Collecting Weather Data Research Activity

Teacher:	**Lesson Topic:**
Curriculum Standard:	**Fifth Grade:** ● ESS.5.1.1 Analyze and interpret data to compare daily and seasonal changes in weather conditions (including wind speed and direction, precipitation, and temperature) and patterns. ● ESS.5.1.2 Analyze and interpret weather data to explain current and upcoming weather conditions (including severe weather such as hurricanes and tornadoes) in a given location. **Seventh Grade** ● ESS.7.1.3 Analyze and interpret data to explain the relationship between the movement of air masses, high and low pressure systems, frontal boundaries and weather conditions that may result. ● ESS.7.1.4 Use models to predict weather conditions based on observations (including clouds, air masses, fronts), measurements (wind speed and direction, air temperature, humidity and air pressure), weather maps, satellites and radar.
STEM Categories	Use Models Analyze and interpret data Construct Explanations
Essential Question:	What can we learn about our climate from daily weather data?
'So What' Factor	Collecting and analyzing daily weather data supports climate change monitoring by tracking long-term trends and informing policy decisions. Public health and safety also benefit from weather monitoring, particularly in air quality management and disease prevention.

Investigation Goals	
What do Students need to know….	**What do students need to do…**
● Data can be collected to analyze wind speed, precipitation, air pressure and temperature. ● This data changes daily and seasonally. ● Weather data can help make predictions for upcoming weather and potential storms. ● Long term weather trends can inform us on changing climate.	● Analyze weather data graphs to begin drawing conclusions. ● Use weather tools to collect their own weather data. ● Observe digital weather data collection through raspberry pi. ● Differentiate between weather and climate. ● Connect long term weather data trends to ideas surrounding climate.

Materials	Thermometer: ● Clear Plastic Straw ● Ruler ● Fine-tipped permanent marker ● Narrow-necked plastic bottle with lid ○ (small bottles used for food-coloring or vanilla extract work best) ● Water ● Rubbing Alcohol ● Food coloring (just a few drops) ● Modeling clay ● Pipette Barometer: ● Small coffee can or empty food can ● Balloon ● Scissors ● Tape ● Drinking straw ● Index Card or sturdy piece of paper ● Rubber band Anemometer: ● Scissors ● 5 cups (such as dixie or solo cups), one should be of a

	different color or easily discernible • Pen • 2 strips of stiff cardboard/wooden dowels • Ruler • Stapler • Push pin • Pencil with an eraser on the end • Watch with a second hand or a timer. • Calculator Raspberry Pi: • Raspberry pi • Monitor, keyboard, mouse • MPL3115A2 sensor

Investigation Procedure/Scientific Method		
	Description/Key Points	**Points**

Observation	• Navigate to this weather data website
	• Use the search feature to locate the nearest weather station to your location.
	• Allow 3-5 minutes for students to explore the current weather and make any observations
	• Direct students to the **"Plot Recent Data"** tab.
	• Begin with temperature:
	  ○ Select **"Monthly"**
	  ○ Select **"Past 10 Years"**
	  ○ Select **"Average Air Temperature"**
	  ○ Select **"Update Plot"**
	• Provide students with two minutes to observe the graph that has been generated and record observations
	  ○ Seasons, average temperature in winter is trending warmer
	• Select **"Clear Plot"**
	• Allow students 5 minutes to create and	

	observe graphs exploring any parameters they wish. ○ Inform them that they must have one observation to share out loud at the end of the time.	
Idea & Questions	Inform students that today they will be making their own weather data collection tools and practice collecting weather data. **Question:** *What can we learn about our climate from daily weather data?*	
Hypothesis	● Students write an answer to the question that is <u>testable</u> using the materials available in this investigation. ● "I hypothesize that……"	
Experiment/Test	**Weather Data Stations** Students will rotate through a series of stations where they will build their own weather data collection tools and also work with weather data technology on the Raspberry Pi. **Thermometer** 1. The clear plastic straw will become the narrow tube of your thermometer. Use the marker to make small marks on the straw, from the top down, at half-centimeter intervals. These marks will serve as level marks on your thermometer. 2. Modeling clay will seal the bottle's neck and hold the straw in place. Mold the clay until it feels soft and elastic, then form a ball and push it flat. This round flat piece of clay should be bigger than the neck of your bottle. 3. Use your straw to punch a hole in the	

middle of this round piece of clay, just big enough to allow the straw to go through.

