

GARDEN-BASED LEARNING:  
The rationale, the purpose, the function.

By  
KOH MING WEI

*A Zen roshi is dying.  
All of the monks gather – an eagerness restrained – around the deathbed,  
hoping to be chosen as the next teacher.  
The roshi asks slowly, “Where is the gardener?”  
“The gardener,” the monks wonder aloud, “he is just a simple man  
who tends the plants, and he is not even ordained.”  
“Yes,” the roshi replies, “but he is the only one awake.  
He will be the next teacher.”*

Zen Story

This article focuses on the relationships between the purpose of education for a sustainable future and the school garden movement, and on the theoretical framework that informs the pedagogy and design of an interdisciplinary standards-based school garden curriculum that I created, implemented, and evaluated at Kohala Elementary School. It is my hope that educators will adapt the ideas and information presented in this paper appropriately for their contexts. Quotes and questions are included at the end of each section to prompt the reader to think of personal applicable experiences and new educational ideas.

Section One: **What is the purpose of education?** I briefly discuss this, so that the readers may understand my strong inclination toward the use of school gardens as a vehicle to teach through place, subjects, processes, and skills, and as a haven to nurture attachments to nature.

Section Two: **Children and Nature.** I review briefly the literature about the relationship between children and nature.

Section Three: **Child consciousness development and learning theories.** I situate what I have reviewed about the relationship between children and nature (in Section Two) and child development within the framework of structural-developmental learning theory.

Section Four: **School Gardens.** In a central position in this chapter, I review how school gardens are used to teach content, social and intellectual process and skills, and as a place to develop and nurture relationships with nature and community. I draw on the work of Dilafroz Williams and Jonathan Brown, as well as of Michelle Ratcliffe to develop a **conceptual framework for Garden-based education.**

Section Five: the **Six General Learner Outcomes (GLOs)** of the State of Hawaii Department of Education. I review the literature explaining and interpreting the six Hawaii's GLOs from different perspectives.

**What is the Purpose of Education?**

I contrast two philosophical positions prevalent throughout modern education. The first position is based on the belief that our education system is necessary to prepare future members

of the workforce, ensuring that they will keep our economic system stable and growing. This has been particularly true since the Industrial Revolution. "...for one hundred and fifty years institutional education has seen fit to offer as its main purpose the preparation for economic success. Good education = good job, good money, good *things*" (Gatto, 1992, p. 66).

Public education, in its current manifestation, was built on the need to produce workers for the factories and production arenas of the Industrial Revolution. Schools were looked upon in the early twentieth century as a "branch of industry and a tool of governance" (Gatto, 2006, p. 38). Woodrow Wilson, before the First World War disclosed: "We want one class to have liberal education. We want another class, a very much larger class of necessity, to forgo the privilege of a liberal education and fit themselves to perform specific difficult manual tasks" (p. 38).

According to several prominent educators and philosophers, including Gatto (1992), New York Teacher of the Year 1991, J. C. Holt (1967), Orr (1992, 1994), and Sterling (2001), the emphasis of education during this period moved from process to product. In the industrialized schooling paradigm, scoring well on a multiple choice test seems to be the aim of all formal schooling, which alienates many students resulting in dropping out of school and underachievement (Wise, 2008, pp. 6-7). Children are rushed from one subject to the next with little time for reflection and discourse to gain understanding of the lessons (Gatto, 1992, p. 6). Memorization of facts and figures is given priority over understanding of procedures and their application (J. C. Holt, 1967, pp. 28-29). The purpose of education has

shifted from *educational* values to do with process, and developing potential and autonomy, and *social* values relating to equality of opportunity, community and social cohesion, toward *economic* values such as efficiency, quality control and production, which education is supposed to serve in an unprecedented way. (Sterling, 2001, p. 39)

Personally, I have watched many teachers, especially public school teachers, become information transmitters instead of educators – those who draw out the potential in each and every student. The current education system is a transmissive system instead of a transformative one (O'Sullivan, 1999; Sterling, 2001). In this transmissive system, students are viewed as empty vessels waiting to be filled. This mentality leads to the homogenization of curriculum, weakening social and ecological systems and privileging the marketplace (Illich, 1996, p. 25; Williams & Brown, 2012, p. 7). This forces the continuation of the status quo. I quote Sterling (2001) again,

At present, an extreme instrumentalism dominates educational policy and practice. In Britain and other Western countries such as the USA, Canada, Australia and New Zealand at least, a very managerialist view of education has come to dominate our schools, modeled on economic change and perceived 'demands' of a globalized economy and an increasingly globalized culture. (p. 27)

The global corporate leaders are increasingly influential on the education system as it is clearly in their best interest to manage the workforce and, in Elie Wiesel's words, as cited in Orr, this system: "emphasize[s] theories instead of values, concepts rather than human beings, abstraction rather than consciousness, answers instead of questions, ideology and efficiency rather than conscience" (Orr, 1994, p. 8).

In the industrialized world-view, nature is viewed as a resource to be mined, clear-cut, drilled, exploited and extracted; to be worked against instead of with, to be conquered instead of cooperated (Berry, 1977; Ehrenfeld, 1997). Similarly, an education system in a nature dominating paradigm strives to teach us how to "manage planet earth" (W. C. Clark, 1989, p.

46), instead of learning to “reestablish a harmonious relationship with nature” (Ehrenfeld, 1997, p. 63). In this view, the aim of education is to perpetuate economic growth.

A *being and becoming* view of education is not limited to the single-minded purpose of job preparation, economic success, or the dominance of nature. What this means, in my own words, is that the aim of education embodies the notion of *being* and *becoming*, not only for the students and for the educators, but also for their community. This more organic view of education emphasizes the journey more than the destination, and thus the *process* of learning more than the product. In this view, education supports the development of capacities to meet all the needs of society, including the ecological, social and spiritual needs, and not just the economical (Orr, 1992, 1994; Williams & Brown, 2012, p. 14).

Dewey (1934), who advocated educative experiences and experiential learning, believed there is an intimate connection between education and social action in a democracy. He held this view:

The purpose of education has always been to everyone, in essence, the same—to give the young, the things they need in order to develop if an orderly, sequential way into members of society. This was the purpose of the education given to a little aboriginal in the Australian bush before the coming of the white man. It was the purpose of the education of youth in the golden age of Athens. It is the purpose of education today, whether this education goes on in a one-room school in the mountains of Tennessee or in the most advanced progressive school in a radical community. But to develop into a member of society in the Australian bush had nothing in common with developing into a member of society in ancient Greece, and still less with what is needed today. Any education is, in its forms and methods, an outgrowth of the needs of the society in which it exists. (p. 1)

In this being and becoming view of education, the student, teacher and the community in which the learning and teaching are taking place construct collaboratively the education. Thus, education must be for the common good of the community (Dewey, 1934, p. 5).

Education for the common good was also one of the main themes of the work of Phenix (1961). He proposed that schools teach respect for all forms of life, in order to build conscience, and would shun all social stratification—racial, economical, and intellectual. There would be no grades given which segregate the students, instead schools would be structured to encourage and develop cooperation, collaboration and the true sense of community. He wrote:

The most important product of education is a constructive, consistent and compelling system of values around which personal and social life may be organized. Unless teaching and learning provide such a focus, all the particular knowledge and skills acquired are worse than useless. An 'educated' person whose information and ability are directed to no personally appropriated worthy ends is a menace to himself and to society. A highly sophisticated society educated to no coherent way of life is likewise by its very learning made the more prone to disease and degeneration. (Phenix, 1961, p. 21)

Schumacher, a pioneer of sustainable development, has viewed education as the most vital resource of humanity. His quest for patterns of sustainability has provided him the experience to question traditional structures, especially that which prioritized only the economic structures. Schumacher (1977) stated that we need to “look at the world and see it whole” (p. 15) and by doing that we could develop to be better, nobler selves. Schumacher (1973) wrote that: “The task of education would be, first and foremost, the transmission of ideas of value, of what

to do with our lives...to understand the present world, the world in which we live and make our choices” (p. 86).

The purpose of education for a meaningful life is not just a Western construct. Tsunesaburo Makiguchi, a Japanese educator in the early 1900s, also took up the idea of value as a purpose in education. This was the era when Japan entered the industrialization race, and Makiguchi was deeply troubled by the inadequacies he perceived in the Japanese educational system. As an antidote to industrialization, Makiguchi advocated the support of the creative nature of human beings. Makiguchi (cited in Bethel, 1989) wrote, “Helping us learn to live as creators of value is the purpose of education” (p. 54). He contended that education should enable “each individual to perceive life in the context of its nurturing community, human beings will choose to use their creative capabilities both to enhance their own lives to the fullest and to create maximum benefit for their community” (p. 6).

This idea of creating value is also found in the State of Hawai'i Department of Education GLOs. Students and teachers in Hawai'i are asked become *quality producers*. The state definition for quality producer is as follows, *the ability to recognize and produce quality performance and quality products*. The word quality denotes that there is some kind of value attached to the product and/or performance.

Gatto (1992) collected his thoughts and critiques of compulsory school in *Dumbing us Down: The Hidden Curriculum of Compulsory Schooling*. In his 26 years of teaching, Gatto (1992, 1993, 2001, 2006) found that in order to help children break the thrall of industrialized school or compulsory school, students need independent study, community service, large doses of solitude, and variety of apprenticeships with adults of all walks of life. Thus education is not passive, but an active involvement of discovery. In his writings, Gatto (1992) offered the following: “Education will help you figure out *what really matters? Discovering meaning for yourself*, and discovering satisfying *purpose* for yourself, is a big part of what education is” (p. 68). An educated person can discover the truth for oneself. Gatto (2001, p. 226) has shown that he has an intense awareness of the profound significance of *being*, and the profound significance of being *here*.

Donning yet another lens to look at the purpose of education, I approach this topic from the environmental education perspective. Orr (1994) is among the leading environmental educators of today. His work with ecological literacy has been used to shift the emphasis of education from economics to ecology. He posited that more of the same kind of education that led to the industrialization of planet earth can only make things worse. However, he clearly pointed out that the subject is only the tool with which we can change the direction we are heading, the guide or the one holding the reins is us, human beings. In his essay “What is education for?” he paraphrased the Greek concept of Paideia and wrote, “The goal of education is not mastery of subject matter but mastery of one’s person” (p. 13).

