Lesson Title: Predictable Patterns

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Topic: Patterns in weather, Data Collection, Decoding Vocabulary

Targeted Grade Level: 3rd

**Time Needed**: At least 6 days of instruction, or 12 days for data collection

Subject Integration: Science, Math, Literacy

<u>Justification:</u> Understanding that students must make sense of weather data and its impact on human planning, and climate tracking, it is important to teach each skill necessary for the foundation.

In order to talk about the concepts of weather, students must decode, and internalize the vocabulary. In order for students to debate weather, and write about weather, they must feel confident in how the terms relate to each other, and feel confident using them. Knowledge of the root words will allow them to mentally retrieve the terms needed in quick discussion. Knowledge of decoding patterns will allow them to access non-fiction text, and produce the correct vocabulary in their field notes.

To collect data like rainfall and temperature, students must first master the skill of measuring them with a thermometer and ruler. This skill will be practiced and tested for 3 days before it is used to log their data. Students will move on to find differences in the values as a way of authentically comparing the data collected.

Laying the groundwork of Math and Literacy skills will allow for unfettered deeper thinking within the scientific core concepts
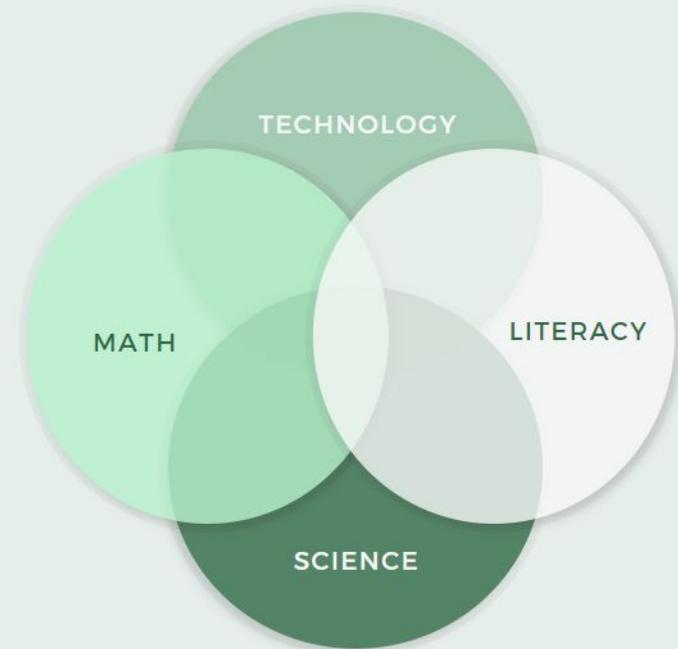
Measurable Student Learning Objectives

Students will be able to make initial observations and infer causation.

Students will be able to collect and display data and compare it to that of their peers.

Students will be able to interpret measurements, and grapheme patterns.

Students will be able to revise how they collect data and draw conclusions from the new data.

Students will be able to critique the data and conclusions of their peers.

Students will be able to categorize weather observations to predict future weather.

Students will be able to analyze the patterns of temperature, precipitation, weather conditions, and cloud formations

Nature of STEM: *This lesson addresses the distinction between observation and inference when student's preconceptions about clouds, weather, and climate are challenged. Students are also deriving their knowledge from observations of the natural world. There is great potential for discussion to turn to how these patterns (especially hurricane formations) impact at risk populations, creating an opportunity to explore how it is socially embedded.*

| Science and Engineering Processes	Disciplinary Core Ideas	Crosscutting Concepts
Analyzing and Interpreting Data ❖ Introduce quantitative approaches to collecting data ❖ Conduct multiple trials of qualitative observations ❖ If possible, digital tools should be used Students will represent data in tables and other various graphical displays to reveal patterns that indicate relationships.	Weather and Climate ❖ Just like scientists, students will record patterns of the weather across different times and areas so that they can make predictions about what kind of weather might happen next	Patterns ❖ Patterns can be used to make predictions ➢ Weather patterns ➢ Patterns of 10 (metric) ➢ Orthographic patterns ➢ Visual patterns in data

