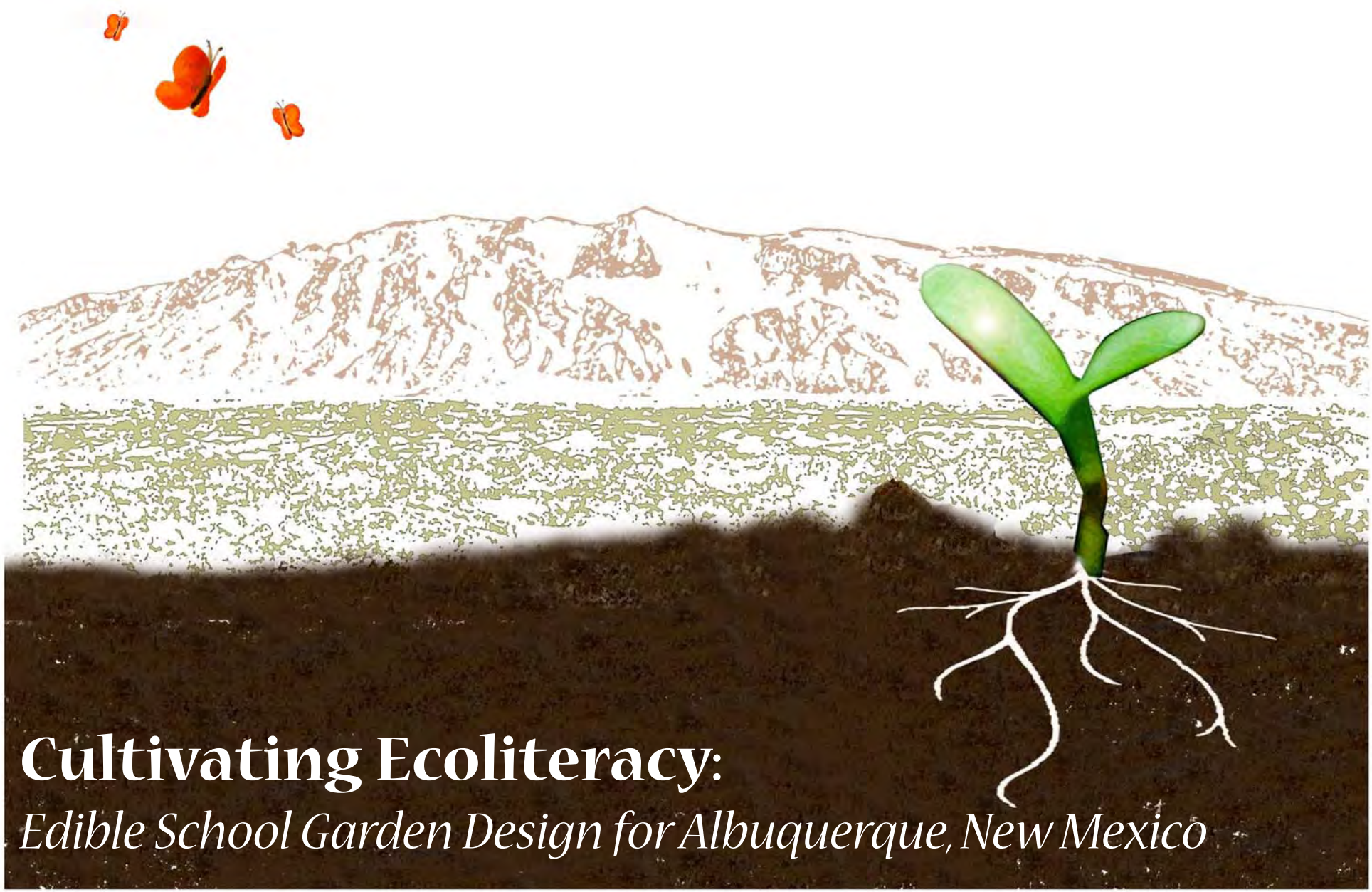


Cultivating Ecoliteracy:

Edible School Garden Design for Albuquerque, New Mexico

Cultivating Ecoliteracy:
Edible School Garden Design for Albuquerque, New Mexico

Master's Thesis
University of New Mexico
Landscape Architecture Program
Amy Duckert
May, 2008

Thesis Committee:
Baker H. Morrow, chair
Dr. Anne P. Taylor
James R. Sais

Table of Contents








Acknowledgments

My deepest gratitude to my committee, my parents, and Mike Bell for their guidance, patience, support, and good humor. Heartfelt thanks is also given to the students and teachers at Oñate Elementary for their infectious enthusiasm and vision for an edible school garden.