Steiner (1997), the founder of Waldorf Education, saw education as a force for social change. He put it succinctly, “The purpose of education is to develop free human beings who are able, of themselves, to impart purpose and direction to their lives” (Steiner, 1928, p. 27).

The ideas on the purpose of education from a being and becoming stance form the first assumption my readers should know as they enter this discourse. These philosophers/educators and their texts inform my belief and action as an educator, and yes, even as a human being. In summary, I agree with these thought leaders and in my words state my first assumption: the purpose of education is to *help us create value in our actions, develop love in our thinking, and foster equality and righteousness in our emotions*.

## PROMPTS

- What do you think is the purpose of education?
- How does that purpose guide your educational philosophy and curriculum development?
- What are some of your assumptions about education?

### Children and Nature

*I like garden class.*

*Why?*

*'Cuz we are outside. I like outside.*

*Why do you like outside?*

*'Cuz it is nice and friendly.*

From a conversation with a first grader.

*Maybe it is weird but I really like being with plants.*

*Why?*

*I feel comfortable around them and some of them smell really nice. And even if they don't smell nice, I still like them.*

From a conversation with a third grader.

*The old Lakota was wise. He knew that man's heart away from nature becomes hard; he knew that lack of respect for growing, living things soon led to lack of respect for humans too.*

Chief Luther Standing Bear

According to Kahn (2002), Kellert (2002), Louv (2005), and Nabhan and Trimble (1994), in our contemporary twenty-first century, with more than 50% of the world's population living in urban areas, there are fewer opportunities for children to have direct experience with wild or semi-wild places than in the past century. Concerns about the ability of children to function safely without adult supervision and the increasing dependence on motorized transportation add further obstacles to spontaneous and familiar interactions with proximate nature.

In the industrialized school paradigm, children are cut off from nature (Gatto, 1992; Nabhan & Trimble, 1994; Orr, 1994). This route has brought us to climate change, devastating pollution, desertification, and other environmental calamities. Correspondingly, in the words of Berry (1977), "the ecological crisis is a crisis of character" (p. 17). Not only are we in ecological crisis, when we look around we still witness major social injustice, social stratification, racism, and the loss of culture. As those in the developing nations strive towards economic growth, there is homogenization of cultures and loss of language and indigenous wisdom (Berkes, 1999; Woodbridge, 2004).

In the being and becoming educational paradigm that I presented, the purpose of education is to help us create value in our actions, develop love in our thinking, and foster equality and righteousness in our emotions. This educational paradigm can reconnect children (and adults) back to their environment – ecological and social. I believe that reconnecting with nature may be crucial to shift the emphasis from economical growth to environmental and cultural sustainability, and ultimately to the survival of this planet.

Chawla (2002) found a striking pattern when she reviewed studies of the lives of environmentalists. Most of them ascribed their strong ecological values to "a combination of many hours spent outdoors in a keenly remembered wild or semi-wild place in childhood or adolescence, and ...an adult who taught respect for nature" (pp. 204 & 213). Lots of time

rambling in the neighborhood woods and fields and a parent or teacher who cared about nature were frequently cited as causal forces in their development of their own environmental ethics (Sobel, 2008, p. 9).

Rachel Carson (1956) wrote: “If a child is to keep alive his inborn sense of wonder, he needs the companionship of at least one adult who can share it, rediscovering with him the joy, excitement and mystery of the world we live in” (p. 10). This thought is congruent with the ideas shared by Louise Chawla and David Sobel that children benefit more with the guidance of an adult from experiences in nature.

E. O. Wilson (1984), preeminent biologist, suggested that within all human beings there exists a deep source of attachment to nature. He posited that we are bound to living organisms well beyond the particularities of habitat. He described the innate urge to affiliate with nature, which begins in early childhood and flows into social and cultural patterns. *Biophilia*, as E. O. Wilson termed it, is “inscribed in the brain, expressing tens of thousands of years of evolutionary experience” (Thorp, 2001, p. 11).

Steiner (1982) posited that young children, before the age of 9 or 10, do not distinguish themselves from their environment.

Therefore it is important to speak of everything that is around the child, plants, animals and even stones, in such a way that all these things talk to each other, that they act among themselves like human beings, that they tell each other things, that they love and hate each other. You must learn to use anthropomorphism in the most inventive ways. (p. 48)

After 9 or 10 years of age, Steiner (1998) has suggested, children can understand that they are separate from their surroundings and yet *in* it. Thus it is crucial to teach and show the child genuine relationships of nature, and that nature has “living meaning only in its context” (p. 194). He advocated using plants to teach children of the middle childhood ages about these relationships. However, he cautioned,

when working with children we should never consider plants in any way other than in their connection with the Earth and the Sun...you should never awaken any idea other than the living idea that the Earth and the root belong together...that the flower is brought forth from the plant by the Sun and its rays. In this way, you place the children in the universe with life. (p. 194)

Sobel (2008), a leader in the creation of place-based pedagogy, developed this hypothesis: “One transcendent experience in nature is worth a thousand nature facts” (p. 13). He posited that children perceive nature differently from adults. He wrote, “their experiences [in nature] were transcendent in that the [child] often felt connected to or merge with the natural world in some highly compelling fashion” (p. 13). This view is in congruence with that of Rudolf Steiner’s.

Kellert (2002) described a conceptual framework to consider the potential impact of contact with nature in child development. He suggested three distinctions among the kinds of experience children have with nature and its systems and process (pp. 118-121).

1. *Direct experience* involves actual physical contact with natural settings and nonhuman species. This experience is largely unplanned, and the natural setting includes creatures and habitats that function largely independently of human intervention and control.
2. *Indirect experience* of nature involves actual physical contact but in far more restricted, programmed, and managed contexts. Nature in these contexts is usually the product of deliberate and extensive human mastery.

3. *Vicarious or symbolic experience* occurs in the absence of actual physical contact with the natural world. The child encounters depictions and representations of nature that sometimes are realistic but that also, depending on the circumstance, can be highly symbolic, metaphorical, or stylized characterizations.

Direct encounters with nature provide children the opportunity to observe phenomena, such as trees growing in certain conditions but not in others; the rate of growth of plants during the rainy and dry seasons; the journey of insects on the ground or in the air; and such. In nature the child meets an inexhaustible supply of opportunities to develop and practice the act of comprehension (Kellert, 2002, p. 124). These experiences provide the child with opportunities to distinguish, identify and classify, engaging in conceptual tasks based on concrete observations. For example, insects have six legs, while spiders have eight. On the Big Island of Hawai'i, the wind blows in from the ocean during the day, and blows back out from the land to the ocean at night.

While the direct experiences in nature are the most vital and crucial for a child to develop a relationship with nature, both Kellert (2002, p. 134) and Sobel (2003, p. 159) asserted that direct experiences in an indirect nature setting are just as important and relevant. The experience of playing and working in a garden, nature center, or zoos, while not a substitute for wild and semi-wild places, can still lead the child to appreciate, care for and love the earth. For example, children tending plants in a garden learn to care and learn to be responsible for them.

Wells (2000) after reviewing studies on the restorative effects of nature surmised, "A pattern seems to emerge from the literature. The pattern suggests that a child living in a place with more nature, with more restorative resources is likely to benefit with respect to his or her cognitive functioning or attentional capacity" (p. 782).

Kaplan's (1995) research with Attention Restoration Theory provided strong evidence that natural environments can assist attentional functioning in adults. Kaplan posits that there are four components in a restorative experience. They are fascination, being away, the environment must have extent, and there must be compatibility between the environment and one's purposes and inclinations (1995, pp. 172 – 173). Natural settings have all four components and "is likely to be supportive of the inclinations of those who seek a respite there" (p. 174). Taylor, Kuo, and Sullivan (2001) extended that research to children with Attention Deficit Disorder (ADD). Their results provided evidence that the Attention Restoration theory may be applied to children. In this day and age, children are bombarded from every angle by electronic images, synthesized sounds, and engineered chemicals. They have to expend energy to filter out the excess stimuli, an undertaking which can lead to attention fatigue. Taylor et al. wrote:

Children's schoolwork requires extended periods of deliberate, effortful attention. And like adults, children often must carry out these tasks in a context filled with powerful distractions that constantly demand attention, making it extremely difficult to concentrate on the task at hand. In addition, because children's attention is not fully developed, they may be fighting off distractions with less attentional control than adults. Thus, children may need supportive environments where they can go to restore their ability to attend to stimuli. It seems plausible that natural environments might support attention in children, including children with ADD. (p. 58)

Sebban (1991) offered a different understanding of the impact of nature on attention. She suggested that the dynamic feature of nature constantly confronts all the child's senses. Nature signifies life which no technology, no matter how sophisticated, can truly simulate. Life is a riot of activity, growth, metamorphosis, and transformation. These stimuli increase the likelihood of

the child's development of awareness, recognition, adaptive and problem-solving responses, and attention. Sebba, as cited in Kellert, stated that nature-based development is a critical and irreplaceable dimension of healthy maturation (Kellert, 2002, pp. 140-141).

To end this section, I bring back the first idea of biophilia. I suggest again that a crucial reason for children to be in nature is for them to love and be loved by her. Gould (cited in Orr, 1994) said, "We cannot win this battle to save species and environment without forging an emotional bond between ourselves and nature as well – for we will not fight to save what we do not love" (p. 43).

We value what we love. If our children are to be creators of value and save our planet, then they must be given the opportunity to love the earth.

It is through close and intimate contact with a particular patch of ground that we learn to respond to the earth... We need to recognize the humble places where this alchemy occurs... Everybody has a ditch, or ought to. For only the ditches--and the fields, the woods, the ravines--can teach us to care enough. (Pyle, 1993, pp. xv, xix)

The second assumption of education I have emerges from the research cited above: *Being in nature and developing a sense of place is an essential core of children's lives.*

## PROMPTS

- What are your personal experiences in and with nature?
- How did experiences affect your educational path?
- What are some of your students' experiences with and in nature?
- How do you develop the sense of place?

## Child Consciousness Development and Learning Theories

*What is important for the art of education is a knowledge of the members of the human being and of their various developments. We must know what part of the human being especially needs to be worked on at a certain age and how to work on it in the proper way.* Rudolf Steiner

*How children learn is a direct function of how they think and grow intellectually.*

Mitchell Sakofs

For the scope of this study, the focus of child consciousness development will mainly be on the middle childhood period or elementary school age, 6 to 12 years old. This is the period of childhood for which the interdisciplinary standards-based school garden curriculum was written. Children younger or older than 6 to 12 have different developmental needs.