Standards:
- ❖ Standard 1: Oral Expression and Listening
  - ➢ GLE 1: Participate cooperatively in group activities.
- ❖ Standard 2: Reading and Writing for all purposes
  - ➢ EO c.i: Use information gained from illustrations (for example: maps, photographs) and the words in a text to demonstrate understanding of the text (for example: where, when, why, and how key events occur). (CCSS: RI.3.7)
  - ➢ GLE 3: Apply knowledge of spelling patterns (orthography), word meanings (morphology), and word relationships to decode words and increase vocabulary.
- ❖ Standard 3: Earth and Space Science
  - ➢ GLE 1: Climate describes patterns of typical weather conditions over different scales and variations; historical weather patterns can be analyzed.
    - ■ EO a: Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season. (3-ESS2-1) (Clarification Statement: Examples of data could include average temperature, precipitation, and wind direction. Obtain and combine information to describe climates in different regions of the world.)
- ❖ Standard Mathematical Practices
  - ➢ Developing mathematical practices are processes and proficiencies necessary to flexibly use skills and concepts in multiple contexts
    - ■ Use appropriate tools strategically
- ❖ Standard 3 Data, Statistics, and Probability
  - ➢ Measurement & Data
    - ■ Generate measurement data by measuring lengths using rulers

Day 1- Engage

Procedure (35 minutes):

1. Students are exposed to the phenomena🔗 through flipgrid🔗

2. Students are asked to make observations about what they see. Encourage students to use accurate adjectives when describing Form. Students may infer causation behind cloud formations. This is all recorded in flipgrid as a pre-assessment.

3. The teacher will transfer the classroom thinking to one space to reference later.
-Teachers should formatively assess preheld vocabulary and concepts as well as a student's ability to communicate academically.
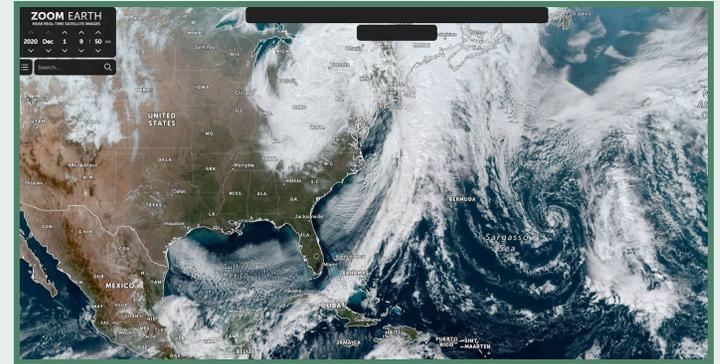
Modifications:

💬 Support ELL students as well as students less confident in their verbal ability with sentence frames for academic discussion:
   "I see a _____ shape. I think this is because of_____." "I notice that the colors are _____. This could be from _____."
   "I observe a pattern of _____. The texture seems _____."

👁 The phenomena is accessible to emergent readers, as well as second language learners because it is visual.

👁‍🗨 Flipgrid allows for recording without video. This gives students a chance to keep their remote setting private.

📅 Having the discussion on flipgrid allows remote students who could not be a part of the live observation, a chance to come back in their own time and engage with the thinking of their peers.

💬 Extension- When students finish recording their response, they should be encouraged to respond to each other's video.

Standards	Skills

❖ Standard 1: Oral Expression and Listening
  ➤ GLE 1: Participate cooperatively in group activities.
❖ Standard 2: Reading and Writing for all purposes
  ➤ EO c.i: Use information gained from illustrations (for example: maps, photographs) and the words in a text to demonstrate understanding of the text (for example: where, when, why, and how key events occur). (CCSS: RI.3.7)
	Students learn to effectively **communicate** in written, digital, artistic, and oral forms. Students learn to explore and articulate their own points of view, while respectfully exploring and understanding the perspectives of others.

Day 2, 3, 4- Explore

Set Up (45-60 minutes once):
1. The class should determine a guiding question. This may vary based on their schema and interest. The teacher may lightly guide the questions to be centered around patterns of clouds in different parts of the world.

2. Students can only make direct observations about their local weather and clouds that will lead to further questioning. Students should decide to collect* data on precipitation, temperature, conditions, and cloud Form.

Equipment to measure this may vary. Teachers can use physical thermometers or digital thermometers online, both technologies should be acknowledged. Students may decide to set up a rain catcher in a way that makes sense for them. Some may even be inspired to log wind direction or speed. If students design a technology to measure something, that should be highlighted

3. Form A should be filled out semi-uniformly. The guiding question is suggested to be the same for everyone, but this could be changed.

Log (30 minutes, two times per day)
4. Students explore any outdoor setting they have access to. They may consult the separate technologies they have access to (rain jar, thermometer, etc.)
5. Students are asked to make observations in Form B about what they see. These observations will reflect their current understanding*.

Explicit instruction about cloud types, how to read ruler, thermometers, and more, has not taken place. These three days are a student structured inquiry, and acts as a benchmark for their growth.

