Lesson 12: Ho`olaulima
Let’s Make a Hawaiian Garden

Summary
School gardens are living laboratories in which basic elements of math, science, natural and cultural history, research and life skills such as cooperation and natural rewards for hard work can be experienced and practiced. This lesson gives a basic framework for a small, simple garden, and links to resources that you can use and adapt to your school’s unique situation. Primarily, this lesson plan tries to encourage you to dream big (but start small), reach out to your fellow teachers and community, and start digging!

Objectives
• Students will help develop a classroom garden and use it as a living laboratory

Materials
These are materials needed for a single 3’ x 8’ raised garden bed, suitable for almost any school campus. Simply add more beds by doubling the amounts shown. See Teacher Prep for hints on finding material. Additional materials needed for other projects may be found in various sections below.

4 sheets of used metal roofing:
2 each: 30” wide, 3 feet long.
2 each: 30” wide, 8 feet long.
4 lengths of padding for edges of the metal roofing.
2 each: 3 feet long
2 each: 8 feet long
16 sturdy stakes: 36-48” long
48 cubic feet of soil and fill.
Fertilizer
Seeds and/or seedlings
Making Connections

To make the gardening experience fun and enjoyable for everyone, remind yourself that this is a second grade garden. Rows may not be strait, weeds may grow, bugs and worms will interest the kids just when you are trying to get them to focus on the difference between a leaf and a stem…. it is all ok. Allow the students to choose what to plant—consider even their most outlandish attempts scientific experiments, worthy of making predictions and observations and drawing conclusions from. Incorporate some interesting structures—add some tee-pee poles for beans and gourds to climb, a piece of clear plastic to view root growth, a large pot for some draping mint. Consider growing the plants from the Family Heritage Recipe Book, a multi-cultural, home-school bridge of a garden.

Teacher Prep for Activity

1. TALK TO YOUR STAKEHOLDERS:
For this small garden, you may only need to talk to your principle, the school groundskeeper and custodian, and other second grade teachers. To secure the permission or agreements you need, be sure to have your curriculum standards in hand, and a good plan to keep this from becoming a lot of extra work for the groundskeeper.

Keep in mind, that the bigger the garden grows, the bigger your garden community grows—check out “school gardening in Hawaii.” It is an excellent resource for checking off all the steps you might need to go through to get the community and school support you need for ambitious garden projects. Listed in resources section below.

2. OBTAIN METAL ROOFING:
Call your local roofing company or building contractor to ask for good quality used metal roofing. They will usually deliver for free, but you may have to accept their whole load. Some county dumps have a metal disposal area. If a nice guy is working, he will help you find some decent scraps and load them into your truck.

3. PADDING:
Ask for free used bicycle inner tubes at your local bike shop or buy foam insulation used for hot water pipes at a hardware store (the stuff everyone puts on their car surf-board racks).

4. STAKES:
These can be made out of various materials, mix and match, but at least the 8 outside stakes need to be very strong. Steel pipe, old EZ-Corner tent poles, 4 x 4 lumber or plastic lumber, are all good materials. 2 x 4 lumber, 2” or larger PVC, or steel re-bars will also work, but don’t always hold in soft soil.

5. OBTAIN THE SOIL/FILL MATERIAL:
This can be potting soil brought in by the bag (very expensive, but each parent might donate one bag), a small dump-truck load of topsoil (a little cheaper, or possibly free if you ask around, but won’t have much organic matter in it) or make it yourself by composting (Do step 6, Build the Garden Bed first, and build the compost pile inside).
you live in a very wet area, put about 4-6” of coarse cinder or gravel on the very bottom to improve drainage. No matter where you live, be sure to add plenty of organic material (i.e. compost—see instructions below).

6. BUILDING THE GARDEN BED:
This requires two people, preferably four. Please wear gloves—metal can be very sharp!

a. Lay the four sheets of metal flat on the ground, with corners touching, in position to make a 3 x 8 foot rectangle.