Rudolf Steiner provided indications for consciousness appropriate education in the early twentieth century. His philosophy, pedagogical ideas, and curricular thoughts were first put into practice in 1919 at a school located in the Waldorf-Astoria Cigarette Company in Stuttgart, Germany. This led to the naming of all schools that followed Steiner's educational philosophy as Waldorf Schools.

Steiner (1926, 1996a, 1996b, 1997, 1998) presented a view of three stages of child consciousness development. Early childhood, from birth to change of teeth (about 7 years old); middle childhood (ages 7 to 14); and late childhood (14 to about 21). The willing (doing) realm is developed the most strongly in the first stage, as infants navigate their way through the world

of physical senses, movement, taste/smell, nature, and touch, to reach middle childhood. Children at this early childhood stage “think” by doing. The learning that happens during this phase is unconscious (Steiner, 1996b, p. 87). During this phase of life, children have a certain character that they express by being imitative. They try to imitate everything they see and hear. He wrote:

Children, however, do not learn by instruction or admonition, but through imitation. The physical organs shape themselves through the influence of the physical environment. Good sight will be developed in children if their environment has the proper conditions of lights and color, while in the brain and blood circulation the physical foundations will be laid for a healthy moral sense of children see moral actions in their environment...As the muscles of the hand grow firm and strong through doing the work for which they are suited, so the brain and other organs of the physical body of human beings are guided into the correct course of development if they receive the proper impressions from their environment. (Steiner, 1997, p. 19)

By imitating what adults around him/her are doing, the child is learning actively, and is involved in everyday life tasks and activities, in familiar contexts and settings. Steiner posited that “everything done to and with a child at this stage has a direct effect on the formative of the child’s being” (1926, pp. 15-16). What adults do around, to, and with young children form their physical bodies.

The emotional realm or feeling capacity is the most intensely developed during middle childhood (elementary school age). Steiner (1982, p. 19, 1996a, p. 109) postulated that artistic and imaginative endeavors are the most optimal form to guide the development of the emotional realm. He cautions educators against locking children’s minds and thoughts to finished concepts, but instead to provide them examples and ideas that can grow and expand further.

We must give them living concepts that can be transformed. But this can be achieved only through an imaginative approach in every subject...[I] will encourage you to use language creatively, to draw helpful drawings on the blackboard or to take up a paintbrush to make colorful illustrations of what you want to communicate...They have an eye for what is mobile. They can apprehend ideas that are flexible, and they can perceive what comes in the form of pictures or music. (Steiner, 1996a, p. 109)

As the middle childhood is a time for connection to the rhythmic processes of nature, Steiner encouraged intimate experiences with cycles of nature that can guide the child to perceive the world as an order-creating, patterned universe. This experience may facilitate the understanding of systems thinking as the child matures (Capra, 2005; Steiner, 1998, pp. 193-204).

Piaget (1954) identified various stages of cognitive development in children. The stages identified were:

1. Sensory motor (ages 0-2),
2. Preoperational (ages 2-7),
3. Concrete operational (ages 7-11), and
4. Formal operational (ages 11-14).

Children operating within the sensory motor, preoperational, and concrete operational stages are dependent upon concrete interactions with the world in order to promote intellectual growth and true learning. Piaget concluded that the child’s “development of an accurate representation of physical reality depends on the gradual coordination of schemes of looking, listening, and touching” (Bransford et al., 2000, p. 80). It is only after the ages of 11 or 12 that a child is ready

and capable to operate at a more formal manner and grapple with abstractions (Piaget, 1954; Sakofs, 1995, pp. 149-151).

Sobel (1993, 1996) studied the stages of child consciousness development through children's mapmaking. He found clear patterns of development through analyzing the maps, and interacting with the mapmakers. He found that early childhood (between 4 and 7) is characterized "by a lack of differentiation between self and the other" (Sobel, 1996, p. 13). From ages 7 to about 11, children have a strong desire to explore and to wander beyond that which is familiar (Sobel, 1996, p. 19). Only after the ages of 11 or 12, do children want to engage in solving community issues and understand the implications of global issues (Sobel, 1996, p. 27). Thorp (2001) presented Sobel's schema beautifully in her dissertation:

1. *Empathy*, between the child and the natural world should be the objective for children ages 3-7. This connectedness to the natural world is the foundation to the understanding that everything is interrelated. Stories, songs, close encounters with plants and animals, and seasonal celebrations are suggested.
2. *Exploration*, marks the phase from age 7-11. This is the time to immerse children in the stuff of the physical and natural world. Constructing forts, creating small imaginary worlds, hunting and gathering, following streams and pathways, making maps, gardening, and shaping the earth are perfect activities during this stage.
3. *Social Action*, appropriately begins around age eleven and extends beyond age fourteen. Sobel strongly stated, "No tragedies before fourth grade." While woods, parks and playgrounds are the landscapes of middle childhood, adolescents want to engage with the larger community. Curricula that focus on environmental problems will be most successful when it starts in fifth and sixth grade, however Sobel warns it should be grounded in local context. (p. 29)

Kellert (1996, 2002) pulled the thoughts of Steiner and Sobel into a nature-based approach of looking at child consciousness development. He suggested that there are nine values of nature, which differentially emerge at varying ages or stages of development. The nine values are:

1. Aesthetic – physical attraction and appeal of nature;
2. Dominionistic – mastery and control of nature;
3. Humanistic – emotional bonding with nature;
4. Moralistic – ethical and spiritual relation to nature;
5. Naturalistic – exploration and discovery of nature;
6. Negativistic – fear and aversion of nature;
7. Scientific – knowledge and understanding of nature;
8. Symbolic – nature as source of language and imagination; and
9. Utilitarian – nature as a source of material and physical reward.

The developmental progression has four characteristics. First the formation of values of nature moves from relatively concrete and direct perceptions and responses to the more abstract levels of experience and thinking. Next the values generally shift from highly personal, egocentric, and self-centered concerns to the interests of others and to social interests. The geographic focus of the values leans from local and parochial settings to more regional and then global outlooks. Finally, emotional and affective values of nature emerge earlier than the more abstract, rational and logic-deduced perceptions (Kellert, 2002, pp. 131-132).

Kellert (2002) posited that between 3 and 6 years of age, the child develops the utilitarian, dominionistic, and negativistic values of nature. The child at this stage, becomes a

little more independent and this stage “involves a primary emphasis on satisfying the child’s material and physical needs, avoiding threat and danger, and achieve feelings of control, comfort and security” (p. 132). The child has an affinity towards that which is familiar, such as domesticated animals and recognizable nature settings, and also to that which meets personal needs and desires.

The second developmental stage is middle childhood, between the ages of 6 and 12 approximately. “Middle childhood is a time when the humanistic, symbolic, aesthetic, and knowledge components of the scientific value develop most rapidly,” while the values of the first stage diminish in significance (Kellert, 2002, p. 132).

Kellert (2002) also emphasized the middle childhood years as the most critical period in the development of the individual relationship with the natural world, just as Steiner and Sobel did before him. During this time, children are more likely to explore and venture beyond what is absolutely familiar. They develop cognizance of the rights of other living beings, and can begin, independent of adult imposition, to develop feelings of responsibility for care of nature. Most important, Kellert asserted:

This is a time of greatly expanded interest, curiosity, and capacity for assimilating knowledge and understanding the natural world. Rapid cognitive and intellectual growth occurs including many critical thinking and problem-solving skills achieved through interaction and coping in the non-human environment. (p. 133)

Steiner, Piaget, Kellert, and Sobel concurred that children in elementary school can best learn from concrete, connective, nature-based, and imaginatively presented experiences. These educators also strongly stated that it is only after ages 11-12 that a child can begin to reason and conceptualize, only then can a child grasp abstract ideas and lessons. The ability to reason abstractly is based on the development of the nature values of humanistic, symbolic, aesthetic, and knowledge during the middle childhood phase.

Having presented child development theory, I now discuss the learning theory that best supports my understanding of learning from nature-based experiences. Williams and Brown (2012) included many student reflections in their book *Learning Gardens and Sustainability Education*, such as:

We started collecting dirt inside a wheelbarrow then we dumped it in flower beds. We started digging rows but we could not dig the rows too deep or else the plants might drown. It was fun working with the wet soil. It was not mud but it was still wet; it stuck to our hands. (p. 126)

Williams and Brown (2012) posited that reflection is about meaning-making. They wrote: Because an experience is an interaction between a student and the environment, there is change in the self and also in the environment. The change encompasses both the learner and the social and environmental milieu each impacting the other in profound ways. (p. 126).

Williams and Brown (2012) conveyed the gist of structural-developmental theory, sometimes also known as constructivist theory, social cognitive theory, or structural interactional theory (Bandura, 1986; Damon, 1977; DeVries & Zan, 1994; Kahn, 2002; Kohlberg, 1969; Piaget, 1983). This theory posits that “behavioral, personal and environmental influences interact continuously in a reciprocal manner” (Ratcliffe, 2007, p. 107), and that “through interaction with a physical and social environment children construct conceptual understandings and values” (Kahn, 2002, p. 94).

In layperson's terms, this theory can be called by many names. Learning by doing, hands-on education, project based education, experiential education, discovery learning, participative learning, problem-based learning. Whatever it is called, learning by interaction with the physical and social world demands active involvement, taking time to practice, meaningful activities, and restructuring prior knowledge (Vosniadou, 2001). Active involvement requires that students interact with the world by exploring objects, manipulating tools, grappling with questions and controversies, performing experiments, and/or working. When doing, students engage multiple abilities. Building a trellis for the pole beans in the school garden, requires motor skills, spatial skills, mathematical and thinking skills. As a result of the interactions and in engaging multiple abilities, students may be more likely to remember concepts and knowledge discovered on their own, as opposed to the transmissive model (Hammer, 1997). This approach builds upon children's natural motivation to explore, succeed and understand (Piaget, 1954), and "secures the active cooperation of the pupil in construction of the purposes involved in his studying" (Dewey, 1938, p. 67).

Through structural development "early forms of knowledge do not disappear but are transformed into more comprehensive and adequate ways of understanding the world and acting on it" (Kahn, 2002, p. 94). In the student reflection cited above, the student knew "we could not dig the rows too deep or else the plants might drown" (p. 94) after the experience of working in the garden. The student's knowledge is now "hierarchically integrated into a larger conceptual organization" (p. 94).