Modifications:
Support ELL students as well as students less confident in their written ability with sentence frames for academic writing:
   "In the sky I see _____." "The air feels like _____."

Observations could be making observations by looking out of a window. A digital version of the log book will be available for unreachable students.

Students who miss a day of logging data may rely on a peer

Extension- If it doesn't come up naturally, try discussing how measurements may be different depending on the size of the rain jar, or the location of the thermometer.

Our guiding question

This is a picture of how we will set up the equipment | We will collect the following data

These are the steps we will follow to collect data
_____
_____
_____
_____
_____
_____
_____

Form A

	Day 1 Date:	Day 2 Date:	Day 3 Date:
General Morning Observations: "In the sky I see ____" "The air feels like ____" "I would describe the weather as ____"			
Do we have a chance of rain? Why?			
Symbol for the weather (On the page before)			
General Afternoon Observations: "In the sky I see ____" "The air feels like ____" "I would describe the weather as ____"			
Amount of precipitation:			

Form B

Standards	**Skills**

Standards

❖ Standard 3: Earth and Space Science
  ➢ GLE 1: Climate describes patterns of typical weather conditions over different scales and variations; historical weather patterns can be analyzed.
    ■ EO a: Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season. (3-ESS2-1) (Clarification Statement: Examples of data could include average temperature, precipitation, and wind direction. Obtain and combine information to describe climates in different regions of the world.)

Skills

Students will show **critical and creative thinking**.

Students can:
–generate questions to deepen understanding
-use a design process to identify possible solutions to a problem
-develop a prototype
-reflect on and adjust ideas based on failure and success
-use their imagination to think of new ideas and extend the ideas of others
-adapt to new environments using past experience

Day 2,3,4 continued

Literacy Skill (≈ 60 minutes each day)
6. Assuming students have previously been taught cvc structure and short vowels, this time should be used to explore digraph structures.

Day 2- ee, ea, ai, ay, oa, ie

  A. Present the Vowel Team presentation with Pear Deck, have students join on computers, or, if unavailable, use whiteboards
  B. After whole group, have students determine the sound of a vowel team in weather related words: heat, season, deep, rain, sea, hail, clear, breeze, sleet, freezing, sunbeam, coast, sunshine

Day 3- oi, oy, ou, ow, au, aw

  A. Present the Vowel Digraph presentation (the "band-aid brothers"), have students interact in a way that is accessible (Some words at the end may have vowel teams from the previous day)
    a. It is very important that you have students holding their jaw and feeling how the air passes and the sound is constructed
  B. After the whole group, have students search nonfiction weather texts for either kind of vowel digraph (Students may share their favorite in group reflection)

Day 4- th, ch, sh, ph, wh

  A. Present the Consonant Digraph presentation, have students interact in a way that is accessible
    a. It is very important that you have students holding their jaw and feeling how the air passes and the sound is constructed
  B. After the whole group, have students search nonfiction weather texts for consonant digraphs (Students may share their favorite in group reflection)

❖ Standard 2: Reading and Writing for all purposes
  ➢ GLE 3: Apply knowledge of spelling patterns (orthography), word meanings (morphology), and word relationships to decode words and increase vocabulary.

Students will show **content mastery** in a subject when they are fluent and creative in using their knowledge, skills, and understanding.
-apply learning from one subject to another
-use academic vocabulary

Day 2, 3, 4 continued

Math Skill (about 60 minutes per day- at least 35 minutes should be given to independent practice)
7. Students should spend this chunk of the week preparing to use tools of measurement accurately.

Day 2- Accurately measuring with a ruler (metric)
- A. Each student in class should be provided with a ruler 📏 (Website ruler alternative 🔗)

- B. The teacher should open with observation from the students on the Forms and Patterns of the ruler. Observations should be recorded in a log.
    - a. How many "little lines" are between the numbers? What do you think they represent?
    - b. Are there any lines that are longer, where?
    - c. What else do you notice? What do you wonder?
- C. The repetition of 10 is discussed as a whole group. Students will learn that the smaller lines (hatch marks) are millimeters, and the larger numbers indicate a whole centimeter
    - a. Milli- Latin "one thousandth part"
    - b. Centi- Latin "one hundredth part"
    - c. Meter- Latin "measure"
- D. The teacher may use any form of *formative assessment* accessible: printed shapes to practice measuring, objects around the house, fingers, etc. Students could even dip the ruler in water to determine the height.(The website alternative also provides practice)
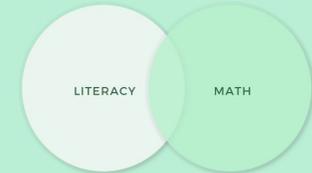
Day 3- Accurately measuring with a thermometer
- A. The best results will be seens with a physical 🌡️ thermometer, but the Website thermometer alternative 🔗 is also useful