Abstract

This study explores how an edible school garden can be an essential and unifying component of schoolyard ecosystem design in an Albuquerque, New Mexico elementary school. In addition to designing an edible school garden for Oñate Elementary kindergarten and first grade classes, this study also develops a series of corresponding integrated curricular experiences as a way of teaching ecoliteracy, required subject matter content, and learning processes for kindergarten and first grade students. A synthesis of information gained from a review of literature, precedent studies, and a pilot study at Oñate Elementary yields a framework of causal pathways and feedback loops that are applicable and adaptive for edible school garden design in Albuquerque.

Chapter One

Introduction
Need for the Study
Methodology
Limitations of the Study

Introduction

Today we face a number of challenges never before presented to the human population. We spend an incredible 95% of our time indoors, causing nature to be understood as an abstraction that is separate from our selves (Orr, 2007). Members of the population who have the most money and power conduct their daily lives with little or no understanding of the food, water, energy, and waste systems that support their survival on earth. Our global population is 6.5 billion and growing rapidly, raising questions of carrying capacity and associated dilemmas of social and environmental justice. We are also entering an age of peak oil extraction, meaning the end of cheap oil as an energy source. This will require significant lifestyle adjustments and creative problem solving for alternative energy sources and use. In addition, global temperatures are rising due to record high CO_2 levels in the atmosphere, with unknown but likely severe consequences for global climate.

How can we deal with these challenges? Orr (2007) suggests, "We can't be optimistic, but we can be hopeful." Designers have the ability and the responsibility to respond to these major, world shaping challenges. Because design directs so many of our daily activities, it can play a central role in cultivating ecoliteracy in current and future communities. Learning to be ecologically literate requires us to understand the world through relationships, not discrete things. As a result, we have a better understanding of life-sustaining processes and the consequences of our actions. In turn, ecoliteracy enables us to live as mindful members of our communities. Educational environments are of particular importance for developing ecologically literate communities. Schools are where the world's future leaders spend the majority of their time and develop the perceptions, values, and attitudes that shape society.

Landscape architecture in school settings can have a considerable impact on how and what students learn. Therefore, landscape architecture in schools can be a powerful tool for developing ecoliteracy. This study focuses on the role that edible school gardens can play in revealing life-sustaining processes, teaching systems thinking, and cultivating ecoliteracy.

Schools can be highly influential community centers, both reflecting and regenerating community hopes, values, and traditions. Edible school gardens are microcosms of the larger schoolyard ecosystem, containing, reflecting, and connecting to surrounding natural and cultural systems. The integration of edible school gardens into the school environment and curriculum familiarizes students with these systems, helping them to understand their interconnections with the surrounding world.

In a review of literature, this study considers the worldviews behind many of today's environmental problems, and how a shift to a paradigm of ecoliteracy is changing the organization and goals of major institutions in business, education, and design. A discussion of the history of school gardens in America reveals how garden pedagogy can reflect and reinforce dominant worldviews. Finally, a review of previous studies in schoolyard design and exemplary edible school garden programs yields a preliminary framework for edible school gardens as unifying

Edible School Gardens Reveal Systems on Multiple Scales

components of schoolyard ecosystem design.

To further refine the framework for use in the Albuquerque Public School District, a precedent study of existing edible school garden programs in the Albuquerque area was conducted. A pilot study at Oñate Elementary in Albuquerque provided the author with firsthand experience working with a school community to design an edible school garden in Albuquerque. Additionally , the pilot study allowed for the development, testing, and revision of a set of curricular experiences to support edible school garden design while teaching concepts of ecoliteracy, required subject matter content, and learning processes for kindergarten and first grade students. A synthesis of information gained from the above studies provides a useful framework for edible school garden design in Albuquerque. This framework is articulated in the design of B-Building Garden, an edible school garden for kindergarten and first grade classes at Oñate Elementary.

