



7th Grade Lesson

NC State Science Standards:

- 7.E.1.4 Predict weather conditions and patterns based on information obtained from:
 - Weather data collected from direct observations and measurements (wind speed and direction, air temperature, humidity, and air pressure).
 - Weather maps, satellites, and radar

Essential Questions:

- What characteristics of weather do we measure and how do we measure them?
- How do these measurements help meteorologists make predictions about the weather?
- What is weather forecasting?
- What tools do meteorologists use when forecasting?
- List a variety of ways meteorologists measure temperature, wind speed/direction, air pressure, and humidity.
- Why are long-range weather forecasts more difficult to predict than short-term forecasts and how do we improve them?

Brief Lesson Description:

Students explore the intricacies of meteorology, weather instruments and forecasting through a station lab, weather data collection, and development of their own 5-day weather forecast. Students will investigate the importance and intricacies of weather forecasting.

Performance Expectation(s) and Specific Learning Outcomes:

- Students will be able to describe the weather using qualitative observations.
- Students will be able to describe the weather by measuring characteristics such as temperature, wind, and precipitation and collecting quantitative data.
- Students will be able to explain how meteorologists predict the weather and how forecasting has improved based on improvements in technology.

Prior Student Knowledge:

- Familiarity with characteristics of weather such as temperature, precipitation, air pressure, and wind.
- Basics of weather formation such as air mass development and movement, frontal systems, and types of weather formed by the interaction of air masses.

Possible Preconceptions/Misconceptions:

- The weather is easy to predict.
- Weather and weather forecasting is a consistent and exact science.

Materials:

Thermometers
Anemometers
Fans (small desk will work)
Jars
Straws

Balloons
Tape
Index cards
Heat lamps
Rulers
Rubberbands
Computers

LESSON PLAN - 5-E Model	
ENGAGE: Opening Activity - Access Prior Learning / Stimulate Interest / Generate Questions:	Time: 30 minutes
<p><i>How accurate are weather forecasts and how do meteorologists make their forecasts?</i></p> <ol style="list-style-type: none"> Ask students if they have ever heard the weather person is always wrong? This is a common complaint. You check the weather forecast for the day. It says sunny all day, but then a storm rolls through in the afternoon dumping rain all over your plans, and you didn't bring an umbrella! Have students read: <ul style="list-style-type: none"> https://www.scientificamerican.com/article/why-are-weather-forecasts-often-wrong/ <ol style="list-style-type: none"> Have students use turn and talk to explain if they agree or disagree that the weather person is always wrong. Encourage students to use evidence to back up their argument. Now that they have discussed it, poll students using a Mentimeter poll or some other form of polling strategy. Share results, but save them for later in the lesson. <ul style="list-style-type: none"> https://www.mentimeter.com/ Explain to students that they are going to be exploring this idea of weather forecasting and accuracy. They will become meteorologists during this lesson! 	
EXPLORE: Lesson Description - Materials Needed / Probing or Clarifying Questions:	Time: 180 minutes
<ol style="list-style-type: none"> Explain the <i>Weather Forecasting Station Lab</i> to students. Facilitate the lab as students work through each station in groups of 2-3. <ol style="list-style-type: none"> Station 1: Measuring Temperature with a Thermometer Station 2: Measuring Precipitation with a Rain Gauge Station 3: Measuring Wind Speed with an Anemometer Station 4: Measuring Air pressure with a Barometer Station 5: Understanding Satellite Systems Station 6: Understanding Radar Station 7: Using Weather Maps When students have completed the lab, have students summarize their findings and share what they learned with other groups. Ask students how all of these might be used together to make weather forecasts. Collect student ideas on how weather forecasts are made utilizing the weather tools on an anchor chart. 	

EXPLAIN: Concepts Explained and Vocabulary Defined:

Time: 60 minutes

1. Explain to students that they will take what they learned in their station lab and connect it to how weather forecasts are created.
 - a. Show students the video: <https://www.youtube.com/watch?v=LIWCStJ3BCU>
2. Facilitate working through the *Weather Tools Foldable*.
3. Discuss with students any further questions they may have about what they have learned about measuring the weather and how meteorologists utilize these measurements to make forecasts. You may wish to revisit the anchor chart here.

