PEDAGOGY OF FOOD – DEVELOPING THE INTERDISCIPLINARY STANDARDS-BASED SCHOOL GARDEN CURRICULUM

by
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The purpose of this article is present a case study of the framework, development, and implementation of an interdisciplinary standards-based school garden curriculum at Kohala Elementary School. I hope that readers can take this information and apply it in their own context and schools.

The Discovery Garden of Kohala Elementary School

Ne huli ka lima in luna, pololei ka opu; Ne huli ka lima i lalo, piha ka opu.
When your hands are turned up, your belly will be empty; When your hands are turned down (to the soil), your belly will be full. ‘Ōlelo No’eau

It's good to work with the plants.
Weeding.
Sunny.
Itchy.
Carrots.
Work is good for plants.
Fun.
A gazillion times fun.
Awesome.
Taro.
Fun.
Mud.
Weeding.
Digging.
Teamwork.

A poem by First Graders, collectively created January 27, 2011.

In September 2010, the Discovery Garden at Kohala Elementary School Talk Story group which included the principal of Kohala Elementary School (KES), a KES faculty member, a Kohala Middle School representative, one Kohala High School faculty member, a school parent, at least one community member, and myself collaboratively created this working vision of the Discovery Garden of Kohala Elementary School:

The Discovery Garden will produce healthy produce and healthy, contributing citizens. The mission of the Discovery Garden is: To teach in an exploratory manner, sustainable agricultural practices, the STEM subjects, wellness and nutrition, and pono (uprighteousness) behavior in the setting of a school garden.

The objectives of the 4.0-acre Discovery Garden were:

1. To support academic achievement;
2. To be an avenue to teach *pono* (uprighteous behavior), wellness and nourishment, mind/body engagement, food eating and making;
3. To be involved in place making by interacting with nature and in the garden;
4. To build community; and
5. To meet the GLOs of State of Hawai'i Education Department, for students to become:
    a. Self-directed learners,
    b. Community contributors,
    c. Complex thinkers,
    d. Quality producers,
    e. Effective communicators, and
    f. Effective and ethical users of technology.

Using the principal's vision, borrowing from best practices of other successful garden programs, and including the calculation of continued community support, I created a draft of a 5 year plan for the Discovery Garden. This plan supports the development of the school garden as curricular, physical and social learning environments, and enabled us to prioritize and effectively manage the projects.

The school year 2010-2011 of the Discovery Garden program was the pilot year. It was dedicated to learning how to garden, to develop fully each grade's garden plot, and to build up the infrastructure systems such as irrigation, composting, tool use and storage, and a protected outdoor meeting space. At my first introduction to the faculty, I asked the faculty to think about their vision or ideas of the function of the school garden, and which academic benchmarks I could help to meet through garden activities and lessons. Some homeroom teams asked to meet with me, but most teams met and discussed their vision about the school garden without me. After their meetings, they emailed me their thoughts and benchmark ideas. Their data and information helped me to design the following for the 2010-2011 school year:

Grade One: Senses garden to teach scientific inquiry and observation;

Grade Two: Butterfly/insect garden to teach biodiversity and unity;

Grade Three: Vegetable garden to teach life cycles and interdependence;

Grade Four: Hawai'ian subsistence plants – taro and sweet potatoes to teach science, technology, and society; and

Grade Five: Pizza Gardens to teach circular geometry and heredity.

Once we had these ideas agreed upon by the team and the principal, garden classes began.

Pedagogy of Food

Are soil, food, gardens, and water the most effective gateways to the next phase of social and pedagogical engagement the result of which will not only be deep but also delicious?

Pramod Parajuli

Sustainability contains the word *'āina* (land or that which feeds), which contains the root word *'āi* (food).

What would happen, for example, if we were to start thinking about food as less of a thing and more of a relationship?

Michael Pollan

In this section, I will synthesize the conceptual framework concepts, learning garden principles, and the four assumptions I have about education presented in the previous chapter into a pedagogical philosophy, I call the *Pedagogy of Food*. This pedagogy was used to develop the interdisciplinary standards-based school garden curriculum. There are four pedagogical principles that guided my creation of the curriculum:

1. The curriculum is consciousness appropriate – humans eat from liquids to solids.
2. The curriculum is situated in the structural-development theory framework – you are what you eat.
3. The curriculum is food, place, and relationship based – you eat what you are.
4. The curriculum provides for the realization of the dimension of time – slow food, slow school.