Edible School Garden Crops:
Chard, Calendula, and Broccoli

Statement of Purpose

The purpose of this study is to demonstrate how an edible school garden can be an essential and unifying component of schoolyard ecosystem design in an Albuquerque elementary school. A second objective is to develop a series of corresponding integrated curricular experiences as a way of teaching ecoliteracy, required subject matter content, and learning processes for kindergarten and first grade students.

Patterns in Nature Describe Function:
Circulation and Distribution in Chard Branches

Need for the Study

The need for this study is based on the conviction that landscape architects can play an active role in building ecologically literate communities through design and education. Community ecoliteracy is an empowering device that not only improves the physical health of people and their surrounding ecosystems, but also improves economic and social conditions and interconnections (Orr, 1994). Identifying and understanding the potential impact of the work done by landscape architects in this regard is imperative in a time when ecologically literate communities will likely hold the key to continuing human presence on earth.

Design, Education, and Cultural Norms

Unsustainable human behavior has several root causes associated with understandings of the relationships humans have with their environments, which is in turn an ever-changing result of culture and personal experience. These environmental perceptions, values, and attitudes are linked to cultural standards shaped by experiences, education, and design of the surrounding world (Saul, 2000). Several cultural institutions, private and public, contribute to the reproduction of these norms. Public education plays a significant part in reproducing and changing dominant cultural standards because it has the power to legitimize (and de-legitimize) forms of knowledge and shape human-environment relationships (Bowers, 1997). Schools can be influential community centers that help define roles and relationships for students, teachers, parents, and the surrounding community. Landscape architects, as designers of educational environments, should take an interest in the opportunity they have to make positive changes in cultural standards and resulting behavior with their work in schools.

The Importance of Educational Environments

Louv (2005) argues that today's children spend an insufficient amount of time in outdoor environments. This contact with the outdoors at an early age has been shown by several researchers to be a major factor in determining future patterns of behavior as adults. More specifically, early contact with local natural environments makes us more aware of how we are interconnected with the natural world and results in more environmentally sensitive behavior (Louv, 2005). Child abduction fears have caused parents to keep children inside at home while the lure of TV and video games causes many children to make that decision themselves (Dennis, 2008).

At school, increased accountability as a result of the No Child Left Behind Act of 2001 has diminished time for physical education, recess, and outdoor education (usually deemed as 'extra'). When they are not at home, children spend the majority of their time in school and at day care. Special attention should be given to these everyday environments in order to provide much needed contact with the outdoors. According to Dennis (2008), "Nature play in everyday landscapes produces fit, healthy, and happy children. Landscape architects should be more engaged in the growing interdisciplinary efforts to create more healthy living environments… the next frontier in children's environmental design will likely focus on school landscapes and neighborhood design" (p. 37).

Schoolyards are an ideal location to give children an opportunity to experience their local natural environments first-hand. Unfortunately, many school environments are devoid of these types of opportunities to

A Redundant Sand Box in an Acre of Sand,
Oñate Elementary Playground, Albuquerque, NM

interact with nature. Acres of treeless asphalt cover valuable land lying fallow, marked by all-too-familiar metal and plastic play structures that provide a highly controlled monoculture of play environments.

The physical environment, as part of the school's hidden curriculum, is a highly influential learning tool. In fact, up to 25% of learning comes directly from the physical educational environment (Ballantine, 1997). Public school environments, as they currently exist, are based on a model that stems from the philosophy of the Industrial Revolution – one that contains and sorts students but does not necessarily facilitate active and creative learning (Taylor and Vlastos, 1983). Most learning happens casually, by example (Illich, 1970). A school's physical environment plays a meaningful role in how and what students learn at school.

