WASTE AUDIT

What inferences can we make from a waste audit about our school's impact on the *'āina*?

HAWAIʻI DOE STANDARD BENCHMARKS

Math 13: Data Analysis, Statistics, and Probability DATA ANALYSIS

- **MA.6.13.1** Make inferences about a population based on the interpretation of a sample data set.

Science 1: The Scientific Process: SCIENTIFIC INVESTIGATION

- **SC.6.1.1** Formulate a testable hypothesis that can be answered through a controlled experiment.
- **SC.6.1.2** Use appropriate tools, equipment, and techniques safely to collect, display, and analyze data.

Language Arts 5: Writing: RHETORIC

- **LA.6.5.1** Select appropriate details, examples, reasons, and/or facts to support an insight, message, or thesis.

NĀ HONUA MAULI OLA

- **NHMO 10-7** Recognize and identify the healthy cultural behaviors that are practiced and promoted within the environment (i.e., *kōkua*, reciprocity, *aloha 'āina, mālama 'āina*).

KEY CONCEPTS

- We can make inferences about our school population and our impact on the *'āina* based on the data we collect about school wastes.
- We need to be more thoughtful and actively participate in recycling programs that will help keep our *'āina* healthy.
- We can reduce management costs and promote better use of our limited natural resources.

ACTIVITY AT A GLANCE

Students form teams and conduct a waste audit of their class and school. They sort and record their results, and make inferences about the school populations based on their data.

ASSESSMENT

Students:

- Develop and test hypotheses.
- Analyze the data they collect from their school audit and graph the results, using the information to make inferences that apply to the school population.
- Write reflections that discuss the process of conducting a waste audit and the potential impact on the *'āina* of the waste that we generate.

TIME

3 class periods

SKILLS

following directions, developing hypotheses, collaborating, analyzing, graphing, making inferences, writing

MATERIALS

Provided:

- ✓ Student Reading 2
- ✓ school waste audit form
- ✓ waste category signs
- ✓ Learning Log 3

Needed:

- ✓ secure, well ventilated work area sheltered from sun, wind, and rain
- ✓ tarp (for displaying items)
- ✓ garbage dump supplies (see previous lesson)
- ✓ rubber gloves (at least one pair for each 5 groups)
- ✓ box of 13-gallon garbage bags
- ✓ 5-kilo spring scale
- ✓ tape
- ✓ graph paper
- ✓ broom and disinfectant
- ✓ safety equipment and first aid kit
- ✓ 5 barbecue tongs to pick up and sort waste
- ✓ graph paper

VOCABULARY

audit - a systematic process of objectively obtaining and evaluating evidence

inference – a conclusion that is derived from analyzing data or evidence. It is also an assumption about a behavior, an object, a picture, etc.

observation – what a person is actually seeing, hearing, feeling, etc.

three R's – in this context, reduce, reuse, recycle

waste audit – one of the first steps in conducting a recycling project

waste stream - solid waste from homes, businesses, institutions and manufacturing plants that is recycled, burned, or disposed of in landfills, such as the 'residential waste stream' or the 'recyclable waste stream.'

ADVANCE PREPARATION

- ☐ Make five (5) copies of the school waste audit form.
- ☐ Make 6 sets of the waste category signs.
- ☐ Make a copy of Learning Log 3 and Student Reading 2 for each student.
- ☐ Assemble the "garbage dump" items from the previous lesson onto a tarp.

TEACHER BACKGROUND INFORMATION

Waste affects many aspects of our lives. No matter who we are or where we live, we create waste. It is a normal consequence of day-to-day life, and it has been that way for as long as people have populated the planet. From medieval Europeans tossing their refuse out a window to modern waste-to-energy plants, people have taken different views of the waste they generate depending on their lifestyle and available technology.

Waste is continually created and discarded in a "waste stream," as people generate waste,

which is then separated, collected, and either recycled or disposed.

Many people feel they can have no effect on the amount of waste generated by society. Environmental problems such as global warming, hazardous waste, loss of rain forests, endangered species, acid rain, the ozone layer, and the municipal waste crisis can feel out of our control. One thing that each of us can exercise some control over is the amount of waste that we generate. By practicing the 'three Rs" – reduce, reuse, and recycle – we can all have a positive impact on our environment.

You can make a difference!
A waste audit can be performed to determine composition and quantities of waste being generated. This process leads to a more efficient and effective organization, reduces waste management costs, and promotes better use of limited natural resources. Through recycling newsprint, office paper and mixed paper, millions of trees can be saved. Recycling paper also cuts energy usage in half. Every pound of steel recycled saves enough energy to light a 60-watt bulb for over 26 hours. Recycling a ton of glass saves the equivalent of nine gallons of fuel oil. Recycling used aluminum cans requires only about five percent of the energy needed to produce aluminum from bauxite. Recycling just one aluminum can saves enough electricity to light a 100-watt bulb for 3½ hours.

In this lesson, students will be conducting a waste audit of various areas in your school. Waste audits should be carefully planned and the safety of people conducting the audit is very important. Sorting should be done in ventilated areas. The confidentiality and privacy of documents or personal information found in the waste stream must be assured. No documents or school papers should be read or removed from the sorting area. Sorters should use protective equipment such as tongs and gloves. Waste is never handled with bare hands.