![Diagram of garden bed]

b. Hammer two stakes into the ground, one near each end of a panel, on the inside of the rectangle. Stakes should end up just a few inches shorter than the metal panel when it is stood on end. Stand the panel up and check.

c. Then, while a partner holds the panel, hammer two stakes on the outside of the panel (remember, save your strongest stakes for the outside).

c. Repeat for each panel, adjusting the position as needed to make the corners as flush as you can.

d. Check to be sure all the panels are secure. The inside will be further supported by soil.

e. Metal is very sharp, and rusty metal is downright dangerous. Put the padding on right away, using either:

   BICYCLE TUBING:
   1. Use an Exacto knife to slice the tube open lengthwise, and cut to the length of your panel.
   2. Apply a line of carpenter’s glue to the inside of the tubing.
   3. Press onto the top of the metal panel.
   4. Cut open a flat patch of tubing and glue over any jagged rust holes elsewhere.

   Or HOT WATER PIPE INSULATOR:
   Just follow steps 2 and 3 above. Use any thick, rubbery or plastic material to cover excess rust spots.

f. Add the soil:
   This is a good time to involve the students. As appropriate, dump the soil in and rake it smooth, or uncover your compost pile to reveal the humus you have created.
7. COMPOSTING TO MAKE YOUR OWN SOIL—start 6 months to 1 year ahead of time! You cannot count on compost to “go” on your schedule.

**Materials:**
- 3 x 8 foot garden bed
- 6 bamboo or strawberry guava poles
- Cover for garden bed (see step 3 below)
- Bucket or small trashcan for food scraps (with cover)
- Small pile of topsoil

1. Talk to your principal, groundskeeper, and cafeteria staff about composting school lunches. Your class alone will make more than enough for this small garden bed, so no need to make it a huge school project. Explain how you will control flies, rats, and cats (see below) and be prepared with the specific science, social studies, and math Standards you will draw from!

2. Build the garden bed (instructions above)

3. Make a cover to keep cats and rats out of the garden bed. You can use an old tarp or black plastic, but animals can easily sneak under the edges. Here is a simple, permanent solution (if you are not making a 3x8’ garden, adjust accordingly).

**Materials:**
- **38 feet of 3-foot wide, ½ x 1” hardware cloth** (sturdy fence material used for small animal cages) or 1” chicken wire (less durable, cheaper).
- **Small roll of stainless steel wire** (usually near the bulk fasteners at hardware stores).
- **Needle-nose pliers**
- **Wire cutters**

1. Cut a 14-foot length of the hardware cloth. Using needle nose pliers, bend the sharp cut ends of the material into tight “u” shapes, to prevent your skin from getting cut.
2. Bend a 3-foot length, at each of the ends upward (90°), so you have the beginnings of an 8’ long, 3-foot deep box top.
3. Cut 2 eight-foot lengths of the hardware cloth. Make the u-shape bends again.

Using 5” lengths of the stainless steel wire, attach the 8-foot sides to the box.

You now have a lightweight top that can fit over the whole garden until the plants are almost 3 feet tall. You can even add a couple of chickens for a few months to turn the compost and fertilize for you. It can be used over and over, for years.

3. Call a tree service/landscaping company, or a friend with a truck.

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4. Explain your project and timeline, and ask for a donation of wood chips, or mulch from the county green waste facility (professional tree services have to PAY to dump their wood chips at the green waste facility, so they like to donate it). A small pick up truck can probably fill the bed in two loads (shoveling out with a pitchfork). A full-size truck could fill it in one trip. Don’t know whom to call? Try a cardboard sign on the school fence that says: Wanted: Free Woodchips: Call 555-5555.

5. Arrange to have the woodchips or mulch delivered.

6. After mulch is in the garden bed, show students how to select leftover food to compost:
   a. Compost only NON-ANIMAL products: cheese, eggs, milk and meat should NOT go in the compost, or you will have problems with flies and maggots.
   b. Compost napkins, but not milk cartons or plastic forks (although an experiment is waiting to happen here!).
   c. Have students separate out the appropriate compost items into a specially marked bucket in the cafeteria, then bring to the compost pile after lunch each day.