- B. The teacher should open with observation from the students on the Forms and Patterns of the thermometer.
    - a. How many "little lines" are between the numbers? What do you think they represent?
    - b. Are there any lines that are longer, where?
    - c. What else do you notice? What do you wonder?
- C. The repetition of 10 is discussed as a whole group. Students will learn that the smaller lines are used to calculate a temperature that hasn't quite met a benchmark, and the larger numbers indicate benchmark temperatures (in either Fahrenheit or Celsius)
    - a. Thermo- Greek "hot, warm, heat"
    - b. Meter- Latin "measure" (review)
- D. The teacher may use any form of formative assessment accessible depending on materials. If physical thermometers are not available for measuring, an inquiry can be crafted through the website alternative. Ex: "Snow falling from the sky is frozen water. What temperature would it need to be to freeze?" Alternatively, digital or printed versions of math aids materials 🔗 are good for practice

Day 4- Accurately decoding weather reports for conditions
   A. There are many technologies for checking weather conditions for the day or the week. Here are a few:
      a. https://kidsweatherreport.com/🔗 - Kid friendly, better for Primary
      b. https://weather.com/🔗 - Gives the familiar "10 day" but there are ads
      c. Google had a very easy to read forecast that can be projected or searched for students
   B. This is an opportunity for kids to get creative
      a. Have students come up with their own symbols for conditions like rainy, sunny, snowy, and cloudy.
      b. Next, let them search different weather sources to see how their version is different, and how it is the same.
      c. Finally, give them a space to record out-of-the-box weather symbols they may not have thought of (hurricane, frost, haze, smoke, clear, etc.)
      d. As an extension teachers can have students come up with never before seen symbols to describe a weather condition (slightly wet outside, or hot as lava)

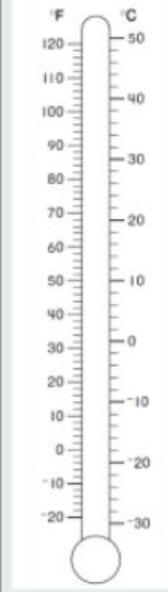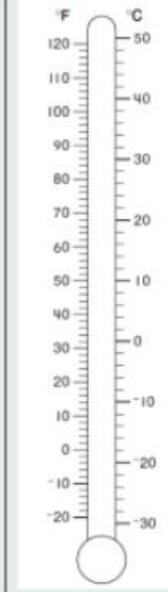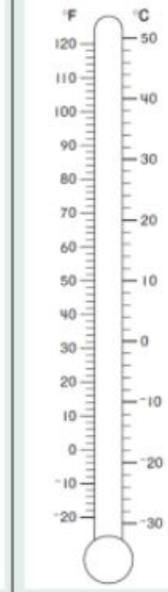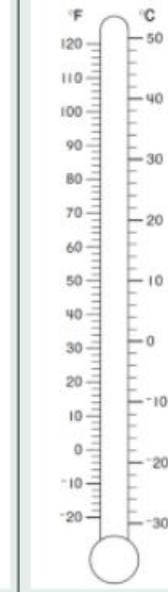| Standards	Skills

❖ Standard Mathematical Practices
  ➢ Developing mathematical practices are processes and proficiencies necessary to flexibly use skills and concepts in multiple contexts
    ■ Use appropriate tools strategically
 	
❖ Standard 3 Data, Statistics, and Probability
  ➢ Measurement & Data
    ■ Generate measurement data by measuring lengths using rulers
	Students will show **content mastery** in a subject when they are fluent and creative in using their knowledge, skills, and understanding.
	
	Students can:
	-apply learning from one subject to another
	-use academic vocabulary

Day 5

Log (30 minutes)
1. Teachers may reveal the daily log to the students. The data will be more powerful the longer it can be taken, and if it is taken over weekends as well.
2. Teachers should model how to fill in each column
   a. The date can be filled in
   b. The temperature can be colored up to the appropriate line, or written in as the degree
   c. The time should be recorded. Explain to students that trends will be most visible if the temperatures being compared are taken at the same time and in the same place. (Teachers can choose to do two readings in one day or more)
   d. The weather picture should be the condition symbol
   e. Cloud types will start as descriptive words, but as the unit progresses, students should start to label the name of the cloud type
3. Students should create a plan of where they will keep the log, how they will remember to transport if necessary, and how they can fill in information they missed by consulting weather reports and peers

Date:	Dec 21	Dec 22	Dec 23	Dec 24	Dec 25
Temperature					
Time (AM or PM)					
Weather (Picture)					
Cloud Type					

Day 5 continued- Explain

Students should have already determined a guiding question in the beginning. It should be centered around patterns of clouds in different parts of the world.

