# Education-By-Design

**Karen Baker (kbaker@ucsd.edu ), Beth Simmons (besimmons@ucsd.edu) and Dawn Rawls (drawls@ucsd.edu )**

**Scripps Institution of Oceanography, University of California San Diego**

…scientists as advocates in science education that understand the culture of science and that of our schools."

**Dr. Bruce Alberts: President of the National Academy of Sciences**


"Long-Term Ecological Research (LTER) sites offer unique opportunities for establishment of science education programs and partnerships because of their long-term design. These sites provide environments for effective learning about long-term science through participation and inquiry by students and teachers."

**Diane Ebert-May**

## Curriculum Development

Themes: Modules: Lessons

Mutually-supported classroom modules that collectively and critically challenge students to integrate scientific concepts, improve their knowledge and understanding of long-term research and achieve scientific literacy.

**I. Forming a Hypothesis**
- a. Boning up on Research*
- b. Ice Adventure*

**II. Long Term Research**
- a. Time Series
- b. Information Management
- c. Ice Adventure*

**III. Navigation/Geography**
- a. Finding Your Way*
- b. The Amazing Race*
- c. Voyage to Antarctica

**IV. Primary Productivity**
- a. Through the water Column

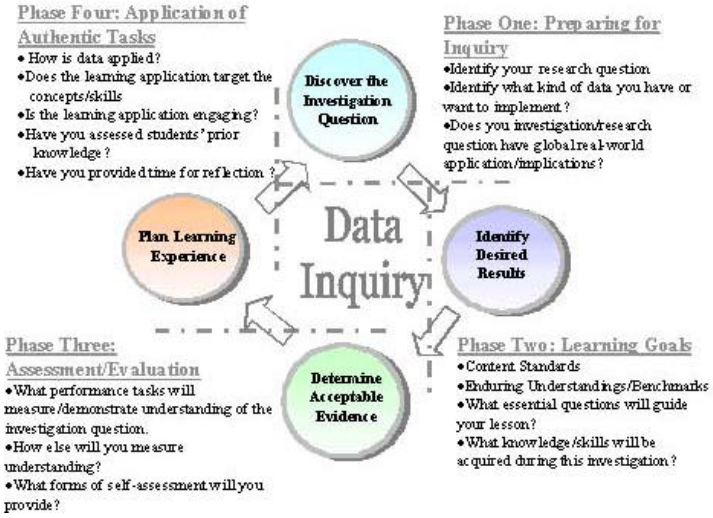
**V. Antarctic Food Web**
- a. Penguin-Temp-Ice-SOI Dataset
- b. Penguin Story

**VI. Across the Ecosystem (LTER)**

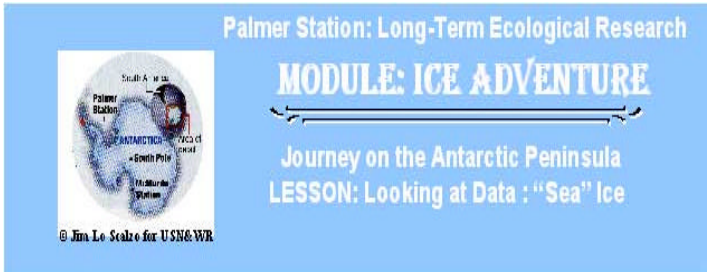
**VII. Global Impacts**
- a. Ice Adventure*

* Lesson in progress

"Inquiry science which is engaging and meaningful can spawn a students' 'innate' curiosity for the natural world. Students observe, ask questions, make predictions, think about results, reflect on their progress and craft their next move." (Wheeler, 2000)



# Authentic Task: Using Data in the Classroom




LESSON FOUR: MOCK "TIME-SERIES" EXERCISE

In the following exercise, we will review techniques that are useful to scientists as they analyze series of data, that is, sequences of measurements that may or may not follow patterns. In the analysis of this data, it can be assumed that the data file represents consecutive measurements taken at equally spaced time intervals. However, in real-life research and practice, patterns of the data are unclear, individual observations involve considerable error, and we still need not only to uncover the hidden patterns in the data but also generate forecasts.