7. Managing the compost pile:
   a. Rake most of the compost to one half of the garden bed, so you have a big hill and a big valley.
   b. Cut three 6-8 foot bamboo or strawberry guava poles from a side road, and lay them in the “valley”—one pointing out in each direction, with one end resting on the edge of the bed. These are your aerators (stirrers).
   c. Pour the bucket of scraps into the “valley”, spread thinly with a rake, and cover with a few inches of mulch from your hill.
   d. The next day, do the same thing, a layer of scraps, and a layer of mulch.
   e. If you were also able to obtain some cheap topsoil, mix a few shovels-full in every time you add the food. Keep the pile of topsoil covered with a tarp, or the weeds will take it over. Let the groundskeeper know he or she can empty grass clippings into the compost pile, too.
   f. As the poles become buried, have students gently stir the pile by rowing the exposed end of the pole like an oar. The buried end should stay put. This allows for air to get down into the bottom for microorganisms to survive.
   g. Continue to do this each day until your hill becomes a valley, and the valley becomes a hill—then fill in the new valley with three poles, and layers of food scraps, and mulch from the hill you made. If it gets stinky or you see lots of maggots, just stop adding food, and cover with more mulch, cut grass, or dry leaves. After two weeks, start adding food again.
   h. In a few weeks, your whole garden will be a mixture of food and mulch.
   i. Now you, and the garden can rest for at least 3 months! All you have to do is have the students come out and “stir” the compost once a week--
using the big poles that are now sticking out like oars. (Leeward districts: add a few gallons of water once a week, too). It is a good idea to cover it with a solid tarp or black plastic, or weeds will start to grow in it. Although the first year’s students may not get a chance to plant in the garden bed, they can measure the temperature (hot!) and volume changes (it shrinks) in the compost pile, and watch for growth of worms and bugs in the pile. NOTE: centipedes like compost, and fresh food scraps are germy, so never let students stick their bare hands in the pile!

j. In 3-6 months you will have a fine, black loam, with little, if any evidence of cafeteria waste. If it seems marshy or soupy, find some dry leaves and cinder to mix into the mess. Leave open to the sun to help it dry up. If instead it is bone dry, with napkins still evident, water it, stir, and continue to water, cover and stir it regularly.

k. When it looks like garden soil, go ahead and plant! Of course, you have a garden plan, right?

8. PLANNING YOUR LONG TERM GARDEN:

Every school and every teacher has a unique combination of goals, resources, and challenges when it comes to implementing a garden. The book: School Gardens in Hawaii, combined with the resources section below, and your own sleuthing, will help you develop a solid garden plan. There is nothing wrong with a plan as simple as: build a garden bed and grow stuff…for many this is the easiest, most interesting way to learn. But if you are trying for anything more ambitious than a simple square of soil, a little planning can’t hurt.

As far as selecting and managing the vegetables go, not everyone’s idea of fun includes pouring over gardening books for new and better ideas, so try the basic bible of gardening in Hawai’i: Kathy Oshiro’s Growing Vegetables in Hawai’i. This thin paper-back gives simple instructions on fertilization, water and light requirements, growing times, and recipes for many of Hawaii’s favorite home-garden veggies. These are not strictly organic techniques, but she strikes a nice balance using pragmatic, proactive techniques to grow healthy plants with a minimum of chemical intervention.

For the enthusiast: how much time do you have for reading? There must be millions of garden books out there! See the resources section below, but also try heading strait to the Hawaii agriculture section of your library and just browse. Always keep this in mind: most gardening books are written for people on the East Coast of North America. Always look for advice from the tropics!

Plan for seedlings. Try to have your garden box ready to make use of the plants you will be growing throughout the unit investigations, i.e. the bok choy or brassica, wheat sprouts, or the little grass pastures the students planted. You can also plant directly from seeds or start lettuce or other vegetable seeds in small break-apart trays at least 3-6 weeks before moving to the garden. Try to use only local brand seeds, bought in air-conditioned stores—they are kept fresh and dry by the cold air.
Background
According to Dr. Gary Pennington, of the University of British Columbia, education philosophers have enunciated a number of simple yet profound principles that converge when we discuss children and gardening:

- Learning is most effective when the subject matter is "demystified", that is, when it is immediate and familiar to the learner. (Illich)
- Exploration, selection, and refinement are the essential education processes through which learning occurs. (Laban)
- Equality of opportunity and cooperation optimize conditions of learning. (Rogers)
- Nature, simplicity, time for reflection, and self-reliance are the essence of the learning process. (Thoreau) (City Farmer, 1988).

In simpler terms, the school garden provides opportunities for hands-on, inquiry-based support of all subjects taught in the school. It provides a link to integrate separate subject curricula, so that an entire, academically rigorous unit can be taught around the garden.