Alice Waters, chef of the world-renowned Chez Panisse Restaurant in Berkeley, California and the founder of the Edible Schoolyard at Martin Luther King Middle School, argues that a school's physical state teaches children volumes about what their community values (Center for Ecoliteracy, 1999). If the school's environment is cared for, students understand that their community values their welfare, the importance of a good education, and their ability to be active, contributing citizens. A school's physical environment can be integrated explicitly into daily curriculum, becoming a compelling and beneficial educational tool (Bowers, 2001). Using the school environment as an integrating context for all curriculum is helpful for teachers trying to meet state content standards and teach in a hands-on, interdisciplinary, and meaningful manner.

Landscape architects are therefore charged with the duty of creating educational landscapes that facilitate this kind of "environmental education." As Van der Ryn (2005) states, "Making the design, operation, and improvement of their buildings part of curriculum could create a revolution in what and how students learn" (p.96). Regardless of educators' intent or method, students will learn from their environment. It makes good sense to see the educational landscape for the readily available resource it can be, and to draw on it for the good of the entire school community.

The benefits of healthy schoolyard environments integrated with daily school activities are conclusive and noteworthy. Several

Industrial Era Educational Environment:
Lecture Hall Desks at the University of California, Santa Barbara

Proud Students and Their Harvest at the Edible Schoolyard, Martin Luther King Jr. Middle School, Berkeley, California
(Center for Ecoliteracy, 1999, p. 8)

studies have shown the ability of an interdisciplinary curriculum integrated with the school environment to raise students' test scores, improve students' critical thinking skills, increase student attendance and boost general enthusiasm for learning (Lieberman and Hoody, 1998 and Glenn, 2000). These benefits are the result of an education that is integrated with students' everyday world, making it relevant, meaningful, and lasting. Creating healthy, sustainably designed school environments improves more than the physical health of a community. A recent study on Leadership in Energy and Environmental Design (LEED) certified green school buildings compared with conventionally constructed schools found that green schools save a community significant amounts of money while improving student attendance, student performance, the image of their community, and the ability of the school to attract and retain teachers (Kats, 2006). The quality of the physical environment of a school clearly makes a difference in how, what, and why students learn.

Edible School Gardens in Schoolyard Ecosystem Design

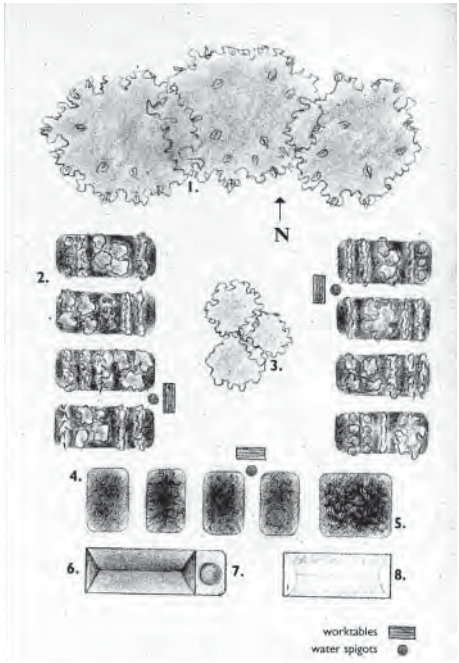
Edible school gardens are essential features of successful schoolyard ecosystems (Capra, 1999). A well-designed schoolyard that includes an edible garden can connect children, parents, instructors, and whole communities with each other and their environment (EDC, 2000). Several case studies, such as the Edible Schoolyard in Berkeley, California, provide a model for the successful integration of edible school gardens (food production and preparation, water systems, waste systems, social systems, and habitats) into the physical school form and into required curriculum.

An abundance of edible school garden success stories exists across the United States, across of a wide range of demographics and income levels. The state of California is currently in the process of making school gardens a requirement for every school (Kawamura, 2007). On a national level, the House and Senate recently passed legislation to reauthorize H.R. 2419, The Food and Energy Security Act of 2007. The Senate-passed version of this bill contains an amendment that would provide national funding for gardens in public schools. This amendment targets schools in areas with high poverty levels and would allow students to plot, plant, and harvest a community garden during the school year and/or summer program (ASLA, 2007). Clearly, the notion that edible school gardens can have widespread positive impacts is starting to take hold across the country.