Scaffolding is yet another approach that describes this theory in action. Scaffolding can be described as learning by doing, in place, over time. Williams and Brown (2012) wrote, "...it is not necessary to learn everything anew from personal experience alone; the combination of firsthand familiarity with collective cultural or community knowledge is foundational... Stories, songs, knowledge, practices, and customs contribute to meaningful engagement and communicate experience intergenerationally. (p. 127) Another important aspect of the structural-developmental theory is that of learning through and in relationships.

Mercogliano (2001) wrote the following about educational relationships:

Call it what you will, the learning that goes on within relationships and the learning that goes on about relationships are a fundamental part of the educational process. Anyone who has observed children in a setting that is based on cooperation and mutuality knows this to be so. If there are to be schools at all—and the arguments against them grow more compelling every day—then certainly their justification has to begin with their serving as safe, caring environments where kids can learn from and about each other, where they can establish enduring relationships with teachers and mentor figures, and where they can experience the interconnectedness of all life on a daily basis. (p. 1)

Profound learning can happen when the relationships between the student and teacher, between the student and student, and between student and learning are safe, valuable, successful, involving, caring, and enabling (Bransford, Brown, & Cocking, 2000, Rogers & Renard, 1999). Relationships form a structure for development and thus learning.

In the classic book, *Teacher*, Ashton-Warner (1963) provided this insight:

From long sitting, watching and pondering (all so unprofessional), I have found out the worst enemies to what we call teaching. The first is the children's interest in each other. It plays the very devil with the orthodox method. If only they'd stop talking with each other, fighting each other and loving each other. This unseemly and unlawful communication!

In self-defense I've got to use the damn thing. So I harness the communication, since I can't control it, and base my method on it. They read in pairs, sentence and sentence about. There's no time for either to get bored. Each checks the other's mistakes and hurries him up if he's too slow, since after all, his own turn depends on it. They teach each other all their work, sitting cross-legged knee to knee on the mat or on their tables, arguing with, correcting, abusing or smiling at each other. And between them all the time is this togetherness, so that learning is so mixed up with relationship that it becomes a part of it. What an unsung creative medium is relationship! (pp. 103-104)

Resnick (1987) reported that one major contrast between everyday settings and school environments is that the latter place much more emphasis on individual work than most other environments. In his article, "Collaborative Learning Enhances Critical Thinking" Gokhale (1995, p. 1) drew upon work of others:

Proponents of collaborative learning claim that the active exchange of ideas within small groups not only increases interest among the participants but also promotes critical thinking. According to Johnson and Johnson (1986), there is persuasive evidence that cooperative teams achieve at higher levels of thought and retain information longer than students who work quietly as individuals. The shared learning gives students an opportunity to engage in discussion, take responsibility for their own learning, and thus become critical thinkers. (Totten, Sills, Digby, & Russ, 1991)

Sobel (1996, p. 10) has made significant contributions to supporting the need for adult-mediated or structured environments in healthy childhood development. The teacher's task is to prepare environments that are developmentally appropriate to accommodate a child's inner strivings to connection and autonomy (Piaget, 1954; Thorp, 2001). Sobel argued in *Beyond Ecophobia* that elementary curriculum often is not aligned with child development, nor do they provide proper scaffolding to learning. Sobel said, "authentic ...commitment emerges out of firsthand experiences with real places on a small, manageable scale" (p. 34)

Sobel (1996) stated:

The crux of the issue is the developmental appropriateness of...education curricula. Our problem is premature abstraction. We teach too abstractly, too early...If we prematurely ask children to deal with problems beyond their understanding and control, prematurely recruit them to solve the mammoth problems of an adult world, then I think we cut them off from the possible sources of their strength...children's biological tendency to bond with the natural world. (pp. 5-6)

These developmentally appropriate experiences may be described as educative experiences. Educative experiences are those that scaffold learning instead of stunting learning, which can be linked cumulatively to each other, and which can expand the learner's horizons.

Dewey (1938) wrote:

The belief that all genuine education comes about through experience does not mean that all experiences are genuinely or equally educative. Experience and education cannot be directly equated to each other. For some experiences are mis-educative. Any experience is mis-educative that has the effect of arresting or distorting the growth of further experience. An experience may be such as to engender callousness; it may produce lack of sensitivity and of responsiveness. Then the possibilities of having richer experience in the future are restricted. (pp. 25-26)

Structural-developmental theory is an interactional theory. Children 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. The experiences that are thoughtfully mediated by a caring adult or educator can be more educative, and create more structures or scaffolds of learning than the experiences that arrest or distort growth. Positive social interactions with adults or peers can help children build relationships with humans, nonhumans and nature.

This theory of learning understands that the process is more important than the product. DeMarco (1997) succinctly wrote:

Taking risks in learning is promoted, and errors are used as a strategy to further learning. Learning is also directly related to the learner's prior knowledge and individual context, and it is made relevant when it is related to the real life of the learner. (p. 10)

The review of child development and structural-developmental/constructivist learning above shapes my third assumption, that *learning is as diverse as the learners - everyone can learn, but not always in the same capacity or context or rate*. This theory also formed my fourth assumption, which is *learning causes change, and thus learning is change*.

### PROMPTS

- How did you develop your understanding child development? What were your observations, a-ha moments, readings, etc?
- How can we apply these theories and understanding towards teaching the Common Core Standards?
- Are these standards developmentally appropriate – how or how not?

### School Gardens

*Learning gardens on school grounds provide poetic and critical texts for nurturing students' connection with the more-than-human world.* Dilafruz Williams & Jonathan Brown

### A Brief History and Rationale for School Gardens as Outdoor Learning Spaces

The school garden movement is not new. Notable educators and philosophers including Rousseau, Dewey, Montessori, Pestalozzi, and Gandhi promoted school gardens (Subramaniam, 2002). Montessori (1912) outlined five specific benefits of gardening to children:

1. Learning to care for living creatures and for life;
2. Executing independent work, without the help of the teacher;
3. Developing patience by waiting for plants to grow;
4. Developing and appreciation for nature; and
5. Developing interpersonal skills.

Prior to World War I, in the United States, educators used the school garden with individual plots to train children “in the basics of civic responsibility and the industrial work process” (Bassett, 1981, p. 3). At these gardens, children were taught the efficiency of every move through working in well-defined, neat rectangular plots, and how the energy conservation could lead to increases in productivity and economic wealth (p. 3).

World War I and World War II brought about the “liberty gardens” and “victory gardens” movements, respectively, as a means for citizens to show patriotism and to support the military effort. Children were mobilized with the formation of the U.S. School Garden Army, and this

“army” produced food for the school lunch programs and learned about production. Hayden-Smith (2007, p. 22) quoted the federal Bureau of Education (BOE), “Every boy and every girl . . . should be a producer. . . Production is the first principle in education. The growing of plants and animals should therefore become an integral part of the school program. Such is the aim of the U.S. School Garden Army.” The school garden movement waned in the 1950s due to the focus on technology and to winning the Cold War (Subramanian, 2002). However, this movement is on a comeback with contributions from prominent players such as Michelle Obama, Alice Waters, and environmental and place-based educators.

According to the U.S. Department of Agriculture Economic Research Services (2006), more than 83% of the population of the United States lives in urban areas. This limits children’s accessibility to natural habitats and interactions with nonhuman life cycles (Blair 2009; Moore, 1995). Urbanization coupled with parental fears of unsupervised activities has led to a context in which the childhood experience exploring woods, rivers, and fields on one’s own is mostly a thing of the past (Kahn, 2002; Kellert, 2002, Pyle, 2002).

One place still stands out in parents’ minds however, as a relatively safe and supervised space – schools. Thus, well-designed school grounds, play yards and gardens can readily improve on the diversity of many children’s natural experiences and provide the repetitive access, meanings, and associations needed to create a bond with a place (Blair, 2009, p. 17).

School gardens provide a real world context for learning that is distinguishable from typical hand-on learning activities in the classroom, which tend to be simulations of real world experiences (Ratcliffe, 2007, p. 101). A garden can be a microcosmic reflection of the natural environment, and the gardener must work *with* not against nature. School gardens can provide children with direct experiences with nonhuman life cycles and systems such as growth and decay, living soil systems, plant-insect relations, water cycles, waste and fertility, and such. In school gardens, children can witness and observe the simple and the complex simultaneously.

School gardens can also teach place-making, localization and that “small is beautiful” (Schumacher, 1973). Blair (2009) wrote:

Everything except possibly the purchased plants and seeds are part of the natural local environment. The clouds, rain, and sun, the seasonal cycle, the soil and its myriad organisms, the insects, arachnids, birds, reptiles, and mammals that visit the garden teach about place. Even if some of the weeds, insects, and birds are not native to a place, these immigrant flora and fauna are as locally adapted as the children themselves. (p. 17)

### **Conceptual Framework for Garden-Based Education**

I presented four assumptions in preceding sections that shaped my thinking about education. These four are:

1. The purpose of education is to help us create value in our actions, develop love in our thinking, and foster equality and righteousness in our emotions.
2. Being in nature and developing a sense of place is an essential core of children’s lives.
3. Learning is as diverse as the learners - everyone can learn, but not always in the same capacity or context or rate.
4. Learning causes change, and thus learning is change.

Several researchers working in this area of school gardens have suggested that it is important for the sustainability of school garden programs to develop a contextually appropriate, place-based model (or design) of garden-based education (Blair, 2009, p. 35; Ozer, 2007, pp.

851-853; Phibbs & Relf, 2005, p. 427; Van Dexter, 2008; Williams & Brown, 2012, p. 58). In the next few pages I will focus on two garden-based exemplars, which fit with my views and assumptions presented in the beginning of this chapter. These are Williams and Brown's (2010, 2012) learning gardens principles linking pedagogy and pedology, and Ratcliffe's (2007) Model for Garden-Based Education (MGBE).

### **Williams and Brown: Learning Gardens principles linking pedagogy and pedology**

Williams and Brown (2010, 2012) used living soil as metaphorical construct for education. Upon a deep and delicious look at living soil, Williams and Brown dug up and developed seven guiding principles.