Teaching Suggestions

1. **Distribute the student reading to each student, read and discuss.**

2. **Place garbage dump items from the previous lesson on a tarp and ask students to form a circle around the "dump" site.**
   - Ask each student to use tongs to select an item and place it in a pile you have designated as recyclable or non-recyclable materials.
   - Confirm that the materials have been appropriately sorted and make adjustments if necessary.

3. **Discuss students' ideas about the potential of recycling the items.**

   Discussion Questions

   - Why would clothes end up in a recycling pile? (Clothes can be donated to second-hand stores and resold or given away.)
   - How can jars and other plastic containers be reused? (Jars can be used to store items such as nails, mango chutney or coins.)
   - Are there any other items that could be recycled that are not represented in our garbage dump? What are they? (Food waste that could be composted; plastics that can be recycled)

4. **Explain to students that they will be conducting a waste audit of the school.**
   - Introduce the focus question for this lesson:

   What inferences can we make from a waste audit about the impact of our school on the *'āina*?

5. **Help students to distinguish between an "observation" and an "inference."**

   What is an observation? An observation is what a person is actually seeing, hearing, feeling, etc. For example, if you walk outside your *hale* (home) on a summer's day and feel the sun beating down on your head and the air is still with no trade winds, you might **observe** that it is hot outside.

   What is an inference? An inference is an assumption about a behavior, object, or picture, etc. For example, if you are inside your *hale* (home) with air conditioning turned on and notice children outside washing their family car, there are no clouds in the sky, and there's a *tūtū* fanning herself underneath a *kukui* tree, you might **infer** that it is hot outside. You are basing your inference on what you notice (cloudless sky, the time of year, perhaps people spending time out-of-doors). However, you are not observing the temperature as you stand inside your *hale* in a cool, air-conditioned environment.

6. **Ask students to share their initial ideas about inferences and the kind of inferences they could make related to recycling.**
   - Example: "Many people in our school drink bottled water, but they do not recycle their bottles."
   - Ask students to develop an example of a hypothesis that they can test about the wastes they believe they will find in their waste audit. For example: "There will be more paper waste than plastic waste because we use so much paper at school." (Note: Lesson 3 will go into more detail about developing testable hypotheses.)

7. **Divide the class into five teams and prepare for a waste audit of the school.**
   - Distribute the **school waste audit form** to each team along with gloves and/or tongs and a garbage bag.
   - Tell students that you have already made arrangements for each team to perform a waste audit in a certain location on the school grounds.
   - Assign a specific location to each *hui* and emphasize that **no** waste should be collected from the health room or bathrooms.
   - Challenge each team to develop a hypothesis that they will be able to test in the waste audit of their location.
   - Have teams share their hypotheses and refine them as needed before students begin their audit. Discuss what makes a hypothesis "testable."
   - Advise students that they have half an hour to collect as much rubbish as they can from their assigned area.

8. **Have students sort the waste they have collected.**
   - Distribute a set of recycling signs to each group and seven (7) 13-gallon garbage bags.
   - Have each group sort and place items they collected in the appropriate garbage bag.
   - Remind them that only plastics with the 1 and 2 numbers on the bottom can be recycled in Hawai'i.

9. **Record results on the school waste audit form.**
   - Ask each group to determine the mass of each bag of waste in kilograms and record the amount on their waste audit forms. (They can determine the mass by weighing each bag on the classroom spring scale.)
   - Have each group record the volume of materials in each of the 13-gallon (50 liter) bags. (They will need to estimate the volume. Half full = 25 liters.)

10. **Have groups present their hypotheses and their findings.**
    - Have students in each group present their hypotheses and findings. Record their results on the board or on chart paper at the front of the room.
    - Ask students whether their data supports their hypotheses or not and discuss.
    - When all groups have presented, ask students to make some inferences about the school population based on the items found on campus.
    - Discuss the size of this data set and ask if students think it is large enough to represent the school population.

11. **De-brief the waste audit with students.**

    <u>Discussion Questions</u>
    - What was the greatest volume of school waste?
    - What were the main components of the school's waste?

- What inferences did you make about our school's population from the data we have collected?
- Would the results be different if the waste audit was done at a different time of year?
- What were some of the items that could have been reused instead of thrown away?
- How could you reduce the amount of items that were thrown away?
- Which items would have the most impact on the *'āina*? Why?

12. **Have students clean up the classroom and sort recyclables.**
    - Have each group clean up their area.
    - Return all non-recyclable items to the garbage.
    - Sort recyclables into bins (if your school has a recycling center) or place in garbage bag and label for recycling.
    - Recyclables can be delivered to your nearest recycling center.

13. **Individual student assessment.**
    - Distribute a sheet of graph paper and **Learning Log 3** to each student.
    - Work with students to graph the results of their waste audit. Have each student graph the results of their school's waste in mass and volume.
    - Have each student complete Learning Log 3 for individual assessment.

Adaptations / Extensions

Coordinate an art fair. Have students create art pieces, using recyclable materials. Invite parents and school administrators as guests.

Use the recycling of plastic bottles and aluminum cans as a school fundraiser.

Resources

Oregon Green Schools. *Saving resources, one school at a time*. 1997. Accessed March 20, 2007 from http://www.oregongreenschools.org/waste_audits.cfm

Pennsylvania Department of Environmental Protection. © 2007 Commonwealth of Pennsylvania. All Rights Reserved. *Recycling Saves Natural Resources*. Accessed March 20, 2007 from http://www.dep.state.pa.us/dep/deputate/airwaste/wm/RECYCLE/FACTS/benefits2.htm