In addition to federal and state support, countless national and regional organizations provide resources for schoolyard gardening. For example, the National Gardening Association provides a "Kidsgardening" website where educators can search lesson plans, have online discussions with other educators, get expert gardening advice, search funding opportunities, and purchase garden supplies. The California School Garden Network (CSGN) also has a website offering a comprehensive collection of resources for educators wishing to start and maintain their own school garden program. The Rainwater Environmental Alliance for Learning (REAL) is an organization that has set up several school gardens in Texas. In the coming years, however, REAL hopes to become a resource for schools nationwide.

Even with the existence of all of these examples, resources, and support, a framework for schoolyard ecosystem design unique to the needs of Albuquerque is much needed. As of this writing, there are no

Community Gathering, Merriewood Children's Center Garden, Lafayette, California



Sample Garden & Outdoor Classroom Plan
(Center for Ecoliteracy, 1997, p. 18)

guiding precedents for edible school gardens as a unifying component to schoolyard ecosystem design, hence the purpose of this project.

This study seeks to demonstrate how edible school gardens are essential for successful schoolyard ecosystem design. A complete schoolyard ecosystem would incorporate food, water, waste, habitat, and social systems into the everyday life and curriculum of the school. As a microcosm of many larger interconnected systems, the edible school garden is a central feature for the larger schoolyard ecosystem.

In an edible school garden students have direct, hands-on experience with all of these systems at an accessible scale. An edible school garden can also support the sociocultural fabric of the school community. For example, community members could participate in growing, cooking, composting, water harvesting and recycling, additional volunteer activities, and community classes. An edible school garden gives back to the community with food production, waste recycling, water harvesting, and providing a place for community gatherings and celebrations. The edible school garden, as part of a whole schoolyard ecosystem, could be seen as a highly functional form of eco-revelatory design in the school setting. Clearly, there are several opportunities and forms an edible school garden could take because of its role in the larger, place-dependent schoolyard ecosystem. This form depends a great deal on the school's location as well as the desires, values, and resources of that particular school community.

Designing Edible School Gardens in Albuquerque

An edible school garden, as part of the larger schoolyard ecosystem, is unique to its location, environmentally and culturally. It is a system that is made up of the local life zone, schoolyard microclimates, regional and local history, and the people who interact with it every day. While excellent examples of statewide, district-wide, and school-wide programs exist in other locations, it is difficult to find any model that would apply perfectly to public schools in Albuquerque. Albuquerque currently has a handful of school gardens, most of which occur at private or charter schools.

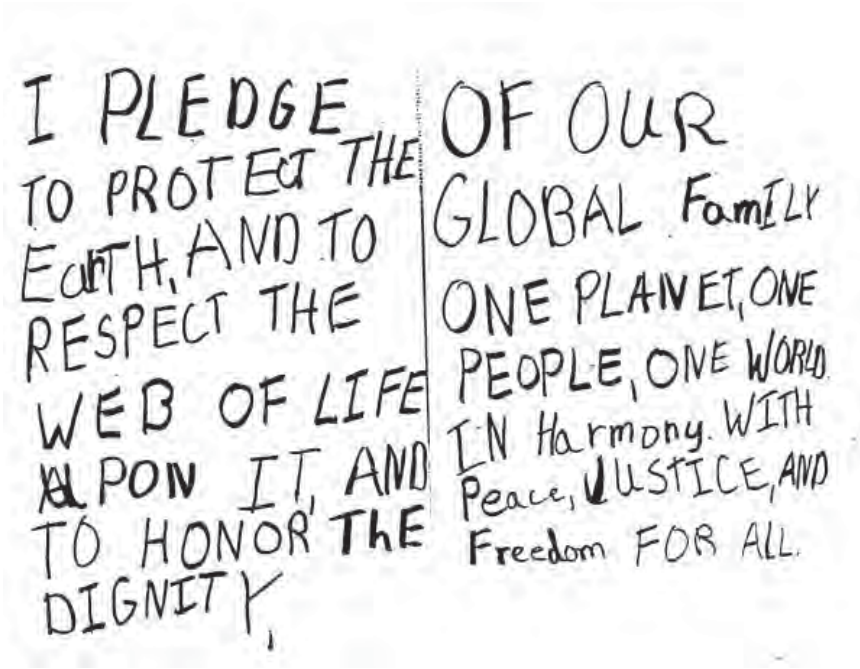
At first glance, challenges specific to Albuquerque include a lack of funding, difficult soil conditions, lack of water supply, and a growing season that is mismatched with the typical school year. Lack of funding and resources for public education provide a challenge for new schoolyard design projects, and can result in negative attitudes surrounding suggested changes in school structure or practice. Further, soil that resembles light-duty concrete and water-use restrictions limit the amount and type of edible crops that can be grown. The typical growing season in Albuquerque occurs in the summer and fall, when most students are not in regular school session. Edible gardens and schoolyard habitats in public schools are often the result of one or two dedicated and enthusiastic teachers. When these teachers change schools or retire, the program usually leaves with them. A new expertise, one of local food, water, and waste systems is required in Albuquerque schools.