Figure 2. Pedagogy of food principles.

Curriculum is consciousness appropriate and curriculum is situated in the structural-development theory framework

The child development and learning theories were reviewed in the preceding Literature Review chapter. In brief, children in elementary school can best learn from concrete, connective, nature-based, and imaginatively presented experiences. Elementary school children, ages approximately 6-11 years old, construct knowledge and values through active involvement with the physical and social world. They do not yet have the capacity to understand or conceive the abstract world. Only around ages 11-12 a child can begin to reason and conceptualize, and grasp abstract ideas and lessons. The ability to reason abstractly is based on the development of the natural values of humanistic, symbolic, aesthetic, and knowledge which happens during the ages of 6 to about 11 years old (Piaget, 1954; Steiner, 1982, 1996b)

I designed a curriculum that contained projects, activities, and experiments to be conducted by the students with the understanding of the stages of development and consciousness of the third, fourth, and fifth grade students. The curriculum is experiential-, place-, and project-based with concrete, relatable activities in which the children could be wholly involved. An example of an activity/lesson that is developmentally appropriate and structural-developmentally based, as captured in my field notes follows:

> The study of living soils is the first theme of the curriculum. The students observed closely the soil in the school garden. They used all their senses in their observation. They looked at the soil, shook it and listened, smelled and felt the soil, and they even tasted it, behind my back when they thought I was not looking. Then they ran simple soil analysis tests. They measured the pH of the soil, and soil moisture content, and they used simple soil test kits to determine nutrients in the soil. We sent soil samples to be tested in the

University of Hawaii at Manoa labs, and the students *Skyped* with the graduate assistant who conducted the tests. They watched him conduct soil tests and asked many clarifying questions. Based on their observations, the soil analysis results, and input from soil health research they conducted, the students added soil amendments to an area of the garden, leaving area another untreated. The students planted the same seeds in each section on the same day and at the same time, and observed the plants' germination, growth, and health. They compared and contrasted the plants in the two sections and drew conclusions about the health of the plants based on what they had actually experienced and done.

The curriculum I created also addressed two assumptions: that being in nature and developing a sense of place is an essential core of children's lives, and that learning is as diverse as the learners - everyone can learn, but not always in the same capacity or context or rate. The students were encouraged to engage their five senses, thinking processes, communication skills, and to manipulate technological devices. The many different learning situations ensured that all the students could participate in some way or form during the activity/lesson. The students learned to nurture the soil and provide for the soil through soil chemistry and adding amendments. The enthusiasm at which they tackled the task spoke to feeling that they enjoyed and loved being in the space of the school garden. The curriculum designed around the two pedagogical principles stated above also incorporated two Learning Garden principles from Williams and Brown (2012), that of cultivating a sense of place and awakening the senses.

Curriculum is food, place, and relationship based

Kirschenmann (2008), in his article *Food as Relationship,* urged readers to understand that "food is not an isolated thing—a mere commodity comprised of a list of ingredients or the numbers on a nutrition facts panel. Food always becomes part of the ecology from which it is produced" (p. 108). It has been found that food-based learning within a school garden program supports the development of the students' relationship with food and ecology. A study conducted at Texas A&M University demonstrated that students involved in a school garden program had more positive attitudes toward fruit and vegetable snacks and an improvement in vegetable preference scores (Lineberger & Zajicek, 2000). Similarly, a study conducted by Ratcliffe (2007) at two sites in the San Francisco Unified School District indicated that:

> gardening influenced factors that may predict or affect children's vegetable consumption, including improved recognition of, attitudes toward, preferences for, and willingness to taste vegetables. Gardening also influenced factors associated with vegetable consumption, including increased variety eaten as measured by self-reported monthly consumption, and consumption of different vegetable varieties at school. (p. v)

School garden programs such as *The Edible Schoolyard* at Martin Luther King Middle School, Berkeley, California, and *The Garden of Wonders* program at Abernethy Elementary School, Portland, Oregon, that focus on food as the core component of their curriculum, also report school-wide success in affecting healthy food choices, including choosing fruits and vegetables to eat during school lunch (Parajuli et al., 2008; Rauzon et al., 2010; Williams & Brown, 2012).