#### **Principle 1: Cultivating a sense of place.**

This principle is congruent with the research on the connection between children and nature. Children are fascinated with soil and have no qualms digging in it to discover living creatures, fungi, and roots. By beginning with observing and working with soil in the school garden, we can learn that it is the soil that makes up the land, and it is the land which shapes us (Meyer, 2003, p. 157). Williams and Brown (2012) stated:

Living soil is inherently local... Since globalization is impacting actual local places, for us, gardens provide one fruitful and practical location to grow and cultivate a "sense of place." Individual gardens are finely tuned local expressions of phenomena such as sun, rain, wind, air, and more, all of which are common globally. Just as in each location different species of plants will flourish in response to these common environmental factors, like wise school gardens can focus attention on locally relevant aspects of common global social and ecological factors. (pp. 47 & 59)

The sense of place which can be cultivated through learning and working in a school garden is both physical as well as cultural. We can learn and understand more about local geography as we study the local climate, and what plants grow best in that climate. We can learn about local culture by tracing the history of a plant that grows well, to discover how it came to the local setting. For example; sugarcane was introduced to Hawai'i in the 1800s as a cash crop. Many different ethnic groups from all over the world came to Hawai'i to work the cane fields. Villages, schools, and stores developed in the large areas cultivated in sugarcane (Juvik & Juvik, 1998, pp. 246 – 247). Planting sugarcane in school gardens in Hawai'i provides the opportunity to learn about place through history, culture, and the sweet taste of the juice.

#### **Principle 2: Fostering curiosity and wonder**

Living soil invites endless queries. How did those roots get down there? What will happen to the worms if the garden floods? The transmissive, industrial form of education presented earlier in this chapter stifles curiosity and wonder. Williams and Brown (2012) postulated that curiosity and wonder are foundational to learning (p. 75). They believe that "Learning gardens provide a landscape of inquiry directly on the school grounds that transcend the search for quantifiable answers" (p. 77). A student curious about worms may begin a worm bin. This may lead to vermi-composting as a means to recycle cafeteria green waste. This may lead to more studies on soil fertility using worm castings as fertilizers. There is no end to the wonder and the "what ifs."

#### **Principle 3: Discovering rhythm and scale**

Williams and Brown (2012) wrote, "through engagement with soil, we can tune into the natural rhythms and cycles of earth, moon, sun. Living soil also teaches us something about appropriate and functional scale" (p. 47). This idea of rhythm will be explored further in Chapter

Three where I describe the concept of time in the garden, and as I describe the seasonal curriculum I developed for this project.

**Principle 4: Valuing biocultural diversity**

This principle provides a framework for my assumption that learning is as diverse as the learners - everyone can learn, but not always in the same capacity or context or rate. Williams and Brown (2012) wrote,

Living soil supports both biological diversity and cultural diversity, and in turn biological and cultural diversity tend to support soil...In countering the trend towards homogeneity, valuing biocultural diversity brings life to the center of the educational enterprise, and resists the simplification of the world to which children are introduced. (pp. 48 & 110)

Just as every species of plant, insect, or micro-organism in the school garden has a range of biological, chemical, and physical needs, so does every child in every school. While we may not be able to meet all these needs, we can celebrate them and learn about and from them.

**Principle 5: Embracing practical experience**

This principle is directly connected to several of the General Learner Outcomes, which will be explained in detail later in this chapter, especially *community contributor* and *quality producer*. This principle is also supported by child development and learning theories claiming that we learn best by doing. “Gardens encourage children to go outside of the classroom and put knowledge into practice...Experience deepens learning through creating a back and forth movement between the old and new ways of knowing” (Williams & Brown, 2012, p. 48).

**Principle 6: Nurturing interconnectedness**

All my prior thoughts and descriptions of learning through relationships and in relationships are beautifully distilled in this principle of nurturing interconnectedness. Williams and Brown (2010, 2012) described interconnectedness as relationships. Through working with soil and in the garden, children learn about systems, ecosystems, planting systems, irrigation systems, and such, and can broaden their ways of knowing and thinking.

**Principle 7: Awakening the senses**

I wrote earlier in this chapter that we cannot save what we do not love, and that the task of education is to foster love and value especially of the earth. This may be done through getting to know the earth. Using all the five senses to know something or someone will increase the amount of data we can collect. The school garden provides a diversity of ways to awake the senses through sight, smell, touch, taste and sound. Williams and Brown (2012) offered these reasons to awake and nurture the senses:

Sensory awareness invites us the present moment and thus encourages engagement with life. Through sharpening the role of the senses in learning, meaning-making can be deepened. Engaging the full range of our sensory capacity helps to center awareness, and ground abstract concepts within physical reality. Sharpening the senses reinforces in a bodily way the themes of interconnection that is characteristic of all living things. (pp. 48, 147, 148)

The use of these principles guided my work in the creation of the interdisciplinary standards-based school garden curriculum which will be discussed in more detail in the following chapter. Next I will discuss another conceptual framework for school gardens, Ratcliffe’s Model for Garden-Based Education (MGBE).

### **Ratcliffe's Model for Garden-Based Education**

Ratcliffe (2007) developed a Model for Garden-Based Education (MGBE) with a combination of Social-Cognitive Theory (SCT) and Resilience Model (RM) as the conceptual framework. Please note, as reviewed in the section before, the Social-Cognitive Theory (SCT) is another term for the structural-developmental learning theory. MGBE predicts that a school garden program may improve or enhance the curricular, physical, and /or social learning environments. She wrote that “a school garden may shape the *curricular learning environment*” (p. 96) through hands-on, project-based, and placed-based education, as well as engaging youth and adults in genuine, ongoing processes. The curricular learning environment may also be enhanced through integrating multi disciplines and ages, and by providing experiential learning opportunities to reinforce concepts and abstract ideas. Garden based education also can engage multiple intelligences.

Ratcliffe continued her discussion by pointing out that a school garden may “alter the *physical learning environment*” (p. 96) by improving the quality of the school environment through enriching the visual and sensory aesthetics, and by diversifying the environments in which students play and learn. School gardens provide a perception of safe places in the school and/or community to learn and play. School gardens also provide increased opportunities for “visual reinforcement of learning, consuming vegetables, performing environmentally responsible behaviors, finding refuge, connecting with nature, and nurturing living things” (pp. 96- 97).

In the MGBE, Ratcliffe provided a third way in which school gardens may shape the learning environment in a school. She indicated that a school garden “may influence the *social learning environment*” (p. 97) by positively altering the school culture and identity through increasing opportunities for fostering relationships between the students and adults, and among the students themselves. School gardens can promote and foster cultural exchange, and increased parental and community involvement, which provides more opportunities for intergenerational mentoring. When more parents, caregivers, and community members are involved in school activities and programs, there is increased modeling of behaviors by the adults, which can be emulated by the students. Having a diverse community on a school campus may provide more opportunities to practice democracy and meaningful participation in school and community for both youth and adults.

Ratcliffe continued, the “MGBE predicts that changes in the learning environment described above will directly and indirectly affect participants’ personal characteristics” (p. 97). Ratcliffe used the terminology “development of the whole child” in the MGBE to describe the wide variety of characteristics affected by garden-based learning experiences.

As a result, Ratcliffe predicted that:

the changed learning environments and resulting effects on the development of the child will result in improvements in the following outcomes: (1) academic achievement including science and math test scores, grade point average (GPA), discipline, and absenteeism; (2) health related behaviors including fruit and vegetable consumption, willingness to try vegetables, snacking behaviors, and physical activity patterns; and (3) environmentally responsible behaviors including composting and recycling (pp. 97-98).

I used Ratcliffe’s MGBE framework to guide the organization of the discussion for rest of this section on school gardens.

### **School Gardens Shaping the Curricular Learning Environment**

*Gardening need not be taught either for the sake of preparing future gardeners, or as an agreeable way of passing time. It affords an avenue of approach to [the] knowledge of the place farming and horticulture have had in the history of the human race and which they occupy in present social organization. Carried on in an environment educationally controlled, they [gardens] are a means for making a study of the facts of growth, the chemistry of soil, the role of light, air, moisture, injurious and helpful animal life, etc. There is nothing in the elementary study of botany, which cannot be introduced in a vital way in connection with caring for the growth of seeds. Instead of a subject belonging to a peculiar study called 'botany,' it will then belong to life, and will find, moreover, its natural correlation with the facts of soil, animal life, and human relations...It is pertinent to note that in the history of man, the sciences grew gradually out of useful social occupations.*

John Dewey

In a study by Graham et al. (2005) of 4,194 California school principals, the researchers found that,

the most frequent reason for having a garden was for enhancement of academic instruction (89%)...and that the most frequently taught subjects using the garden were science (85% of the schools surveyed), environmental studies (70%), nutrition (66%), language arts (60%), and math (59%). (p. 149)

In a survey of 13 school-garden researchers, Phibbs and Relf (2005) found that the learning outcomes of school garden educational programs most often studied were health and nutrition (69%), environmental education (EE; 30%), and self-esteem or self-concept (30%). The age groups studied were predominantly elementary (85%) or middle school (38%). The present research also shows that among published quantitative studies, science achievement, nutrition knowledge, and change in food behavior have been most frequently measured, preceding environmental attitude change, self-esteem, and life skills (Blair, 2009, p. 20).

I searched for *quantitative* assessments of school gardens using EBSCOHost, ERIC and ProQuest databases. I found five studies about quantitative assessment of science achievement in conjunction with school garden (Dirks & Orvis, 2005; Klemmer et al., 2005a, 2005b; Mabie & Baker, 1996; Smith & Motsenbocker, 2005), and one dissertation on the affective and cognitive effects of an interdisciplinary curriculum on underachieving students (Sheffield, 1992). All five studies showed higher Science Achievement (SA) for gardening students.

Klemmer et al. (2005a) developed a science achievement evaluation instrument which was used in two studies, Klemmer et al. (2005b), and Smith and Motsenbocker (2005). Both studies used the same Junior Master Gardener (JMG) Level 1 curriculum developed by the Texas Agricultural Extension Service (1999a, 1999b). However, class teachers who had been trained in using the JMG curriculum taught the students in Klemmer's study, and the teachers in Smith and Motsenbocker's study were primarily young and inexperienced undergraduate students (p. 442).