Albuquerque landscape architects need a framework to assist in the design of edible gardens within schoolyard ecosystems integrated with school curriculum. The opportunity exists for landscape architects to work with the Albuquerque Public School District to implement district-wide edible garden - and eventually whole

schoolyard ecosystem - programs. Landscape architects also have the chance to combine their efforts with educators to teach ecoliteracy and required subject matter content through concepts of landscape design. This effort would facilitate a process of much-needed community building. Food and water availability are major concerns in the Southwest and it will be very important for communities to be able to deal with water, food, and waste systems in a sustainable and cooperative manner. Implementing edible school garden programs is one way to provide Albuquerque communities with the skills to do so. In this way, school neighborhoods would begin to provide and pass on vital knowledge and skills surrounding local food production, waste recycling, and other life-sustaining systems.

Creative design solutions that address the edible garden's relationships with the whole school campus and surrounding community are needed for all of these challenges. While challenges exist, Albuquerque's strong cultural ties to local agriculture and New Mexico's tradition of creative solutions to dry climate present exciting precedents and possibilities. In addition, the Bernalillo County Extension Service offers a number of resources for schools, including informational handouts (see Appendix C) and volunteer Master Gardeners willing to share their time and expertise. Understanding the capacity of edible school gardens as central and unifying features of schoolyard ecosystem design as well as the ability of these gardens to facilitate interdisciplinary, integrated curriculum is the first step in developing a framework and guide for schoolyard ecosystem design in Albuquerque.

"What I Would Like to Grow in My Garden"
Drawing by Oñate Elementary Kindergarten Student



Student Pledge for Ecoliteracy
(Center for Ecoliteracy, 1999, p. 36)

Methodology

Using a variety of methods, this study will show how an edible garden can be an essential and unifying component of schoolyard ecosystem design in Albuquerque public elementary schools. To support the integration of edible schoolyard design, this study will also develop a series of corresponding integrated curricular experiences for kindergarten and first grade.

Review of Literature

This study will review pertinent literature to provide a theoretical and historical background for understanding the ability of an edible school garden to serve as a central feature of schoolyard ecosystem design. A synthesis of information gained from an examination of two exemplary school garden programs and a discussion of previously conducted studies on schoolyard environments will provide a guide of general characteristics for successful edible school garden design.

Precedent Study: Existing Edible School Gardens in the Albuquerque Area

In order to develop a more specific model suitable for edible school garden design in Albuquerque, the author conducted a precedent study of existing edible school garden programs in the Albuquerque and Santa Fe areas. Findings from site visits and conversations with teachers, landscape designers, and/or program leaders associated with each individual program are also reported.

Pilot Study: Oñate Elementary, Albuquerque

A year-long pilot study with kindergarten and first grade classes at Oñate Elementary in Albuquerque gave the author opportunities to work closely with the school site, teachers, and students to better determine a site-specific guiding framework for edible school garden design. Through weekly visits to kindergarten and first grade classes, a series of integrated and supporting curricular experiences for edible school garden design were developed and tested. In addition, this first-hand experience helped to further refine the guiding framework for edible school garden design in Albuquerque, specifically for grades K-1.