The work of the school garden educators mentioned above complement my personal belief and experience that it was logical and natural to have a school garden curriculum be themed around food, and then to tie that theme into ecology, science, mathematics, and culture. For example: taro or kalo is a staple food of Hawai'i, and is central to the Native Hawai'ian creation story. The following is adapted from the traditional Hawaiian mo'olelo (story) retold by the Hawaiian Studies kumu (teacher) at Kohala Elementary School:

> They say that Papa Honomaku, the Earth Mother and Wakea, the Sky Father came together and gave birth to a beautiful girl named Ho'ohokukalani, the stars. Ho'ohokukalai and Wakea came together to create a child who was born premature and alu`alu, watery or deformed. They named the child Haloa Naka Lau Kapalili, and buried it into the ground, and after Ho'ohokukalani wept upon the grave the kalo plant sprung forth. Wakea and Ho'ohokukalani came together again and created their second child, the strong baby boy also named Haloa. The kalo in the earth became the sustenance for the younger brother Haloa the Man, and the genealogy of the Hawai'ian people was forever linked to the sacred kalo.

To launch our study of the *botany of food*, a unit designed to be taught for 3-4 weeks, the students asked several elders of the Kohala Elementary School community how to plant taro. The following is taken from my field notes (spring 2011).

> There were two different ways suggested. Several elders suggested planting the taro in trenches, so that the plant could grow out and up. Other elders said that since taro is primarily a root crop, it should be planted in mounds, so that the root could grow down into the hump. So, the students created two different taro patches of the same size. In the first patch, the taro was planted in trenches, and in the other patch, the taro was planted in small mounds. Both patches were planted from the same stock four days apart, and treated with the same soil amendments, and provided equal volume of water. When students harvested and weighed the taro, they found very little difference in size, shape or weight of the taro corm (root). Several homeroom teachers and I speculated that the students treated the plants in each patch so carefully and fed the plants so much organic compost that the plants just responded positively to the attention regardless of the type of

planting system. Two parents and one grandparent prepared the taro for the classes to eat for lunch four days following the harvest. There was enough to feed more than 60 students and five adults. This activity exemplifies how the curriculum was place-based, depended on relationships, and resulted in delicious food.

What I realized from my observations is eloquently described by Charlton (1977) who wrote:

> Any curriculum which is devised as a result of theorizing must include a component which helps sensitize as person first of all to his own past, and then to the past of others…he includes the factor of time in his model [of curriculum] – he builds change into it…[his] theory is relevant to a particular kind of social situation…in which change is considered to be a good thing. (pp. 84-85)

The activity described above can exemplify what Charlton so eloquently stated. The food, place, and relationship based pedagogy of food incorporates the Learning Garden principles of cultivating a sense of place, nurturing interconnectedness, and valuing biocultural diversity. This pedagogy also honors that learning causes change and that "change is considered to be a good thing" (Charlton, 1997, p. 85).

Curriculum provides for the realization of the dimension of time

The structural-developmental theory of learning supports the assumption that children do not all learn at the same pace. The time dimension is an important principle of the pedagogy. The following is a short depiction by Gatto (1992) of a context where time is mechanized and individual learning pace and abilities are not honored. The setting is an industrialized school system run by bells that denote small chunks of time in which all learning is supposed to take place. Gatto described a carefully and thoughtfully planned lesson, and his students enthusiastically receiving his instruction:

> But when the bell rings, I insist they drop whatever it is we have been doing and proceed quickly to the next workstation. They must turn on and off like a light switch. Nothing important is ever finished in my class nor in any class I know of…Indeed, the lesson of bells is that no work is worth finishing, so why care deeply about anything? Years of bells will condition all but the strongest to a world that can no longer offer important work to do. (p. 6)

The pedagogy of food model posits that we all need time to observe, to reflect, to compare and contrast, to engage deeply, to slow down. M. Holt (2005) in his essay *The Slow School*, and Payne and Wattchow (2008*), Slow Pedagogy and Placing Education in Post-Traditional Outdoor Education* both discuss *slow pedagogy.* Payne and Wattchow wrote, "slow pedagogy [acts] as a primacy of experience and the 'growth' required in fostering a secondary, deep reflection about the organism-environment interaction, and human nature of experience" (p. 36).

