Research Question, Hypothesis and Experimental Design 6.4

Summary
As a precursor to the upcoming field trip, the students will state their own hypothesis about the type and amount of marine debris they will find at a specific location. They will design and carry out an experiment to test their hypothesis.

Objectives
- Students will devise a testable hypothesis and an experimental procedure.

Materials
“Human Impacts” worksheet (1 per student)
Pictures of a local beach where the cleanup will be held
“Scientific Inquiry Process” handout

Making Connections
Students will understand the scientific process, and rather than being given an experimental procedure (as in Lesson 6.3) they will design their own experiment. The previous lesson will serve as an example, from which they can expand upon.

Teacher Prep for Activity
Photocopy “Human Impacts” worksheet and know which beach it is they are going to visit for their field trip. You may be able to find information on previous beach cleanup data on the NOAA website: (http://marinedebris.noaa.gov/); or the local Hawaii Wildlife Fund site: (www.wildhawaii.org or email kahakai.cleanups@gmail.com). Photocopy the “Scientific Inquiry Process” handout. Find pictures of your local beach where the fieldtrip will be held.

Background
No additional background information is necessary.

Procedure
1. Prep the students on the scientific process: how to create a research question, hypothesis, and experimental procedure going step by step through the “Scientific Inquiry Process” handout. Let the students know that they will be going a field trip to collect their own marine debris during a beach cleanup at a local beach.
2. Show the students a picture of the beach they will visit during the trip. Break the students into small groups and create a testable hypothesis about marine debris at that beach.
3. Show the students the past data from the same beach (if possible) and have them create a research question and hypothesis based on past data or from the setup of the beach. A possible hypothesis could be: Cigarettes will be the most abundant type of marine debris at the beach (reasoning: based on past data that cigarettes were the most abundant type of debris found on beaches). OR More trash will be found near the shoreline than the parking lot.

4. After each group has formed a hypothesis, have them think of how they would like to collect repeatable data for their study. Discuss the importance of repeatable data using the background from lesson 6.3. Ask them to write down several ways that they could collect their data, and then discuss if the strategies they thought of are possible to do in a single day or if it will prove their hypothesis.

5. After they have decided upon an experimental design, have them write the final group consensus on their “Human Impacts” Worksheet.

Assessments
Completed worksheets

Resources
http://marinedebris.noaa.gov/
www.wildhawaii.org (or contact Hawai‘I Wildlife Fund’s Big Island Marine Debris coordinator directly at kahakai.cleanups@gmail.com)

Extension Activities
Many teachers enjoyed other marine-education activities, such as (if on Hawai‘i Island):
Hilo side - Mokupapa Discovery Center, Pacific Aquaculture & Resources Center (PACRC).
Kona side - Visit West Hawaii Explorations Academy (they have a touch tank for the kids and will give a tour of the school), Natural Energy Lab (NELHA) tours.
The Scientific Inquiry Process

Research Questions
What we “wonder”, based on our observations

Background Information
A thorough study and documentation of information related to the research question which aids in the formation of a testable hypothesis

Explorations
Using the 5 senses to link what we already know (experiential background) with what we observe about the world around us

Hypothesis
* Key word is “testable”
* Is stated in an “If... then... because...” format

Experimental Design
* Identifies specific variables and controls
* Follows logical, safe practices to collect data and answer the research question

Data Analysis
Logically organizes and accurately summarizes the data

Summary and Conclusion
* Reviews the results and makes a decision. Does the data support or refute the hypothesis?
* Answers the question

Implications
* Share the results
* Repeat the study or conduct more research

Partnership for Reform through Investigative Science and Math
Human Impacts Worksheet

Before Data Collection:

Research Questions: (What is it that you would like to find out about marine debris?)

Hypothesis: Write a complete sentence of what you think you will find. You should be able to test your hypothesis. State your answer in a “If ……then…..because…..” format)

Experimental Design: How will you collect your data? (Think of a method you could use to test your hypothesis)
After Data Collection

Data Analysis: What did you find at the beach? Count and categorize your findings. Using graph paper, chart your results. Summarize your results below.

Summary and Conclusions: Review your results. Does your data support or not support your hypothesis? Explain.

Implications: From your findings, what do you recommend we do to malama (care for) the marine environment? How can we share our results? Think of ideas to share what you learned with your school and community.