the CEED
THE CENTER FOR ENERGY EFFICIENT DESIGN

Elementary Meteorologist

Grade Level	Fourth	**Subject**	Collecting Weather Data

Objective(s):
The student will collect weather data for two weeks, at which time he/she will begin to see patterns in each of the following areas: temperature, wind speed, wind direction, precipitation, air pressure, and cloud cover. The student will record daily information on a data table. The student will use this information to predict what the weather will be like the next day or next few days. The student will also write if their predictions were correct from the previous day. He/she will also compare the weather data collected by the C.E.E.D. building to that of the student's home school. This two-week process will be repeated three times during the year to hopefully represent weather conditions from different seasons.

SOL Addressed: **Science---4.1 b, c, e, i, k---**The student will demonstrate an understanding of scientific reasoning, logic and the nature of science by planning and conducting investigations in which:
   * Objects are classified and arranged according to characteristics or properties
   * Appropriate instruments are selected to measure temperature in metric units
   * Predictions and inferences are made, and conclusions are drawn based on data from a variety of sources
   * Data are collected, recorded, analyzed and displayed using bar and basic line graphs
   * Data are communicated with simple graphs, pictures, written statements and numbers

Science—4.6 a, b, c ----The student will investigate and understand how weather conditions and phenomena occur and can be predicted. Key concepts include:
a.) weather phenomena;
b.) weather instruments and meteorological tools and
c.) use of weather instruments and weather phenomena to make weather predictions.

Common Core Standards: 3-ESS2-1. Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season.

Materials Needed Per Class of 30 **and** **Prior Knowledge**	**At least one per class:** • Rain gauge • Thermometer • Barometer • Anemometer (wind speed meter) • Weather vane • Cloud chart **Per student:** • Weather Forecasting Data Table

	Prior Knowledge: Meteorologists collect weather data daily to make forecasts. They use high altitude weather balloons, satellites, weather instruments and computers to make accurate forecasts. Since air travels from one location to another, it is helpful to know what the approaching weather will be. Students must be familiar with weather instruments that meteorologists use and how they are used. Students must also know the different cloud types and what kind of weather each type brings.
Ways to differentiate this lesson plan	• **EXTENSION** for Higher Level Learner—1.) With the data you have, take an average of each component in each season. Compare the same components of each season. Write the differences you see between the seasons. Write down why there are differences in the weather components from season to season. 2.) After having discussed each of the weather instruments, students can conduct research to find out more information about them. They may use encyclopedias, books, magazines, and Internet. Students should write this information down by taking notes as they read. 3.) Students can organize their notes about the weather instrument they researched by writing it in report form. They may give brief oral presentation or put reports in a binder to share with the class. 4.) Students may write riddles about the weather instruments and have the class guess which tool they are talking about. • **MODIFICATIONS** –Students will be grouped together in teams of three to ensure that all strengths are represented. (Data recorder, analytical thinker, strong math student, etc.)
Introduction/ Anticipatory Set	**Anticipatory Set:** How will the teacher introduce the lesson to the students? Review with the students about the instruments meteorologists use and how they are used. Discuss why meteorologists need these instruments and how they can predict the weather. **Questions to ask students:** • Why would a person be interested in what kind of clouds are in the sky? • What is air pressure and how can it let us know a storm is approaching? • What are some forms of precipitation? • How are wind speeds and wind direction related to air pressure? **Introduction:** Explain to students that for the next two weeks they will be using these instruments to see what the current weather conditions are in their area. They will record them on a sheet. They will be doing this two-week data collection three times a year to compare one season to another season. They will also be making predictions of what is going to happen the next day and compare that with a professional forecast, such as that of the Gereau Center Weatherbug. This can be found by visiting the CEED website and clicking on Weather Station. (http://ceed.frco.k12.va.us)

Guided Practice	- Students will need to be assigned to a group of three. With an average class size of 20-24 students, this allows the entire class to be divided into approximately 6-8 small groups. - As a class, discuss where the instruments are going to be placed or taken outside to be read. Also, decide the times of the day that will be observed for data collection. In order to have a more diverse sampling of data, it is recommended that measurements be taken two or three times a day. **(Measurements need to be taken at a distance from any building that may block wind or alter temperature. The thermometers should be read in the shade of a tree or students can use an object to provide the shade.)** - Designate a time to discuss each of the readings. - Predictions need to be made and recorded by student teams: a.) Based on the cloud cover in the sky, will there be any precipitation later today? Tomorrow? b.) Using the barometer readings from earlier today, can we expect an approaching storm or fair weather? c.) Which time of the day will give the highest temperature reading? Lowest reading?
Independent Practice	- Each day when it is time for the instruments to be read, send one group of three outside to read them. In order to meet supervision requirements, this can be done during recess, at the beginning of Science class with entire class present, or with another adult, such as a Teacher Assistant. - Each time the instruments need to be read, send out a new group of students to do it. Over time all students should have the opportunity to measure with all the instruments. - When the group of students brings the information back to the classroom, have a chart available for them to record data. - At the end of each day, have teams discuss each of the readings. - Make a prediction as to what the weather is going to be like tomorrow using the present day's data. - Compare the information with the actual meteorologist information by going to the CEED website and viewing weatherbug data for Gereau Center.

Closure (Summary of Lesson)	Students should have explanations in place to either confirm or deny original predictions. They should be ready to present data to the class. List three ways weather affects our outdoor activities.
CEED Building Application/ Sensor Data	The students will access the CEED real time dashboard weather data (Weatherbug) daily.
Assessment	Students' completed data charts can be assessed. Students should be able to answer the following questions based on the data they collected: a.) Which day had the highest temperature? Lowest? b.) Which day(s) had the biggest change in weather? c.) Which day(s) had the highest cloud cover percentage? d.) Which weather components helped you to predict the weather for the next day? e.) Describe the weather components on a day you enjoy.

INQUIRY LEARNING RESEARCH PROCESS GUIDELINES

The following table is just one guideline to use for developing your own inquiry materials. The seven steps in the Learning Research Process include not only how people learn but also how research is conducted. The heart of the design, the three-stage learning cycle of exploration, concept invention or formation, and application is embedded in the middle. In addition to these three stages, this design takes into account that learners need to be motivated to spend the time required for understanding complex subjects and that learners need to build this new knowledge onto prior knowledge. These are similar to the 5E and 7E learning models.

The Learning-Research Process

Steps in the Learning-Research Process	7E Equivalent	Component of the Activity
1. Identify a need to learn.	Engage	An issue that excites and interests is presented. An answer to the question *Why?* is given. Learning objectives and success criteria are defined.
2. Connect to prior understandings.	Elicit	A question or issue is raised, and student explanations or predictions are sought. Prerequisite material and understanding is identified.

CEED
Instructional Activities

3. Explore	Explore	A model or task is provided, and resource material is identified. Students explore the model or task in response to critical-thinking questions.
4. Concept invention, introduction, and formation	Explain	Critical-thinking questions lead to the identification of concepts, and understanding is developed.
5. Practice applying knowledge.		Skill exercises involved straightforward application of the knowledge.
6. Apply knowledge in new contexts.	Elaborate and Extend	Problems and extended problems require synthesis and transference of concepts.
7. Reflect on the process	Evaluate	Problem solutions and answers to questions are validated and integrated with concepts. Learning and performance are assess

Hanson, D. (2006). POGIL Instructor's Guide to Process-Oriented Guided-Inquiry Learning. Lisle, IL: Pacific Crest