Klemmer et al. (2005a) studied the science achievement of 647 third, fourth and fifth graders from seven elementary schools in Temple, Texas; while Smith and Motsenbocker (2005) studied 62 fifth graders in three schools in East Baton Rouge, Louisiana. Klemmer et al. (2005a) found that the garden-based curriculum was "more effective as a teaching method in raising science achievement scores for boys in third and fifth grades, and for girls in the fifth grade compared to traditional classroom-based methods alone" (p. 448). Smith and Mostenbocker (2005) concluded: "This study shows that even with instructors who had little background in

teaching methods and a once a week gardening session for students, some improvement in science achievement test scores can be attained” (p. 442).

Dirks and Orvis (2005) also used the JMG curriculum with third graders in 14 classrooms in 11 schools in Indiana. These researchers used a modified Likert scale to measure students’ short-term knowledge gain and short-term changes in *attitudes* concerning gardening, science and the environment (p. 444). Their results indicate that gardening can successfully be used in the classroom and has the capacity to influence students positively in their learning, especially for science and agriculture related topics (pp. 446-447).

Sheffield (1992) taught an interdisciplinary garden-based curriculum, *Heritage Garden*, to an experimental group for four hours a day during a 5-week long summer school session. The National Gardening Association developed this curriculum. The children in the experimental and control groups consisted of *underachieving* third and fourth graders who were one or more grade levels behind in reading and math, and who had been retained a grade at least once. Sheffield used the American Guidance Peabody Individual Achievement Test (PIAT) to pre- and post-test the students in both groups (p. 41). At the end of the session, Sheffield found a significant difference in the achievement tests of reading comprehension, total reading, spelling and written language in the experimental group (pp. 116-117). The next aspect to be discussed is the influence of school gardens on the physical learning environment.

### **School Gardens Altering the Physical Learning Environment**

*For every school there should be a garden attached where students may feast their eyes on trees, flowers, and plants...where they always hope to hear and see something new. Since the senses are the most trusty servants of the memory, this method [gardens] of sensuous perception will lead to the permanent retention of knowledge.*

J. A. Comenius

Ratcliffe (2007) stated that school garden may alter the physical learning environment in several ways including enhancing or increasing “quality of the environment where children play and learn...opportunities for visual reinforcement of learning, consuming vegetables, performing environmentally responsible behaviors, finding refuge, connecting with nature, and nurturing living things” (p. 97). Based on that reasoning, I have included studies about the impact of school garden programs on nutrition-based outcomes in this section.

Using EBSCOHost, ERIC and ProQuest databases, I found 11 studies on the impact of garden food and nutrition programs, of which 5 were conducted in-school (Cason, 1999; Lineberger & Zajicek, 2000; McAleese & Rankin, 2007; Morris et al., 2001; Morris & Zidenberg-Cherr, 2002), and the rest were after-school and/or community programs. All studies provided “promising evidence” that “garden-based nutrition-education programs may have the potential to lead to improvements in fruit and vegetable intake, willingness to taste fruits and vegetables, and increased preferences among youth whose current preferences for fruits and vegetables are low” (Robinson-O’Brien et al., 2009, p. 279).

School gardens are an important element of the movement to increase foliage and plants on school grounds (Dyment & Bell, 2008), a movement in response to the sustainability revolution (Edwards, 2005), and the No Child Left Inside (Louv, 2005) movement. Parents, educators, and health experts are advocating more time outside for children to engage in physical activity, nature immersion, and social skills development (Dyment & Bell, 2008; Dyment & Reid, 2005). Schools around the world have embraced the notion of school ground greening and are transforming hard, barren expanses of turf and asphalt into places that include a diversity of

natural and built elements, such as shelters, rock amphitheaters, trees, shrubs, wild-flower meadows, ponds, grassy berms and food gardens (Dyment & Bell, 2008, p. 958).

The greening of school grounds is not only for curricular and health purposes, it is also for the ecological sustainability of our planet. Capra (1997) said:

As we move toward the 21st century, the great challenge of our time is to create ecologically sustainable communities, communities in which we can satisfy our needs and aspirations without diminishing the chances of future generations. For this task, we can learn valuable lessons from the study of ecosystems, which are sustainable communities of plants, animal, and microorganisms. To understand these lessons, we need to learn the basic principles of ecology. We need to become ecologically literate, and the best place to acquire ecological literacy is the school garden. (pp. 45-46)

School gardens can provide a place for children to learn environmentally responsible behaviors and to connect different areas and school systems together. Capra (1997) again:

Learning in the school garden is learning in the real world at its very best. It is beneficial for the development of the individual student and the school community, and it is one of the best ways for children to become ecologically literate and thus able to contribute to building a sustainable future. (p. 50)

### **School Gardens Influencing the Social Learning Environment**

*All human experience is ultimately social; that it involves contact and communication.*

John Dewey

Structural-developmental (or constructivist or social cognitive) theory is an interactional theory; children construct knowledge and values through continuous interaction with a physical and social world. I discussed briefly in the previous section how children can develop through interaction with the natural or physical world of the school garden; this part will briefly explore how school gardens can be a place to foster relationships, build community, foster cultural heritage, and practice life skills.

Robinson and Zajicek (2005) conducted a study to assess changes in the life skill development of 190 third, fourth and fifth grade students participating in a 1-year school garden program in Texas. The researchers developed a Youth Life Skills Inventory (YLSI) that used a three-point Likert-type scale. This was an adaptation of Townsend and Carter's (1983) Leadership Skills Inventory and the 4-H National Youth Assessment Survey (Peterson et al., 2001). The curriculum used in this program is the very same Junior Master Gardener (JMG) curriculum used in the Klemmer et al. (2005a) and Smith and Motsenbocker (2005) studies. Robinson and Zajicek (2005) looked at these six life skill constructs: working with groups, self-understanding, leadership, decision-making, communication, and volunteerism (2005, pp. 454-456).

Robinson and Zajicek (2005) concluded that:

The youth that participated in the year-long garden program increased their overall life skills as well as improved teamwork skills and self-understanding. These skills are extremely important to ensure socially responsible and productive students. Gardens are a place where students can work together, make decisions, manage problems, and gain a sense of responsibility. The middle childhood period marks a strong growth in social relations and may be the right time to introduce youth to gardening and its benefits. (p. 456)

Mayer-Smith et al. (2007) created the Intergenerational Landed Learning Project, which brings together community elders, elementary students, and their teachers on an urban farm to explore how farming practices can be integrated with school curriculum to foster environmental knowing and care. Their study showed that the children gained a new experience of a world outside of their classrooms by working side-by-side with experienced farmers and gardeners who are community elders. This experience was social and contributed to the physical and curricular learning of the students.

These elder farm friends are mentors, friends, and role models for the children. They provide wisdom, direction, and guidance that assist their young apprentices in gaining access to the practice of farming and membership in a community farm. The intergenerational community context provides the social setting and relationships that support the growth of environmental consciousness. Farm friends share with the children the common goal of growing food crops and not only model but also articulate concern for the environment. (p. 83)

In Australia, Cutter-Mackenzie (2009), studied Multicultural Schools Gardens which were created in low-income schools to implement “a culturally focused environmental education program” (p. 122). This program had a strong social focus and used the school garden to bring communities together to design the garden, create curriculum topics, and to work. At the end of her research Cutter-Mackenzie found evidence that:

The multicultural school gardens program went beyond a sole (and typical) focus on gardening, incorporating the students’ cultural heritage. The program led to the development of a “space” that facilitated a strong sense of belonging among students who were formerly dislodged from their birthplaces, coupled with enhanced opportunities in learning English language (an essential skill in living in any Western culture) and forming connections to the local environment. This paper has provided food for thought with respect to the potential for children’s gardening to transcend language and cultural differences, therein providing authentic learning opportunities that extend well beyond previous expectations of school gardening programs. (p. 133)

Parajuli et al. (2008) found that by creating a strong social component of the Learning Gardens at Portland, Oregon, through inviting parents and families to create gardens according to their own agro-ecological and culinary traditions, the following were enhanced:

1. parents and extended families participation in schools and learning gardens;
2. positive impact on the learning home-environment for students; and
3. recognition and validation of parents knowledge and skills. (pp. 45-47)

The studies reviewed above demonstrate that school gardens may be used to influence the social learning environment positively, benefiting not only the students and their families, but also the faculty, staff, and the community at large.

## PROMPTS

- What kind of historical and/or cultural, philosophical or theoretical, and research-based information about school gardens do you need to support your work?
- What kinds of resources do you need for your school learning garden?
- How do or will you build curriculum, cooperation and collaboration, and beauty in your garden program?

### The Six General Learner Outcomes (GLOs)

The review of the GLOs in this section is from a cultural and a global stance. I provide a contextual rationale for my choice to use these GLOs as measurable values in chapter four on methods. In this section, the reader will be introduced to several Hawaiian words and phrases that provide another tone to the discussion.

The State of Hawai'i Department of Education General Learner Outcomes are the overarching goals of standards-based learning for all students in all grade levels. Observable behaviors, which are demonstrated in daily classroom activities, are evidence of GLOs. Student effort, work habits, and behavior are important and *they must be evaluated separately* from academic performance in the content areas (in accordance with Board of Education Policy 4501: Assessing/Grading Student Performance). The GLOs should be an integral part of the school culture as the GLOs do not exist in isolation. The six GLOs are:

1. Self-directed Learner (The ability to be responsible for one's own learning);
2. Community Contributor (The understanding that it is essential for human beings to work together);
3. Complex Thinker (The ability to demonstrate critical thinking and problem solving);
4. Quality Producer (The ability to recognize and produce quality performance and quality products);
5. Effective Communicator (The ability to communicate effectively);
6. Effective and Ethical User of Technology (The ability to use a variety of technologies effectively and ethically).

The GLOs in Hawai'i and similar performance goals in other States were created in response to the No Child Left Behind Act of 2001 and the need to better prepare students with “21<sup>st</sup> century skills for 21<sup>st</sup> century jobs” (U.S. Department of Commerce et al., 1999). The opening paragraph of this 1999 report state:

Global competition, the Internet, and widespread use of technology all suggest that the economy of the 21st century will create new challenges for employers and workers. While it is possible to compete in this new global economy by creating low-wage, low-skilled jobs, America has chosen to take full advantage of its labor force and to create high-performance workplaces. If economic success is to ensure a high quality of life for all Americans, it will require adopting organizational work systems that allow worker teams to operate with greater autonomy and accountability. These new forms of organization and management cannot succeed without additional investments in the skills of U.S. workers. In the workplace of the 21st century, the Nation's workers will need to be better educated to fill new jobs and more flexible to respond to the changing knowledge and skill requirements of existing jobs. Meeting the challenge of employment and training will call not only for the best efforts of employers, educators and trainers, unions, and individual Americans, but also for new forms of cooperation and collaboration among these groups. Lifelong skills development must become one of the central pillars of the new economy. (p. 4)

The impetus for the kind of education as stated above is an echo of the purpose of education for economics sake as presented earlier in this chapter. However, in a closer look at the outcomes from a structural-developmental theory lens, several other reasons for this kind of education surfaced.