M. Holt's (2005) *The Slow School*, "attends to philosophy, to tradition, to community, to moral choices…the students have time to understand not just memorize...the school must be contextualized – it must understand its community, socially and politically, and work with it…and less [coverage] is definitely more" (pp. 59-61).

> Learners, especially in school settings, are often faced with tasks that do not have apparent meaning or logic. It can be difficult for them to learn with understanding at the start; they may need to take time to explore the underlying concepts and to generate connections to other information they possess…Providing students with time to learn also

includes providing enough time for them to process information (Bransford et al., 2000, p. 58).

Time must be factored into the curricular, physical and social environment of school gardens based education. The plants in the school garden cannot be rushed into germinating and growing, and neither can the fruit such as cucumbers, pumpkins, or corn be hastened into ripening. So it is with the children. They too cannot be rushed into learning concepts no matter how appropriate the teacher deems it to be. Time must be given to foster curiosity and wonder, to embrace practical experience, and to discover rhythm and scale (Williams and Brown, 2012). The pedagogy of food employs time in the garden for the children to discover, explore, play, reflect, and work.

The Curriculum

E kuhikuhi pono i na au iki a me na au nui o ka ʻike.
Instruct well in the little and the large currents of life. ʻŌlelo Noʼeau

In teaching, do it well; the small details are as important as the large ones (Pukui, 2004, p. 40).

An ideal curriculum is one in which maximum coherence is achieved, and segmentation is minimized. Phillip Phenix

The design and framework of curriculum development for the Kohala Elementary School Gifted and Talented Program for third, fourth, and fifth graders was based and built on what I understand and know about how children learn, my current experience with Hawaiian epistemology, my experience teaching in school gardens, the Pedagogy of Food, Williams and Brown's Learning Gardens principles, Ratcliffe's Model of Garden-Based Education, interdisciplinarity, and current understanding of the six GLOs. Elements of the project were also taken and adapted from the work of the Learning Gardens of Portland Public Schools in Oregon (Parajuli et al., 2008), The Edible School Yard program (Murphy, 2003; Waters, 2005), and the

Center for Ecoliteracy (Stone, 2009). I also drew from Williams and Dixon (in review), who synthesized research between 1990 and 2010 on the impact of garden-based learning on academic outcomes. They used the following as criteria for rigorous garden programs:

- there was structured garden-based curriculum;
- academic outcomes were measured and linked with subjects;
- intervention consisted of a minimum of an hour at least every two weeks;
- there was intentional connection with subject standards; and
- assessment tests were specific to the age-group being studied.

It was very important to the administration of Kohala Elementary School that the school garden curriculum include a strong STEM emphasis. This was in response to recent research that has brought the need for comprehensive STEM education into clear focus for educators at all levels. President Barack Obama launched *Educate to Innovate*, a campaign to improve the participation and performance of America's students in STEM, on November 23, 2009. As part of this national imperative, teachers *must* engage elementary and middle school children in becoming problem solvers, innovators, inventors and logical thinkers eager to master STEM subjects now and as they move into high school, college and careers. According to the Bayer Report on Science Education (2004), 38% of teachers in elementary classrooms lack full confidence in their qualifications to teach science. Almost as many say that they rely more on what they learned in high school science than on what they learned in their teacher preparation courses in college.

In the September 2010 publication, *Report to the President: Prepare and Inspire K-12 education in Science, Technology, Engineering, and Math (STEM) for America's Future*, the Presidents' Council of advisors on science and technology stated that:

> It is important to note that the problem is not just a lack of *proficiency* among American students; there is also a lack of *interest* in STEM fields among many students. Recent evidence suggests that many of the most proficient students, including minority students and women, have been gravitating away from science and engineering toward other professions. Even as the United States focuses on low-performing students, we must devote considerable attention and resources to all of our most high-achieving students from across all groups. (p. vi)

The council continued by admitting that they are troubled by the pervasive lack of interest in STEM subjects as well as the mediocre test scores. They noted that even schools that are generally successful often fall short in STEM fields. Thus the problem must be addressed with systemic solutions. A huge part of the problematic system, which must be addressed, is teacher development. The council concluded that schools often lack teachers who know how to teach science and mathematics effectively, and who know and love their subject well enough to inspire their students. These teachers lack adequate support, including appropriate professional development as well as interesting and intriguing curricula. Schools also lack tools for assessing progress and rewarding success.

