and an anemometer and wind vane in the secondary unit, which can be mounted separately or as part of the main station. Whether mounted on the main part of the station or separately, the anemometer and wind vane should be positioned about 30 feet above the ground. If mounted on the school roof, it should be 10-12 feet above the roof. The Weather RATS web site should have a photo of the weather station mounting for the school in question.

If possible, classroom/lab teachers should borrow the spare weather station so students can see the components up close. Schools that are part of the RATS network should have access to a spare station.

Key Vocabulary/Definitions:

- *Weather:* The state of the atmosphere at a specific time and place. It is the short-term variations of the atmosphere, as opposed to the long term, or climatic, changes. It is often referred to in terms of brightness, cloudiness, humidity, precipitation, temperature, visibility, and wind.
- *Air Temperature:* Measure of the average kinetic energy of air particles, expressed in terms of units or degrees. The degree of hotness or coldness of the air.
- *Wind:* Wind is moving air. Its movement is caused by differences in air pressure between adjacent air masses. Air under high-pressure moves toward areas of low pressure. The greater the difference in pressure between adjacent air masses, the faster the air moves. It is described with wind direction (based on compass directions) from which the wind is blowing, and speed.
- *Absolute humidity:* Ratio of the mass of water vapor contained in a certain volume of air.
- *Relative humidity:* The amount of water vapor in the air, given a certain temperature. What is usually meant when people say “humidity.” Its value varies with temperature. Useful for determining conditions of human comfort. 100% relative humidity is complete saturation of the air at a given temperature: all the water it can hold at that temperature.
- *Climate:* The historical record and description of average daily and in seasonal weather events that help describe a region. Statistics are generally drawn over several decades.
- *Water Cycle:* The Hydrologic Cycle involves the continuous circulation of water in the Earth-atmosphere system. Of the many processes involved in the hydrologic cycle, the most important are
 - * *Evaporation:* the change of state in a substance from a liquid to a gas.
 - * *Transpiration:* the evaporation of water from plants through stomata. Stomata are small openings found on the underside of leaves that are connected to vascular plant tissues. In most plants, transpiration is a passive process largely controlled by the humidity of the atmosphere and the moisture content of the soil.
 - * *Condensation:* the process whereby water vapor in the atmosphere is returned to its original liquid state. In the atmosphere, condensation may appear as clouds, fog, mist, dew or frost, depending upon the physical conditions of the atmosphere. Condensation is not a matter of one particular temperature but of a difference between two temperatures; the air temperature and the dew point temperature.
 - * *Precipitation:* the result when the tiny condensation particles grow too large, through collision and coalesce, for the rising air to support, and thus

fall to the earth. Can also be thought of as water falling from the sky in frozen or liquid form, and

- * *Runoff*: the process that occurs when there is excessive precipitation and the ground is saturated (cannot absorb anymore water). Runoff flows into streams and rivers, and eventually back into the sea. Evaporation of this runoff into the atmosphere begins the hydrologic cycle over again.
- *Jet stream*: High altitude, high-speed wind current that circles the globe in the northern hemisphere. It divides cool arctic air to the north from warmer, tropical air to its south. It moves and whips around from day to day, thus redistributing the locations of cooler and warmer air across the North American continent.
- *Air*: a collection of molecules that form a blanket around the Earth that is about 80 miles thick. It is comprised of 78% Nitrogen, 21% Oxygen, and 1% of argon, carbon dioxide, and other rare gases.

NOTE: These definitions are intended for teacher background information. These definitions will need to be simplified if they are used for direct instruction with students.

Materials Needed:

- Pre-test, 1 per student
- Access to Davis weather station, either in person or online
- Access to sample weather station which students can hold and examine is desirable
- Internet access

Lesson Sequence:

Introduction/Motivation:

Give students a preview of what they will be doing in this unit. Tell students they are beginning a unit that will take them through the next 12-15 weeks. They will investigate weather, measure it, build and evaluate instruments that measure it, communicate with peers in other parts of the country about their experiences with their local weather, study what happens in these other communities on a daily basis, and how all of them are connected in global weather patterns. They will do a lot of work with data from the school's weather station and collect a lot of data, which will be used for several purposes. All of the data collection will revolve around the idea of how weather impacts, or affect, people in their daily lives. How does weather impact students? Ask for some comments and insights from students. Do they know of other areas of the country that have been severely impacted by weather in some way?

As a starter, the teacher might administer a brief informal writing prompt "What do you know about the weather?" This will help students retrieve and organize background knowledge, and prepare them to address new content.