Explain (≈ 30 minutes)
Based on the first 4 days of exploration, students can give an initial explanation in their own words, with their *current knowledge*. The only instruction they have had so far is that clouds, temperature, precipitation, and other weather conditions may be connected.

Questions to push their thinking:
Where were we seeing thicker clouds?
Was there a difference in the morning and in the afternoon? Why?

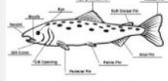Students may choose to add to their explanation and drawing as they are being prompted.

Modifications

📋ELL students may need a word bank to choose from.
💬LEPs may need the directions in their mother tongue, and the opportunity to make observations in their mother tongue.

💬 Many students will need academic sentence stems printed and in front of them "I believe that _____ is _____ because of _____."

💬💬Extension: Have students rotate through groups sharing their explanation (initial hypothesis). At the end, give them a new sheet and see if they want to revise their hypothesis based on consensus, or stay the course.

Date:	
Draw an interesting phenomena you observed	
*Good scientific diagrams are labeled	
Describe what you see and what you think is happening	_____ _____ _____ _____

Day 6

Procedure (35 minutes - 45 minutes)
1.The teacher presents a video (How to Be a Cloud Detective 🔗) to extend student thinking about the types of observations that can be made. Students previously had just known to look for shape and color, but did not have information to anchor to.
2.Ask students what we can look for now, and what will that information mean? Students will record their thinking in their log as a jot.
3.Explain that our challenge is going to be to eventually predict the weather by collecting and analyzing our own data.
Why? – Scientists predict weather to keep people safe and prepared.

Literacy Skill (50 minutes)

4.Teaching New vocabulary: Average, Weather vs. Climate, Elevation, Moisture, Humidity, Pattern, Pictograph, Precipitation, Satellite, Temperature, Weather, Wind Direction, Wind Speed
(Students should write the new vocabulary down with a picture in their log book.)

The lines in the log book encourage students to write the letters large and spaced out. This allows us to box root words, underline prefixes, suffixes, and identify digraphs.

Modifications
🗓️⏱️Students who are unable to join this day should be able to access a recording of the classroom discussions from both periods.

Formative Assessment
Students may choose to use 3 vocabulary words in a verbal discussion, or write them into three separate sentences.

Vocabulary
(Write the letters on each space so that we can see the letters LARGE. You might not use all the spaces.)
_ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _
_ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _
_ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _
_ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _
_ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

Day 6 Continued

Literacy/Science/Math Skill (50 minutes)
1. The teacher will present the pear deck on reading data and making connections 🔗. This skill will support students in the upcoming investigation.
2. When students finish the lesson they should be encouraged to explore the NASA Earth Observatory site 🔗 independently to make their own connections.
3. The teacher should bring the class together to discuss the connections made, and what their new wonderings are.
   How does this connect to clouds and temperatures? (Carbon monoxide, land surface temperature, sea surface temperature)

Continued Days

It is important to remember that data collection should continue for as long as it makes sense for the class.

After possible weeks of data collection students should be ready to analyze.

The following log entry should be completed in small groups (breakout rooms), but they can be completed independently if the student has family support.

Modifications
Students may opt to verbally record their thinking first. This will help them organize their writing. They may also need one to one teacher support.

Analyze your data (draft)

The guiding question	
Our claim	
Our evidence	Our justification for that evidence

Draft Argument

The Report

Teachers may choose to model each paragraph separately, or do a few together.

This particular level of academic writing will most likely take many sentence frames and word banks for most students.

An alternate way to break up this assignment would be for each report be completed by a group.

❖ Standard 3: Writing and composition
  ➢ EO d: With guidance and support from adults, produce writing in which the development and organization are appropriate to task and purpose.

REPORT

We have been studying _____ in class.

Before we started this investigation, we explored _____
_____
_____
_____.

We noticed
_____
_____
_____
_____.

My goal for this investigation was to figure out _____
_____
_____

The guiding question was _____
_____
_____

to

Method

To gather the data I needed to answer this question, so first I _____
_____
_____
_____
_____.

I then analyzed the data I collected by
_____
_____
_____
_____
_____.

Argument

My claim is
_____
_____
_____
_____.

The graphs attached show
_____
_____
_____.

This analysis of the data I collected suggests
_____
_____
_____.