The Partnership for 21st Century Skills (P21) is a national organization that advocates for twenty-first century readiness for every student. In *P21 Framework Definitions* (2009), this

organization advocates the weaving of twenty-first century interdisciplinary themes into core subjects. They list the following themes, and several processes with each theme:

1. Global Awareness
  - Using twenty-first century skills to understand and address global issues,
  - Learning from and working collaboratively with individuals representing diverse cultures, religions and lifestyles in a spirit of mutual respect and open dialogue in personal, work and community contexts,
  - Understanding other nations and cultures, including the use of non-English languages.
2. Financial, Economic, Business and Entrepreneurial Literacy
  - Knowing how to make appropriate personal economic choices,
  - Understanding the role of the economy in society,
  - Using entrepreneurial skills to enhance workplace productivity and career options.
3. Civic Literacy
  - Participating effectively in civic life through knowing how to stay informed and understanding governmental processes,
  - Exercising the rights and obligations of citizenship at local, state, national and global levels,
  - Understanding the local and global implications of civic decisions.
4. Health Literacy
  - Obtaining, interpreting and understanding basic health information and services and using such information and services in ways that enhance health,
  - Understanding preventive physical and mental health measures, including proper diet, nutrition, exercise, risk avoidance and stress reduction,
  - Using available information to make appropriate health-related decisions,
  - Establishing and monitoring personal and family health goals,
  - Understanding national and international public health and safety issues.
5. Environmental Literacy
  - Demonstrate knowledge and understanding of the environment and the circumstances and conditions affecting it, particularly as relates to air, climate, land, food, energy, water and ecosystems,
  - Demonstrate knowledge and understanding of society's impact on the natural world (e.g., population growth, population development, resource consumption rate, etc.),
  - Investigate and analyze environmental issues, and make accurate conclusions about effective solutions,
  - Take individual and collective action towards addressing environmental challenges (e.g., participating in global actions, designing solutions that inspire action on environmental issues).

I am very encouraged about the inclusion of these themes, in particular the Environmental Literacy theme. This is because the weaving of the above themes into core curriculum seems to suggest a more encompassing purpose of education which may include, helping to create value in our actions, develop love in our thinking, and foster equality and righteousness in our emotions. I began to understand that the six GLOs are *processes* or skills, which can be applied to teach, understand, and apply content effectively (Bransford et al., 2000, pp. 77-78). I looked for other expressions of these six GLOs.

*‘Ōlelo No’eau* are Hawaiian proverbs and poetical sayings. Many of these were collected and translated by Mary Kawena Pukui between 1910 and 1960. These sayings “reveal with each new reading ever deeper layers of meaning, giving understanding not only of Hawai’i and its people but of all humanity” (Pukui, 1983, p. vii). Many public schools in Hawai’i, including Kohala Elementary School have *‘Ōlelo No’eau* printed on the walls, posters, and letterhead. The most famous *‘Ōlelo No’eau* is the Hawai’i State motto – *Ua mau ke ea o ka ‘āina i ka pono* – The life of the land is perpetuated in righteousness, which can be found inscribed on the Hawai’i United States quarter.

Kamehameha Schools, a private Native Hawaiian educational institution describes the six GLOs from a cultural perspective, incorporating several *‘Ōlelo No’eau* into the description. The following description was taken from a poster series on the GLOs published by Kamehameha Schools.

Table 1

*The General Learner Outcome as presented by Kamehameha Schools Hawai’i*

GLO in English and Hawaiian	Hawaiian ‘Ōlelo Noeau	Explanation
Self-Directed Learner– <i>Kuleana Ihola</i>	Nānā ka maka, hana ka lima. <i>The eyes watch and the hands perform.</i>	In the days of old, questioning the instructor was rude. The student paid close attention to what was taught. Students learned quickly and were able to perform the task and in turn, teach others.
Community Contributor– <i>Mālama Kaiāulu</i>	Kōkua aku, kōkua mai. <i>As we help others, we find help for ourselves.</i>	The Hawai’ian lived in two distinct areas of the islands; those who lived near the shoreline and those who lived in the uplands. Groups traded with one another those goods only available in their own area. This system created a mutually beneficial relationship that supported subsistence living.
Complex Thinker– <i>Ho’okuano’o</i>	Mai pono hana, hana pono. <i>Don’t be busy with frivolous work; do what you need to do.</i>	When the going gets tough, the tough gets going, it’s been said. In life we are faced with challenges that must be overcome. The first step is to stop and think. At first glance, a problem might seem too difficult. However, if we think on it long enough, we will find the answer. Never give up!
Quality Producer– <i>Hana No’eau</i>	Mai maka’u i ka hana, maka’u i ka moloā. <i>Don’t fear work, fear laziness.</i>	Ka hana no’eau or the well crafted products Hawai’ians made are still today great examples of exquisite craftsmanship. They took their time and were very critical; anything they made needed to be of fine quality.
Effective Communicators– <i>Kākā’ōlelo</i>	I ka’olelo nō ke ola, I ka’olelo no ka make. <i>In the word is life, in the word is death.</i>	The power of the word is easily demonstrated. When we have a poor outlook, we “see” everything in a negative way, and even the activities we enjoy are

Effective/Ethical user of technology– <i>Kūpono Hana'ike</i>	Hele nō ka 'alā, hele nō ka lima. <i>Where the adz goes, the hand goes.</i>	not the same. When we can reframe our situation, we “see” things in a “new light.” Being able to communicate is an important task of a member of a community. Understanding and being understood will help in any situation. As an aboriginal society, the Hawai'ians made use of the resources around them to produce quality products. Today technology is almost limitless. Users of technology must understand how it works to be effective. More importantly the user must appreciate how to use it to benefit others.
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I also consulted a cultural teacher (*kumu*) who is highly respected in the community, for his interpretation of the GLOs from a Hawai'ian perspective (K. Ching, personal communication, 02/01/11). Kumu Keala Ching founded the *Nā Wai Iwi Ola* (NWIO) Foundation to perpetuate the Hawaiian culture and practices through hula protocol and ceremonies, the use and study of the Hawaiian language and by embracing the stories of our *kūpuna* (elders) past, present and future. Kumu Ching is particularly interested in education as he has his degree in early childhood education from the University of Hawai'i at Manoa. He felt that he could expand further on what was presented by Kamehameha Schools and had several more suggestions, including different translations for several for the GLOs. The following is a recapitulation of our conversation held 02/01/11.

Kumu Ching described Self-Directed Learner as *Kuleana Ihola*—self responsibility. He provided this 'Ōlelo Noeau: *Ua mau ke ea o ka 'āina i ka pono* - The life of the land is perpetuated in righteousness. The verbatim explanation is as follows:

Kau'ikeaouli (King Kamehameha III) voiced this wise saying, giving each individual "Hawai'ian" the opportunity to do right to the land, to themselves and to the community. It is the responsibility one has within "kuleana ihola". In old Hawaii, instructors model the righteousness of learning so that learners understand the outcome of learning without questioning the instructors. Righteousness is the best model of verse ('Ōlelo Noeau) teaching.

Kumu Ching described GLO 2 Community Contributor as *Mālama Kaiāulu*—community care. The 'Ōlelo Noeau he chose to match was *'A'ohe hana nui i 'alu like kakou* - No work is large if we work together. He explained:

In old Hawai'i, work was shared throughout the community to nurture all members from the elders to the next generation. A successful model of a community was shared from within the immediate family as the first learning community.

For GLO 3 Complex Thinker, Kumu Ching chose the word *Ho'okauno'o*, which can be translated as learning center. He felt that this could be phrased as *No ka luna ko luna, No ka lalo ko lalo*, meaning, what is up belongs up, what is down belongs down. He went further to say:

Understanding that everything has a purpose in life, the study of 'ahupua'a and complex thinking allows the comprehension learning that upland provides a nurturing source for gardening; where as, lowland provided sources from the ocean. Through 'opelu fishing, a

blend of upland plants like pumpkin, taro, and sweet potatoes provide the chum used for fishing 'opelu. Understanding the resources of place – *Ho'okauno'o*.

Kumu Ching described Quality Producer as *Hana No'eau*, meaning special work. He said: *Ua hala ē ka Pu'ulena, Aia i Hilo* - The Pu'ulena winds of Hamakua, ends up in Hilo! Seize the moment to learn.

In old Hawai'i, a family tradition was handed down through generations, skilled artisans like lauhala weavers, eel catchers, bird catchers, feather makers, and tapa makers, etc. It is told that when you are given the opportunity to learn seize the moment, for the moment might never come again – do not let the Pu'ulena winds blow by and end up in Hilo.

Take all the opportunities to learn, and learn with the greatest intention to perpetuate the art and enjoy your learning process!

For GLO 5, Effective Communicator, Kumu Ching agreed with the interpretation from the Kamehameha Schools' literature, and did not have any additional words to add.

The last GLO Effective/Ethical user of technology, Kumu Ching chose to describe it as *Kūpono Hana'ike*, being rightful & knowledgeable. The 'Ōlelo Noeau he offered was, *Kuhikuhi ho'i na lima, hele wale na maka*, which can be translated as, where the hands are pointed, the eyes follow. He explained:

Focus upon the work at hand, as the hands do the work the eyes observe. Technology involves the hands with the eyes focused on the accomplishments needed. Hawaiians worked with all tools like technology that supports the perfection of the work.

The interpretation from Kumu Keala and Kamehameha Schools presented the GLOs as processes to prepare our students not only to enter the workforce, but also to perpetuate the Hawai'ian culture, belief system, and contribute to society. The following are a few more ideas and thoughts culled from literature to understand more about the six GLOs.