The council also addressed the point that the United States lacks clear, shared standards for science and math that would help all players in the system set and achieve goals. As a result, too many American students conclude early in their education that STEM subjects are boring, too difficult, or unwelcoming, leaving them ill-prepared to meet the challenges that will face their generation, their country, and the world (Presidents' Council of Advisors on Science and Technology, 2010, p. vii).

STEM education is most successful when students develop personal connections with the ideas and excitement of STEM fields. This can occur not only in the classroom but also through individualized and group experiences outside the classroom and through advanced courses. The school garden-based education program seemed to be a perfect fit for the GT program as the garden can provide curricular, physical and social learning environments conducive to learning STEM topics and subjects in an experiential, multidisciplinary way.

I used the above literature and experience to develop and create the interdisciplinary standards-based school garden curriculum which included STEM topics, was experiential, place-, relationship-, and project-based, and linked to specific subjects and their standards. It was written mainly for fourth and fifth graders, and is adaptable for students younger (Kindergarten through third grade) and slightly older (sixth and seventh grade). This interdisciplinary standards-based school garden curriculum will also integrate topics and subjects from agriculture, language arts, fine arts, Hawai'ian culture and history, and geography, and is linked to several specific standards of those subjects.

The objectives of the interdisciplinary standards-based school garden curriculum are to:

1. Teach the six GLOs.
2. Provide opportunities and settings for the learning of the six GLOs.
3. Support the students' continued development and demonstration of the six GLOs.
4. Reinforce lessons, skills, and knowledge of STEM subjects.
5. Reinforce and integrate standards-based knowledge and skills of science, mathematics, social studies and language arts disciplines.

To meet the above objectives, the curriculum design integrated several components such as:

1. The six Hawai'i GLOs, which include the progressive personal and social development of the student.
2. Science, Math, Social Studies, and Language Arts content of each grade.
3. The gardening skills and knowledge appropriate for each grade.
4. The seasonal cycles of the garden and the natural environment.
5. The cyclical nature of community activities of the school and neighborhood.

The daily lessons in the garden will have five major components, framed on the understanding of how children learn:

1. Observation using senses and capacities.
2. STEM in the garden – a topic related to what is being taught in the third, fourth, and fifth grade homeroom classes.
3. Garden jobs – time spent using the STEM skills discussed to execute garden tasks, such as building compost heaps, creating garden beds, weeding, fertilizing, seed saving, harvesting, etc. This component also supports the development of personal and social skills such as cooperation, problem solving, systems thinking, leadership, communication, and quality production.
4. Language Arts in the garden – garden journals, letter writing, speeches, descriptive writing, poetry, drama, based on the topic presented, garden observations, and/or garden jobs.
5. Culture in the garden – a story or activity that will invite a deeper connection and relationship to the context, such as a Hawai'ian myth, art and drawing, and/or cooking.

The content and activities of the school garden lessons are based on homeroom teacher requests and suggestions, Hawai'i state benchmarks, and community connections. The third, fourth, and fifth grade homeroom teachers at the Kohala Elementary School were surveyed in late December 2010 and early January 2011 to gather information on benchmarks and class topics/themes. They were asked to provide information about the following:

1. Science, Math, Social Studies, and Language Arts benchmarks they know students have had challenges meeting and understanding;
2. Topics/themes that they planned to teach each quarter of the school year; and
3. Personal and social skills their students could benefit from learning.

From the survey, the following topics within STEM subjects and skills became clear:

1. Science: Foundations of Life – soil, water cycle, solar energy;
2. Science: Relationships – plant-insects, plant-human, ecology;
3. Botany: Parts of plants;
4. Science Vocabulary;
5. Math: Graphing, application of measurement formulas (eg. how to find area and volume);
6. Life skills:
    a. Cooperation,
    b. Leadership,
    c. Follow-through,
    d. Responsibility, and
    e. Creative problem solving.

