Gold Seal Lesson

Author(s):			*Lesson Title:*			
David Nohara			*Predicting Rain*			
Grade Span			*ICLE Application Model*			
K-4	*5-8*	*9-12*	*A*	*B*	*C*	*D*
	XX					*XX*

Instructional Focus:

Basic Concepts and Knowledge
Students develop an understanding of scientific concepts using facts, theories, principles, and models.

Science as Inquiry
Students demonstrate knowledge and skills necessary to perform scientific inquiry.

Habits of Mind
Students develop habits of mind including curiosity, open-mindedness and persistence.

Statistics and Probability
Students use statistics and probability to analyze given situations and the results of experiments. Students communicate the reasoning used in arriving at a conclusion.

Performance Task

Students are to develop a model for predicting rain, based on different variables. Various websites and almanacs allow people to look up weather conditions on a particular day in the past. One such site is www.wunderground.com, which provides the following variables for many cities throughout the U.S.:

- High and low temperatures
- Dew point
- Precipitation
- Sea level pressure
- Standard pressure
- Visibility
- Average wind speed (but not direction)
- Maximum wind speed
- Gust speed
- Events (tornado, etc.)

It also shows how several of those variables progressed throughout the day, allowing students to see, for example, whether temperatures and air pressures were rising or falling.

Performance Task continued…

Project steps:

1. Based on what they know about weather, students choose two or more variables they feel might help them predict whether it will rain the following day. They should note these in a project log, along with their reasons for choosing them.

2. They then choose a city and month for which to track and plot these variables. (Older students and students using computer software should use data from a two-month period.) Next, they create a table and enter the data, including the date, variables, and whether or not it rained the following day.

3. Students then analyze their data. They should write in their project logs whether or not the data appear to support their original hypotheses. If they wish, they can draw graphs to support their statements, but they should support their conclusions with some sort of statistical analyses (e.g., "it rained on 70 percent of days after days where air pressure was falling").

4. Based on their analysis, students make a formula or set of rules to predict rainfall ("it will/won't rain on the following day if…"). (If student finds no correlation between their variables and rainfall, they can analyze and create a model from the data of another student who was more successful.)

5. Students test their models by examining another one- or two-month period. They record the percentage of days that their models led to a correct prediction.

6. In order to see how useful their models are, they also use a control model, such as predicting without data or flipping a coin. For this method also, they record the percentage of correct predictions.

7. In their project logs, students compare the results of the two methods and explain why they think their model is or is not useful.

Teachers' notes:

This activity fits well with a discussion of weather forecasting history and current practices. This may help them appreciate the difficulty of the task and the accuracy of modern forecasting.

While wind speed can often be found in weather almanacs, wind direction is less common. Since wind direction, coupled with trends in barometric pressure, can be useful in predicting rain, rather than use an almanac, you may wish to keep a daily log in order to generate the necessary data.

ICLE Essential Skills

Know and apply the principles of scientific inquiry. (Implicit in this statement are the processes of prediction, estimation, developing hypotheses, drawing conclusions, evaluation, and following ethical principles and professional procedures.) (s114)
Plan and apply real or hypothetical models and constructions to facilitate investigation and learning and the solution to practical problems. (s115)
Know the relationships between local atmospheric variables (e.g., temperature, pressure, moisture, wind, etc.) (s16)
Exhibit good data management skills by collecting, organizing, and graphing data. (s19)
Predict weather as a probability of occurrence by examining the factors that produce change in atmospheric variables. (s48)
Understand the best procedures for statistical data collection, organization, and display including making estimates and predictions and drawing inferences. (m5)

Scoring Guide:

Variable choice and reasoning 15 Points	• Students select at least three variables and provide reasons for each • Students support variable choice with explanations based on correct information about factors related to rain
Table 15 Points	• Includes key column headings (date, variables, and whether or not it rained the following day) • Entries are complete • Information presented clearly
Analysis 25 Points	• Student states whether data support their original thinking • Student supports conclusions with appropriate statistical analyses and mathematical reasoning • Calculations are correct
Formula 15 Points	• Based on analysis • Provides unambiguous set of directions that can be applied in all situations
Testing formula 10 Points	• Student applies formula to new data • For each day in data set, student records prediction and whether the prediction was correct • Student calculates percentage of correct predictions correctly
Control model 10 Points	• Student creates appropriate control model and applies it to the same set of data used to predict the prediction method • For each day in data set, student records whether the control model was correct • Student calculates percentage of correct predictions correctly
Comparison 10 Points	• Student uses appropriate mathematical reasoning and correct calculations to compare the two methods • Student considers the practicality of formula (although it may be more accurate than guessing, it is accurate enough to rely on?)

Keywords

English Language Arts	Mathematics	Science
Reading	**Algebra**	**Earth Science** **Atmosphere** **Climate** **Meteorology** **Scientific inquiry** **Weather**
Writing	**Geometry**	**Life Science**
Communications	**Statistics** **Data analysis** **Hypothesis testing** **Inference** **Prediction** **Statistics in daily life**	**Chemistry**
Literature	**Calculus**	**Physics**
Other	**Trigonometry**	**Other**
	Other	