### **GLO 1: Self-Directed Learner**

Self-directed learning has been one of the education field's high-interest topics for more than a decade, perhaps because the concept is so central to what adult education is all about (Knowles, 1975; Mezirow, 1985). An estimated 70% of adult learning is self-directed learning (Cross, 1981). Self-directed learning has been described as "a process in which individuals take the initiative, with or without the help of others" (Knowles, 1975, p. 18) to diagnose their learning needs, formulate learning goals, identify resources for learning, select and implement learning strategies, and evaluate learning outcomes.

There is interest in developing self-directed learning capacity in children, though there are not many research studies in this area (Rivero, 2003; Md Nor & Saeedina, 2009). In their study, *Exploring self-directed learning among children* Md Nor and Saeedina (2009), found that children have the capacity to be self-directed learners. Children love to learn, they feel capable of learning anything they may need to know, they like to think about the future, and they are able to evaluate their own learning. However, the inefficiency of current educational system does not support the actualization of these capabilities in children (Md Nor & Saeedina, 2009, pp. 660-661).

In the school garden, self-directed learning can be demonstrated in the curricular learning environment when students use the garden to conduct experiments based on personal interest, such as waste management experiments, soil tests, photosynthesis experiments and so on (Stone, 2009). Self-directed learning in the physical learning environment may be demonstrated through the students taking on the responsibility to create a biologically diverse, aesthetically pleasing school garden (Sobel, 2004, pp. 40-42), and through understanding the connection between the

eating of fresh fruits and vegetables and overall health (Ratcliffe, 2007). To quote Kumu Keala Ching's words above, in the context of the social learning environment of the school garden, "In old Hawaii, instructors model the righteousness of learning so that learners understand the outcome of learning without questioning the instructors. Righteousness is the best model of verse ('Ōlelo Noeau) teaching."

### **GLO 2: Community Contributor**

This GLO is often described as *cooperation* or *collaboration* by the teachers and staff at Kohala Elementary School (field notes, August 2010 through March 2011; A. Carlson, J. Baptista, & A. Nickl, personal communication 03/30/11). The word *kōkua* (cooperation, assistance) is a regular choice made by the staff and faculty (field notes, August 2010 through March, 2011). Resnick (1987) reported that one major contrast between everyday settings and school environments is that the latter place much more emphasis on individual work than most other environments. Bransford et al. (2000) provided several examples:

A study of navigation on U. S. ships found that no individual can pilot the ship alone; people must work collaboratively and share their expertise. More recent studies of collaboration confirm its importance. For example, many scientific discoveries in several genetics laboratories involve in-depth collaboration (Dunbar, 1996). Similarly, decision making in hospital emergency rooms is distributed among many different members of the medical team (Patel et al., 1996). (p. 74)

The school garden provides many tasks and intergenerational opportunities on which to cooperate and collaborate, from building compost piles, to weeding, to sharing of harvests, and learning from the elders (Robinson & Zajicek, 2005; Sobel, 2004, 2008; Stone, 2009; Subramaniam, 2003; Waters, 2005). In this way, the school garden is more of a real-life setting than most school contexts.

### **GLO 3: Complex Thinker**

Often this GLO is also called *Critical Thinker* among the staff, teachers, parents, and community (field notes, August 2010 through March, 2011). This skill is no stranger in all fields. Many articles and books have been written about critical thinkers, of which the work of Brookfield (1987) may be most familiar. He offered seven critical thinking themes that informed this study (pp. 5-9):

1. Critical thinking is a productive and positive activity.
2. Critical thinking is a process, not an outcome.
3. Manifestations of critical thinking vary according to the contexts in which it occurs.
4. Critical thinking is triggered by positive as well as negative events.
5. Critical thinking is emotive as well as rational.
6. Identifying and challenging assumption is central to critical thinking.
7. Critical thinkers try to imagine and explore alternatives.

School gardens can provide many opportunities for critical thinking and problem solving in a concrete context, where the feedback is immediate and garden-based (Stone, 2009, pp. 32-36, 96-101).

### **GLO 4: Quality Producer**

The GLO may seem the one that is most geared towards economics, jobs and the workforce, however, the Hawai'ian culture-based interpretation uses the word *craftsmanship*. This word denotes quality, and to produce something of quality, time is a factor. Something of quality usually lasts; it is permanent. Schumacher (1973) tackled the difficult concept of the economics of permanence in several chapters of *Small is Beautiful*. He wrote,

Nothing makes economic sense unless its continuance for a long time can be projected without running into absurdities. The economics of permanence implies a profound reorientation of science and technology, which have to open their doors to wisdom and, in fact, have to incorporate wisdom into their very structure... To give [a] preliminary example; in agriculture and horticulture, we can interest ourselves in the perfection of production methods which are biologically sound, build up soil fertility, and produce health, beauty and permanence. Productivity will then look after itself (pp. 21-22, 34).

The school garden is a place where high quality foods can be produced and eaten. Students can learn to discern healthy plants from unhealthy ones and to support their growth through practices such as soil fertility, proper tilling, and crop rotation. Students at The Garden Project of Troy Howard Middle School in Belfast, Maine are exemplary quality producers, growing more than 8,000 pounds of vegetables a year, and winning prizes for heirloom vegetables at the country's largest organic fair, and they are doing it at weather conditions below 10 degrees (Stone, 2009, pp. 32-36).

A quality producer does not necessarily mean someone who serves only the economic realm, but also one who adds to the improvement of society and care of the environment.

#### **GLO 5: Effective Communicator**

In the school year 2009 – 2010, only 63% of Hawai'i fourth graders and 64% of the fifth graders were reading proficiently at grade level (State of Hawaii Department of Education, 2010, p. 4). Being able to read and write is fundamental to effective communication, as is verbal communication. The DOE has in their plan to increase those numbers to 75% by then end of the 2011-2012 school year.

More and more children are spending a lot of time in front of the television set or playing video games. According to the National Survey on Children's Health 2007 (U.S. Department of Health and Human Services, Health Resources and Services Administration, 2009), 54.4% of children aged 1-5 watched more than one hour of TV or video during a weekday nationwide. Research conducted by Sage (2003), of the University of Leicester School of Education, on the thinking, speaking, reading and writing skills of children over 20 years provided evidence that children in Leicester, UK, were growing up with poor communication skills, because they were spending too much time watching television. They were learning to process messages visually rather than verbally. Dr. Sage found that having poor conversational skills is a major obstacle to making progress at school. She noted that, families used to gather together every evening and recount what they had done during the day. Children learned in that context how to put verbal ideas together in their minds. Today, children come home from school and sit in front of the TV processing largely picture information, which does not engage children in thinking, speaking and reflecting.

Children who work and learn in the school garden have the opportunity to interface directly with other children, adults and nonhumans. There is no screen between them. The virtue of garden-based work is that it "rewards cooperation," and in order to cooperate there must be effective communication between the cooperators.

#### **GLO 6: Effective/Ethical use of Technology**

The twenty-first century idea of technology almost always includes computerized technology, and renewable energy technology. While that is important, researchers from the Center of Ecoliteracy who have studied schooling for sustainability, including the use of school gardens to teach multidisciplinary programs, have found evidence that it is more developmentally appropriate and supportive to teach younger students the basics of technology,

such as the use and maintenance of simple garden tools, carpentry tools, and measuring tools (Brown, 2010; Stone, 2009, pp. 32-36, 84 – 89, & 90 – 95). In his article, *Little machines in their gardens: A History of school gardens in America, 1891 to 1920*, Brian Trelstad (1997), features several photographs of children using gardening and farming tools. Children are using full size rakes, shovels, hoes, and even a plow (pp. 164 – 168). The basic skills learned in this setting will scaffold the learning of more sophisticated technology such as power tools, and hand-held electrical probes.

Continuing the idea of beauty and permanence in this context of technology, I again defer to Schumacher (1973), who provided two examples of wise or ethical technology:

In industry, we can interest ourselves in the evolution of small scale technology, relatively non-violent technology, “technology with a human face,” so that people have a chance to enjoy themselves while they are working, instead of working solely for their pay packet and hoping, usually forlornly, for enjoyment solely during their leisure time. In Industry, again – and surely, industry is the pace-setter of modern life – we can interest ourselves in new forms of partnership between management and men, even forms of common ownership. (p. 22)

The literature above along with the Hawaiian cultural interpretations informed my understanding that the GLOs are not static, easily quantifiable products, but rather they are dynamic, developing processes. The development of the GLOs does not happen in a linear pattern but concurrently with each GLO supporting and promoting the development of the other five. The visual of this relationship is like gears turning each other as one gear turns (Figure 1). The being and becoming a general learner who is self-directed, contributes to community, thinks complexly, produces quality works, communicates effectively, and who uses technology ethically is a life-long practice. The process of learning is inextricable from the product, which is the learner. The process shapes learner, that the learner in turn deepens and re-defines the process. Thus the learning and application of the six GLOs is also the learning and application of self.



Figure 1. GLOs relationship to each other.

#### PROMPTS

- How can we think about Core Common Standards from a cultural viewpoint?
- How can we use the GLOs to measure how well we teach in the garden?

- How can we use the GLOs to measure how well we teach the Core Common Standards?

### Summary

This review presented a representative sample of the literature in the areas of the purpose of education, child development and learning theory, the relationship of children and nature, the use of school gardens, and a philosophical overview of the six GLOs. Education that helps us to be creators of value, and to be free human being able to impart purpose and direction to our lives emphasizes the process of learning and not so much the product. This paradigm of education focuses on supporting and building on the potentiality of students. As children grow and learn, their knowledge can be scaffolded with educative experiences built upon more educative experiences.

School gardens have been around for more than a hundred years, and are acceptable by parents and educators as places conducive for experiences *with* and *in* nature. Children's experiences in nature support their development cognitively, effectively, and physically. School gardens designed with these three areas in mind will have nature-based elements and principles to create interdisciplinary, child centered, and experiential curriculum; to develop safe, biologically diverse, and healthy physical environments; and to foster relationships both human to human and human to nonhuman.

The school garden is a dynamic setting offering multiple contexts for teaching and learning. Gick and Holyoak (1983) posited that when a subject is taught in multiple contexts, and includes examples that demonstrate wide application of what is being taught, people are more likely to abstract the relevant features of concepts and to develop a flexible representation of knowledge (Bransford et al., 2000, p. 63). The school garden has tremendous potential to be used as a safe, accessible and nurturing avenue to teach, learn, and practice the processes that will lead to consistent demonstration of the six GLOs by all the students involved in the program.

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