There were also important systems that needed to be placed in the Discovery Garden for the sustainability of the garden program. These were based on observations of the garden teacher, local expert gardeners and farmers, engineers, the faculty and staff of the Kohala

Elementary School, parents and community of the Kohala Elementary School. These systems included an irrigation/water catchment system using water off the school roof; a self-containing renewable solar electrical system for the garden to run water pumps, and electrical equipment such as laptops, digi-probes and microscopes in the garden; soil fertility – a composting area; plant nursery for starts and transplants; and an animal husbandry system for the raising of fowl, pigs, and goats.

The lessons were developed using the information from the homeroom teachers, and incorporated the creation and installation of the systems necessary for the sustainability of the garden. The curriculum was divided into broad themes, based on seasonality, on benchmark sequencing as developed by the State of Hawai'i Department of Education, and on homeroom teachers curricular sequencing.

Sometimes the lesson planned is thrown out when a student draws the class' attention to something interesting and exciting in the garden previously unnoticed. Being a structural-developmental/constructivist based educator allows me to use what seems pertinent to the children and class for that moment.

A crucial element of a thoughtful garden program is that there is something for everyone to do. From the detailed oriented to the action motivated. A. Rieux (personal communication, April 2011), Garden Teacher at a neighboring district, said, "Helping students find their place in the garden may help them find their place in whatever that is they choose to do in life." There are six basic tasks in the garden, with many variations within them:

1. Composting and soil fertility,
2. Garden bed preparation and maintenance,
3. Planting,

4. Weeding,
5. Organizing and cleaning the outdoor classroom, tool shed and nursery, and
6. Harvesting.

Each task has specific tools associated with them for efficiency and optimal results. The children rotated through all the tasks, learning proper use of tools, and the skills to do the work.

The closing moving poem was a crucial reflective and evaluative component of the program. After all the tools are put away neatly, the children gather in a circle in the outdoor classroom. They think of a word or phrase that will describe either or a combination of what they did in the garden, how they felt, and/or what they learned. A sample is included at the beginning of this section. I paid close attention to not only what is said, but also who said it. These poems were recorded in the field notes for the day.

The following table is a sample of the curriculum.

Table 1 *Discovery Garden Program Curriculum for Gifted and Talented Class*

Fall 2011–seasonal and evolving. Goal: Prepare the new intergenerational heritage garden for use by Kohala Community tutus and kapuna, and for Ethnic Gardens			
August/Sept. Organizing Theme: *Living Soils*			
Grade	Specific focus	Science and Math Standards Social Studies	GLOs
3	Using the five senses, develop a hypothesis based on observations	Standard 1: The Scientific Process: SCIENTIFIC INVESTIGATION: Discover, invent and investigate using the skills necessary to engage in the scientific process. Standard 4: Measurement: FLUENCY WITH MEASUREMENT: Understand attributes, units, and systems of units in measurement; and develop and use	#1: Self-directed learner #3: Complex thinker #6: Ethical and
4	Using the five senses, develop an experiment to test hypothesis based on observation		

<table>
<tr><td>3</td><td>Using the five senses, develop a hypothesis based on observations</td><td rowspan="3">techniques, tools, and formulas for measuring.

Standard 6: Cultural Anthropology: SYSTEMS, DYNAMICS, AND INQUIRY-Understand culture as a system of beliefs, knowledge, and practices shared by a group and understand how cultural systems change over time.
Culture: Who am I – What is race? What is nationality? What is ethnicity?</td><td rowspan="3">effective use of technology</td></tr>
<tr><td>4</td><td>Using the five senses, develop an experiment to test hypothesis based on observation</td></tr>
<tr><td>5</td><td>Using the five senses, identify variables within the experiment</td></tr>
</table>

Observations	**Lessons**	**Tasks**
Touch, smell, look, listen closely at soil. What lives ON the soil? IN the soil? Dry soil/wet soil – compare & contrast Hard soil/soft soil What is culture? How is that revealed in what we do in Kohala?	What makes up soil? Living and nonliving content. How to care for soil? Simple soil test. Complex soil test. Soil water content analysis. How to use tools such as soil probes, microscope, pH meter. Exploring own ethnicity and culture.	Soil amendments. Compost pile building. Collect soils for soil test. Start seeds, planting. Soil tests – content and water. Mulching paths. Microscope use to look at soil. Interviews of kapuna/tutu from different ethnicities. Video making.