Body of Lesson:

Administer the pre-test. Explain to students that the pre-test gives baseline information on what they know at the beginning of a unit. It is perfectly OK not to know something at the

beginning. The pre-test will not be graded, but will be held, unmarked, until the end of the unit. At that time, an identical post-test will be given, which will be formally graded. Students will get back both papers at once, with the pre-test stapled on top, and the post-test on the bottom. Students will have a clear idea of how much they learned on the Big Ideas during the unit. Even though the pre-test is not graded, students are expected to give their best effort and write down everything they know on these ideas, even if they aren't sure they are correct. Students should take at least 30 minutes to complete the pre-test. After they are all finished, collect the papers.

The pre-test can also be administered as a carousel activity, in which the pre-test questions are written on separate sheets of poster paper and posted around the classroom. Student groups, each with a different colored marker, move from poster to poster and add comments to each one. They can cross off comments if they see something they believe is incorrect. Because they are using specific marker colors, each group's additions and revisions can be tracked and discussed later. These pre-test posters can be saved until the end of the unit and put up again for final reflection and revision. This method allows students to collaborate and communicate about their understanding, use time efficiently, and engage in kinesthetic learning. The growth and development of the class' ideas can be tracked from the beginning to the end of the unit. It does not, however, provide any evidence of individual student growth in understanding. It is up to the teacher to decide what the primary goal is: to keep a record of individual student growth, or class growth.

Closure:

Give students an introduction to the Davis weather station. Walk students to the weather station's location, or go onto Weather RATS web site to see it. If possible, use the "spare" weather station and bring it into the classroom for students to touch and handle. Explain what each part is and how it works. Remove the black chimney to reveal the rain gauge. Show how the rain gauge is a lever that seesaws back and forth, counting tiny amounts of rain. Show students the cups on the anemometer and the wind vane, which points in the direction of the wind.

Ask students if they can read any weather data directly from the station. Do they see a screen with numbers or letters? All they see is a transmitter box with a solar panel and an antenna. Explain how the solar panel makes electricity to run the transmitter that beams data to the console. From the console, show students the wire that connects to the computer. Explain that the data are uploaded onto the Internet from the computer. Everyone has to look at the weather station's data on the Weather RATS web site, not on the station itself. Before leaving the weather station's outdoor location, do a quick oral "pop quiz" and ask randomly selected students basic questions about what the parts of the weather station are and what they do.

Show students the web site and how to find the weather data for their school. If time allows, show students the other parts of the Weather RATS web site. If time does not permit going on the web site today, be sure students have that opportunity in the near future.

Assessments:**Pre-lesson:**

Whole-class discussion of background information on weather and its impact on daily life. Do students show awareness of what weather is and how it affects their decisions and activities?

In Process:

Pre-test, either individual or whole-class carousel.

Summary:

Student questions and comments when viewing weather station. Do students see the parts of the weather station and how they work together to put data on the Internet?

Oral “pop quiz” on parts of weather station and how they work. Do students understand what the parts of the weather station are and how they work?

Lesson Extensions:

Other engaging writing prompts can be used instead of or in addition to the ones given above. For example, students can be asked “What are the four ingredients of weather? If you were a chef and a customer ordered the Thunderstorm entrée, what ingredients would you need to prepare it?”

Students and teachers can also do the Weather Scavenger Hunt. This is a great way to engage students’ observations of the world around them and connect them to unit content. Student groups can explore the schoolyard or other chosen location to observe and record details in their environment that are impacted by weather. After completing the Scavenger Hunt, student groups can prepare responses for a class discussion of how weather impacts the world around them.

References:

Jetstream Online Weather School: <http://www.srh.weather.gov/srh/jetstream/matrix.htm>

Weather RATS web site: <http://weatherrats.cs.umass.edu/wxrats/index.php>

NOAA Weather page (alternative data source): <http://www.noaa.gov/wx.html>

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Name _____

Date _____

Homeroom _____

PRE-TEST

1. What is weather?

2. What is climate?

3. Describe the weather and climate in your town.

4. Draw and label a basic diagram of the water cycle.

5. What is the jet stream, and how does it affect our weather?

Name _____

Date _____

Homeroom _____

POST-TEST

1. What is weather?

2. What is climate?

3. Describe the weather and climate in your town.

4. Draw and label a basic diagram of the water cycle.

5. What is the jet stream, and how does it affect our weather?

15. Something that will soak up the rain

16. Something that smells better after a shower

17. Something shaped by wind or water

18. An object the color of the sky today

19. A spot that receives no sunlight

20. Something that makes rain splatter