New Marigold Sprouts

Using the Framework: Oñate Elementary Garden Design

The guiding framework for edible school garden design in Albuquerque will be articulated through the design of the B-Building Garden, an edible school garden for kindergarten and first grade classes at Oñate Elementary. Results of the design process include site analysis of the surrounding schoolyard and school community, a suggested planting schedule for Albuquerque edible school gardens, and landscape architectural renderings including plan, section, and perspective views. Design features will specifically target the developmental and academic needs of children ages 5 to 6. For example, the garden design will include a series of brightly colored signs and measuring instruments (such as a rain gauge and sundial) with lettering and symbols to encourage students to read from their immediate environment. A set of interdisciplinary curricular experiences surrounding edible school garden design that meets required New Mexico State Educational Content Standards for kindergarten and first grade accompany the design (see Appendix A for curricular experiences and Appendix B for New Mexico State Educational Content Standards).

Limitations of the Study

Limiting factors for the study include the targeted age group (kindergarten and first grade), and the ability to evaluate of success of the edible school garden design for Oñate Elementary.

Age group

Kindergarten and first grade students were selected as the focus of the project for several reasons. The opportunity to work directly with kindergarten and first grade teachers and students at Oñate Elementary narrowed the focus of the study to this particular age group. In addition, the need to align curriculum development with required state educational standards necessitated that the study focus on a particular age group. In conducting design for educational environments, it is important to consider the specific developmental and academic needs of children using the site. Focusing on children ages 5-6 allowed the design to address particular requirements for cognitive, physical, and emotional development.

Evaluation

Given the time and scope of this project, evaluation of the success and effects of the edible school garden design and corresponding curriculum at Oñate Elementary is not possible. Factors such as funding and reasonable time lines for construction cause the actual building of the garden to be prolonged past the time frame of this particular study. Further research in this area is needed to fully assess the success of the edible school garden design framework, how it might apply to other school locations and age groups, and the effects it might have on student and community ecoliteracy.

Wheat Harvest

Spring Kale

Chapter Two

Glossary of Terms
Literature Review

Glossary of Terms

A number of key terms used in this study have vague or multiple meanings. A concise, clear discussion involving these terms requires defining each key term as it is used this study.

Culture

Ward H. Goodenough defines culture as "standards for deciding what is, standards for deciding what can be, standards for deciding how one feels about it, standards for deciding what to do about it, and standards for deciding how to go about doing it" (quoted in Bowers, 1997, p. 25).

Design

Lyle (1985) defines design as "giving form to physical phenomena at every scale" (p. 181). The catch to this definition is that some kind of form (recognition of pattern) was already present. A more accurate definition might be, the intentional ordering and shaping of form and content present in physical phenomena in a way that is potentially representative of cultural aesthetics, attitudes, perceptions, values, and desires. This reordering and reshaping of our physical surroundings is a vital part of the dance between our understandings of nature and culture. Design gives recognizable form to the things that keep us alive. Orr (2007) defines design as, "how we get food, energy, materials, shelter, livelihood, transport, water, and waste cycling" (p. 2). Because designers bring their own personal and cultural intent into the process, they take on the responsibility of understanding the reciprocal relationship between nature and culture and how it aids survival. Accordingly, designers must consider the possibilities and consequences of reshaping our physical surroundings.

Ecology

The root of the word "ecology" comes from the Greek *oikos*, or household. The household is a place we inhabit, a place that shapes and is shaped by its inhabitants (Orr, 1992). Ecology can therefore be defined as the study of ourselves in relation to our household; the understanding of our interrelationships with our ecosystems.

Ecoliteracy

Ecoliteracy is defined by Orr (1989) as "a quality of mind that seeks out connections" (p. 51). This quality of mind is a result of an understanding of the basic principles of ecology, thermodynamics, and natural history. According to Capra (1999), this understanding is furthered through a practice of systems thinking, or thinking in terms of the organizing principles that living communities all share. An ecologically literate person then applies these organizing principles as ecological values in his or her daily life. Place-based education, particularly with the use of an edible school garden, is an effective method of teaching ecoliteracy to students and communities (Sobel, 2005). Many authors argue that building an ecologically literate society is critical for continued human life on earth. The concept of ecoliteracy is further discussed in the Review of Literature section.