Sept/Oct: Organizing Theme: *Sun, wind and weather.*

Grade	Specific focus	Science and Math Standards Social Studies	GLOs

3	Sun movement. Wind movement. Develop a hypothesis based on observations.	Standard 8: Physical, Earth, and Space Sciences: EARTH AND SPACE SCIENCE: Understand the Earth and its processes, the solar system, and the universe and its contents. Standard 4: Measurement: FLUENCY WITH MEASUREMENT: Understand attributes, units, and systems of units in measurement; and develop and use techniques, tools, and formulas for measuring. Standard 7: Geography: WORLD IN SPATIAL TERMS-Use geographic representations to organize, analyze, and present information on people, places, and environments and understand the nature and interaction of geographic regions and societies around the world.	#3: Complex Thinker #2: Community Contributor #5: Effective communicator
4	Sun and earth relationship – daily rotation, annual revolution. How does climate affect geography? Develop an experiment to test hypothesis based on observation.		
5	As above Grade 4 include Earth orbiting the Sun. Identify variables within the experiment.		

Observations	**Lessons**	**Tasks**
Where does the sun rise/set? How fast does the wind blow and which direction? How has the weather been recently? Compare/contrast shady part of garden with sunny part. How does climate affect geography? And vice versa?	Nature runs on sunlight. All our food comes from the sun, as does our energy. Plants depend on sun – how? The four directions – North, south, east and west. Sun orbit patterns. Geography – mapping of place GPS	Mapping – 2D and 3D GPS mapping Google Earth Use maps to design ethnic gardens Begin collecting seeds and plants for those gardens Start seeds Continue to prep the Intergenerational Heritage garden

	Google Earth	Slide show. Video.

Oct/Nov: Organizing Theme: *Water and structure.*

Grade	Specific focus	Science and Math Standards Social Studies standard	GLOs
3	How do these structures keep living things alive?	Standard 4: Life and Environmental Sciences: STRUCTURE AND FUNCTION IN ORGANISMS: Understand the structures and functions of living organisms and how organisms can be compared scientifically. Standard 9: Patterns, Functions, and Algebra: PATTERNS AND FUNCTIONAL RELATIONSHIPS: Understand various types of patterns and functional relationships. Standard 2: Historical Understanding: INQUIRY, EMPATHY AND PERSPECTIVE– Use the tools and methods of inquiry, perspective, and empathy to explain historical events with multiple interpretations and judge the past on its own terms.	#2: Community Contributor #5: Effective communicator #6: Ethical user of technology
4	Plant and animal structures.		
5	Human structures.		

Observations	**Lessons**	**Tasks**
Which plants feel wet/dry? Where do plants store water?	No Water, No Life. Why and how we need water.	Design and install irrigation system of Heritage garden.

How does water travel in a plant? What is the difference a rock and plant? How does water flow? How does water affect/change the geography and culture of a place such as Kohala?	How water travels in a plant, animal, humans. Irrigation system – how it works Plant cell/Animal cell – compare & contrast. Water and culture. Ahu pua'a. Wai/a'ina.	Continue creating beds and gardens. Composting. Mulching. Reports on water.

Nov/Dec: Organizing Theme: *Botany.*

Grade	Specific focus	Science and Math Standards Social Studies	GLOs
3	How do animals depend on plants? And vice versa.	Standard 3: Life and Environmental Sciences: ORGANISMS AND THE ENVIRONMENT: Understand the unity, diversity, and interrelationships of organisms, including their relationship to cycles of matter and energy in the environment. Standard 11: Data Analysis, Statistics, and Probability: FLUENCY WITH DATA: Pose questions and collect, organize, and represent data to answer those questions. Standard 1: Historical Understanding: CHANGE, CONTINUITY, AND CAUSALITY-Understand change and/or continuity and cause and/or effect in	#3: Complex Thinker #2: Community Contributor #4: Quality Producer
4	Explain how simple food chains and food webs can be traced back to plants.		
5	Describe the cycle of energy among producers, consumers, and decomposers.		

		history.	