ELABORATE: Applications and Extensions:

Time: 2 weeks

Part A:

1. Explain to students that they will now collect their own weather data using the instruments they learned about in the station lab.
 - a. *We suggest using the instruments they explored in the station lab, however; you may have students utilize more accurate instruments such as weather kits provided by The Science House or the State Climate Office. There are also some excellent weather data collection devices that can be purchased such as PocketLabs.*
 - b. Have students use their instruments to collect weather data daily for a week in groups of 4. *They will return to these same groups for Part C of the activity.*
 - c. Once collected, have students share and compare their results with other groups. Have students try to identify trends in their data between groups.
 - d. Ask students what would be more helpful if we are trying to find trends. Hopefully, students will suggest more data!

Part B:

1. Show students the ECONet website. It is important to take some time to show the students how to use the website and where to find the information they need. Use the *Cardinal and ECONet Tutorial* in the *Supplemental Materials* folder to help facilitate.
2. Have students use ECONet to compare their data and look for trends.
 - a. We suggest having a NC State Climate Office scientist come into the classroom to talk about how to use ECONet and talk about meteorology with your students.
 - b. Challenge students to make their own weather forecast segment utilizing their new tools!

Part C:

1. Show students the video: <https://www.youtube.com/watch?v=DviDqe-qjPE>. Explain to students that they will be making their own weather forecast using their data and some other resources, just like meteorologists do. *You may want to show past weather forecast segments for your area in NC to give the students some inspiration as they are creating their own segment.*
2. Have students use their own data collection, ECONet, and GOES satellite (<https://zoom.earth/>) images to make a 5-day predictive weather forecast segment.
 - a. *Students can use Flipgrid, iMovie, or some other platform for making and submitting videos.*
3. Have students upload videos to a shared platform such as canvas so other groups can view them.

- a. Discuss any similarities/differences in the forecasts. How accurate were they? What would have helped their forecasts be more accurate?
 - b. Discuss with students how models, computer simulations, larger-scale data acquisition, are important in weather forecasting accuracy.
4. Come back to the question of are weather forecasts really that inaccurate. Discuss why weather forecasting can be difficult and what tools help make it as accurate as possible.
- a. Read the article:
<https://letstalkscience.ca/educational-resources/stem-in-context/why-weather-so-hard-predict>
 - b. Have students work together to complete the accompanying reading strategy:
 - i. How to use Question-Answer Relationship Strategy:
<https://letstalkscience.ca/educational-resources/learning-strategies/question-answer-relationship>
 - ii. Why is the weather so hard to predict? Question-Answer Relationships Strategy:
<https://docs.google.com/document/d/12kXwS2eE6NKJXvyUWwVEQLmat9QbPOWgrAlgDt4D9xc/edit>

EVALUATE:	Time: Throughout Lesson
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Formative Monitoring (Questioning / Discussion):

Formative assessment can be conducted throughout the lesson.

Summative Assessment (Quiz / Project / Report):

Summative assessment can be conducted during the investigation, elaborate, and extension activity.

Elaborate Further / Reflect: Enrichment:	Time: 60 minutes
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1. Explain to students that weather forecasting has been around for a very long time. We can find many early attempts to forecast the weather in folklore.
2. Have students explore weather folklore through the following resources:
 - a. Weather Wiz Kids: <http://www.weatherwizkids.com/weather-folklore.htm>
 - b. *A January Fog Will Freeze a Hog and Other Weather Folklore* by Hubert Davis
 - c. Farmer's Almanac: <https://www.almanac.com/weather-lore-calendar>
 - d. NCSCO Blog Post:
<https://climate.ncsu.edu/blog/2014/11/famous-folklore-suggests-a-cool-winter-awaits/>
3. Have students choose one of the folklore sayings and research if there is actual meteorological science behind it. Students can also draw from what they have learned about weather, as well.
4. Have students write a children's story or create a comic strip about their saying and the science behind its meaning.
5. Have students share their stories/comic strips with each other.