4. Remove any clay clogging the straw (toothpicks work great for this). Don't put the clay cap on the bottle until **Step 6.**
5. Fill the bottle about halfway with rubbing alcohol and a few drops of food coloring, put the lid on the bottle, and shake well.
6. Take the lid back off of the bottle and place your clay cap over the opening. The straw should be immersed in the liquid, but NOT touching the bottom of the bottle. The jar should be closed off to any outside air.
7. Use the medicine dropper to drop the colored alcohol solution into straw until the liquid reaches about halfway up the straw.
8. This is now your Room Temperature. Draw a symbol on your straw to indicate room temperature.
    a. Make note of the actual temperature using a digital thermometer.
9. Take your thermometer outside and observe the way the liquid changes. Does it raise or lower?
    a. Use a digital thermometer to make note of the temperature.

Barometer:

1. Cut the neck off the balloon and stretch it to cover the top of the can and secure it using the rubber band. The balloon should form an airtight seal over the can.
2. Place the straw horizontally on the top of the can. Make sure it is centered (looking down, the straw should split the top of the can into two half circles). Tape the straw in place.
3. Tape the index card to the can behind the straw (you may need to trim the straw for this).
4. Record the location of the straw on the index card with a pencil. Find the current

	barometric pressure for your location at https://forecast.weather.gov/MapClick.php?lat=34.2367&lon=-77.9462 and label your index card with the true pressure (ex. 996.2 mb) 5. Continue recording the location of the straw as often as you want. Does the location of the straw change? 6. For a particular straw reading, you can look up the current pressure at a nearby station and make note of it on your card. **Anemometer:** 1. Cross the cardboard strips so they make a plus sign and staple them together. 2. Using the ruler and pencil, find the center of the two pieces of cardboard by drawing lines down the center of each piece and finding where they intersect. 3. Staple 4 of the cups, including the cup with the different color, to the ends of each cardboard piece. Make sure all the cups are facing the same direction relative to the cardboard pieces. 4. Push the pin through the center of the cardboard pieces. Take the pencil and push the eraser onto the pin sticking out of the cardboard pieces. 5. Using the scissors, poke a small hole in the center of the bottom of the remaining cup. Insert the pencil into this cup. 6. Bring your anemometer outside to a windy spot. 7. Using the stopwatch, count the number of rotations in 15 seconds and multiply this number by 4 to get the number of rotations per minute (rpm). **Raspberry Pi Station:** 1. Complete all Raspberry Pi technical setup and hook up the MPL3115A2 sensor. 2. Press run on the code and observe the	

	following data: a. Barometric pressure b. Temperature c. Altitude	
Results & Analysis	**Create class averages:** ● Have each student fill in their collected data for temperature, pressure and wind speed on a master class data table ● Find the average ○ Repeat measuring the weather data as often as possible. Use averages to update graphs posted in the classroom to visualize data. **Read the following article as a class** ● What Do We Mean by "Climate" and "Climate Change"? **Discussion questions:** ● How is weather different from climate? ● How are weather and climate related? ● Why do we collect daily weather data? ● What can we learn from this data?	
Science Communication & Assessment Options		
Data Talk: ● Revisit the weather data website. Students can pick a piece of weather data and a graph to present. In their explanation of the graph they must include: ○ What data we are seeing ○ What it tells us about our daily weather ○ What we can learn about our climate from studying long term trends.		
Extensions: ● Use Raspberry Pi's to set up a school weather station, continue to collect daily weather data.		