GOALS

a.) Identify the nature of the phenomenon represented by the sequence of observations
b.) Recognize a pattern or trend within the data
c.) Predict future values of the data.

TIME FRAME: 45 minutes

GRADE LEVEL: 9 - 12

CONTENT STANDARDS:

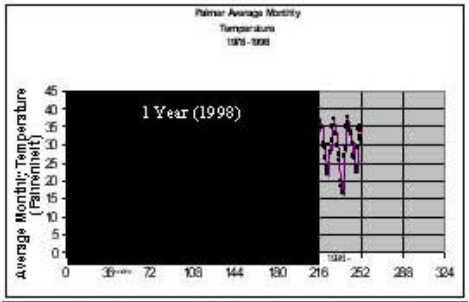
Investigation and Experimentation:

1b: Identify and communicate sources of unavoidable experimental error
1c: Identify possible reasons for inconsistent results, sources of error or uncontrollable conditions
1d: Formulate explanations by using logic and evidence
1k: Recognize the cumulative nature of scientific evidence
1l: Analyze situations and solve problems that require combining and applying concepts from more than one area of science.

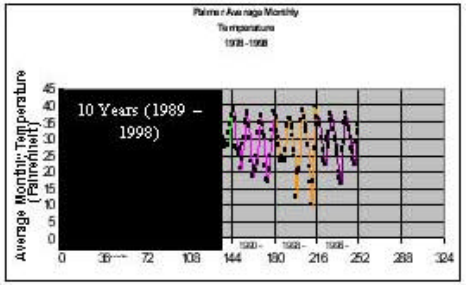
PROCEDURE:

1. Create working lab groups of 3 to 4 students.
2. Explain to the students that they will be analyzing monthly averages of Antarctic temperatures. Ask the students to make *predictions* as to what trends they might expect to see in the 1998 climatic observations
3. Have the students brainstorm within their working lab groups on the following questions.

a. Discuss the advantages/disadvantages of collecting data for a year.
b. What trend(s) is revealed in the 1-year graph?
c. How might a natural phenomenon affect the climate in Antarctica?
d. Predict what the climate might have been in the previous years (1989 – 1997)




Palmer Station Long-Term Ecological Research addresses the gap between short-term process-oriented studies versus time scales that extend months to decades. What is revealed in a one year (short-term) time frame does not reveal much.




Data that reveals a cause and effect can only be detected on longer time scales. In many such cases, long-term studies can be linked to ecological phenomenon and reveal interdisciplinary relationships.


You've made it to the "Big Chill"! In this portion of your "Ice Adventure" you will be evaluating the climate change on the Antarctic Peninsula. The information provided below will assist you in completing this leg of your journey. Good luck!

**Content Standards:** Investigation/Experimentation: a,b,c,d,f,l,k

Earth Science Standards 4c,5c, 6 a,b,c,d

**Develop your Hypothesis:** In the past twenty-five years Antarctica has been in a deep freeze. What insight does the past two and a half decades of data reveal to scientists about the future of Antarctica? Create a hypothesis and support your idea(s)

**Determine Your Data:** What data will you need to test your hypothesis? Explain why.

**Archival Data** **Real Time Data** **Both**

**Background Information:** Please research the Temperature/Climate in Antarctica by clicking on the real time data link below. Record your observations in your lab journal for this adventure.

Real Time Data

**Research Data: Follow** the data link below and answer the **Q-button** questions associated with each link.

Data Link

**( Palmer Air Temperature Versus Time data)**

**State Your Conclusion:** After viewing the data presented in this activity, state your conclusions. Do your conclusions agree or disagree with your hypothesis?

**Global Application (*optional*):** See if your conclusions hold true using global maps and current event articles.

Data Link Data Link

**(Palmer LTER Interannual Variability temperature Maps)** **(U.S. News and World Report)**