**Soil:** a mixture of dirt, humus (organic matter), and living and dead organisms.

**Nutrient:** a substance that provides nourishment, for example, the minerals that a plant takes from the soil or the vitamins in food that keep a human body healthy and help it grow.

**Water:** a clear liquid, chemical formula: H₂O, that is essential for all plant and animal life.

**Air:** a mixture of gases, including nitrogen, oxygen, and carbon dioxide, that living things breathe to survive.

**Oxygen:** the main gas that animals need to breathe to survive.

**CO₂:** the main gas that plants need to breathe to survive. The carbon that makes plants woody and strong comes directly from breathing this gas out of the air.

**Photosynthesis:** process by which green plants produce simple sugars from CO₂ and sunlight.

**Respiration:** 1) the act of breathing air in and out. 2) The process by which animals and plants use oxygen to convert sugars to energy that can be used by the organism—direct opposite of photosynthesis. Most plants do this when the sun goes down.

**Weed:** a plant growing where it is not wanted.

**Garden:** a space for growing plants.

**Vegetable:** an edible plant, usually an herb (has no woody parts)

**Fruit:** the part of a plant containing the seeds, an adaptation to attract animals to spread seeds.

Definitions adapted from the Encarta® World English Dictionary © 1999 Microsoft Corporation. All rights reserved, or from Wikipedia.

Procedure
Since no two gardens are alike, no detailed procedure is offered here. However, here are some basic planting and transplanting instructions.

1. Prepare the planting bed. Use a spade or spading fork to work the soil to a depth of 10 to 12 inches; incorporate organic matter as needed.

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2. Planting seeds: Follow the instructions on the packet. Seems too easy? Here’s the trick, you have to actually follow the instructions on the packet. If your garden is in full sun but the packet says the plant needs deep shade: do not plant those seeds!

3. Transplanting seeds grown indoors:
   'Harden off' your seedlings by leaving them outdoors for longer and longer periods. Start by sheltering the young plants under a porch or bench by day, then bringing them back in by night or during inclement weather. After two or three days, you can safely keep them in the sun for half a day. By the end of a week, they'll be tough enough to soak up the rays all day.

4. If you can, transplant the seedlings to the garden on an overcast day to ease the shock of transition from pot to ground. If a light mist is falling, that’s perfect. Water both the outside ground and the plants before you move them into the garden.

5. Remove each plant from its pot by turning it upside down and tapping lightly on the bottom; it will slide out easily. Gently run your fingers through the roots to loosen them a little. Never hold small seedlings by the stem—hold them by the leaves or the root ball.

6. Use a trowel to dig a hole about twice the size of the root ball and set the plant into the hole so the root ball will be covered by about 1/4 inch of soil. Press the soil firmly around the roots to ensure good soil-to-root contact.

7. Space the plants according to the directions.

8. Water thoroughly immediately after transplanting and again every day until the plants are well established and growing - usually a week. If some plants show signs of wilting, shade them with a bit of screen or a large potted plant until they perk up, which shouldn't take more than a few days.

Adapted from [http://www.ehow.com/how_12178_transplant-seedlings.html](http://www.ehow.com/how_12178_transplant-seedlings.html)

**Assessments**

You really can assess outdoor garden work. You can keep a clip-board with a list of key skills and learning goals, such as “participates cooperatively,” “asks scientific questions,” “makes reasonable predictions,” “proposes scientific experiments,” “knows the names of plant parts,” “counts by 2s,” etc. As each student demonstrates these skills and concepts, check them off. Students who are not forthcoming can be assisted by simply asking them—what do you think is going to happen with that plant? What do you call this part? So that they can be checked off. When a certain skill is not being well covered, create an activity to address it, i.e. Cooperation: “Let’s pretend we are Menehunes today. In the dark of night we sneak down to the garden. We see that the farmers are tired and forgot to water their plants. There is a stream nearby and we have a bucket here. How can we transport the water to the garden silently, so that no farmers wake up and hear us?” The students come up with a plan to make a fire line to cooperatively water the garden. Each student that helps gets a check on his or her cooperation skill. Those that
offered the solution may get a check under “problem solving” or “proposes scientific experiments.”

**Resources**


All the resources you need to plan, grow, and create standards-based lessons for your garden:

- [www.kidsgardening.com](http://www.kidsgardening.com)

Incorporating math into your gardening program:

- [http://www.squarefootgardening.com](http://www.squarefootgardening.com)