Observations	**Lessons**	**Tasks**
Parts of plants – start with roots and move up every week or two. Look for flowers, seeds, fruit. Fungi. Plants and culture. You eat who you are.	Root structures and function. Leaf – veins. Photosynthesis. Plant life cycle. Seeds – covered or gymnosperm (naked). How do seeds travel? Flowers – simple/complex. Decomposers – fungi are fun guys ;-) Energy cycle.	Planting into heritage garden. Garden maintenance. Reports on tasks. Mini-STEM Fair

Implementing the Curriculum in the School Garden-Based Program

The protocol of the Gifted and Talented school garden-based program is as follows:

1. Chant *Oli* (Hawaiian chant) to ask permission to enter.
2. Enter the garden in a pono manner.
3. Gather at a designated area.
4. Garden teacher provide a theme/idea for observation, e.g., look for insects, how are leaves arranged, sounds you hear, soil texture, etc.
5. 2 minutes of silent observation, students should be 10 feet away from each other in the garden.
6. Gather back for discussion of observation.
7. Lesson of the day.

8. The garden teacher will explain garden jobs and other projects– digging, weeding, composting, planting, seed collecting, plant labeling, garden art projects, design projects, etc.
9. Jobs and projects.
10. Provide 5 minute warning to end time.
11. Put tools and materials away neatly.
12. Gather for closing circle – recapitulate the mini-lesson and open sharing.
13. Moving poem – say a word of phrase that will express your feelings about the garden, or what you did or learned.
14. Exit in a pono manner.

The thematic, subject and standards linked lesson of the day followed the curriculum as presented in Table 1. After the first month of class, pairs of students chose garden-related topics or areas in which to be an expert. Students borrowed books from the school and public libraries, looked up topics on the Internet, and asked local experts. Students applied their knowledge in a project and presented their experience at a *Ho'oike* mini-STEM fair, which was modeled after School Science Fairs, at the end of the semester (see Table 2).

Table 2 *Several Student Expertise Projects*

Student	Area(s) of interest	Project	Team
A–male, fifth grade B–male, fourth grade	Soil Science	Improving soils of the Discovery Garden through understanding soil needs, composting, crop rotation, and nitrogen fixing plants.	Pedology

C–male, fifth grade D–male fifth grade	Insects	Encouraging beneficial insects in the garden by planting the optimal plants	Entomology
E–female, fifth grade F–female, fifth grade	Medicinal Plants Useful plants Plant diseases Weeds	Create a chart for K – 3 grades to use to identify medicinal plants and weeds at the Discovery Garden Experiment with organic cures for plants diseases such as powdery mildew on squashes	Ethnobotany
G–female, third grade H–female, third grade	Student Run Farmer's Market Irrigation	Create a student-run farmer's market. Design and install irrigation system to the garden area.	Market
J – female, fifth grade K – female, fifth grade	Orchard Irrigation	Design and install irrigation system to the orchard area. Select trees for the school orchard based on interviews with local farmers, and research.	Water
L–female, fifth grade M – male, fifth grade	Native Hawai'ian plants	Create a chart of the Native Hawai'ian plants in the garden and their uses.	Hawai'i
P – female, fourth grade Q – male, third grade	Plants of European origin	Select culturally important plants. Design and create a Europe garden bed.	Ethnic studies
R – female, fourth grade S – male, third grade	Plants of Filipino origin	Select culturally important plants. Design and create a Philippines garden bed.	Ethnic studies

The six GLOs were implicitly taught in the school garden activities and content lessons. Meaning, I did not introduce the GLO as the lesson of the day. Instead, I created opportunities for the students to engage in the process during the activity. At the end of class, I pointed out to the students how they demonstrated the GLOs while they were in the school garden.

Summary

This interdisciplinary standards-based school garden curriculum is grounded on localized knowledge, strives to be contextually and culturally appropriate, addresses stages of child development, integrates learning principles, weaves several subjects in at the same time, and is intentionally connected with standards. Students are supported to pursue individual interests when studying the school garden, thus providing a wider range of knowledge, and contributing energy, excitement and enthusiasm to the class and program. The pedagogy of food provides a foundation for teaching and learning in and around the school garden, and the curriculum teaches content and knowledge through the application of the six GLOs.