Eco-revelatory Design

Thompson and Sorvig (2000) define eco-revelatory design as, "projects, design approaches, and elements that reveal and interpret ecological phenomena, processes, and relationships" (p. 17). Using an inclusive definition of ecology means that eco-revelatory design also reveals human influences and interconnections as part of the system. The goal of eco-revelatory design is to reveal to humans the ecosystems in which we participate.

The concept of eco-revelatory design is important to this study because it reinforces the idea that people learn from their everyday environment and what we learn influences how we behave. It is easier to feel separate from our environment in a world where electricity, water, and food come from distant and hidden locations and waste just disappears. By revealing our connections with our environment, we start to understand our own ecologies, and acquire a more acute sense of place. Thayer (1994) argues for the "transparency" of landscape as the most vital method toward sustainability because it allows us to understand how we are connected and then make appropriate decisions; "In transparent landscapes, a visual ecology, where we are able to assess the conditions affecting us and make cogent

environmental decisions, is both possible and necessary" (p. 190).

Ecosystem

The American Heritage Dictionary defines an ecosystem as "A community of organisms together with their physical environment, viewed as a system of interacting and interdependent relationships and including such processes as the flow of energy through trophic levels and the cycling of chemical elements and compounds through living and nonliving components of the system." This definition allows for the inclusion of humans as organisms. Lyle (1985) supports this inclusive interpretation of the definition and suggests that seeing ourselves as active parts of ecosystems is critical to designing with them; "We human beings are integral, interacting components of ecosystems at every level, and in order to deal adequately with these systems, we have to recognize that simple fact" (p. 180). This study will define ecosystem as inclusive of humans and our associated cultures.

Another key feature of ecosystems is that they are open systems, meaning that each system exchanges flows of energy and materials with systems around it. Capra (1999) describes these relationships as "nested systems," meaning that each ecosystem is part of a larger system while containing countless numbers of smaller subsystems. A good example of this is to think of each cell in our body as a tiny system, which then makes up larger systems (organs), and larger, more complex systems (organisms), to even more complex systems (interactions between organisms). To make matters more complicated, interactions occur across all of these levels and systems.

Environment

Our understanding of the word "environment" is intricately connected to our understanding of our relationship with it. Different meanings have varying implications for interactions between humans and their environment. According to Palmer and Neal (1994), there are three basic, interrelated meanings for the word "environment."

1. Environment as a thing: Environment is understood as tangible and distant physical surroundings, usually equated with the natural. This definition allows us to separate ourselves from our environment.
2. Environment as an issue: Environment is a political sound byte, promoting the idea that it is either good or bad, something for which an opinion should be formed. Again, this definition allows us to be outside of and separate from it.
3. Environment as setting: This definition encompasses not only physical surroundings, but the interactions taking place within them. The environment is something that is connected to every facet of our lives. Each person's definition of environment is a result of his or her experience within the context of society and culture. This definition is based on the idea that we are constantly learning from interactions with our surroundings.

For the purposes of this study, the third definition will be used.

The Spiral: Symbol For Nested Systems and Ecosystem Dynamics

Hidden Curriculum

The concept of a hidden curriculum suggests that students learn through their interactions with each other and their environment. Illich (1970) notes that, "most learning happens casually" (p. 12). This casual learning is important because it often determines what is legitimate and what is not (Illich, 1970). Coined in 1971 by Benson Snyder, the term "hidden curriculum" signifies the informal system of schools. Ballantine (1997) described the hidden curriculum as the

"other three R's: rules, routines, regulations" (p. xiii). Several other terms exist to describe the same idea: unwritten, unstudied, tacit, latent, unnoticed, silent, and para-curriculum. In comparison, formal curriculum is the lesson plan, the textbook, the content standards, etc. The hidden curriculum is found in how the lesson is taught in each particular classroom setting. Based on a synthesis of existing definitions, this study will define the hidden curriculum as the implicit curriculum communicated from the setting and structure of classrooms, including the tone and type of physical interrelationships in the classroom and schoolyard.

Inhabitant

The concept of the inhabitant is tied to that of ecoliteracy. In order to be an inhabitant, a person must be ecologically literate regarding the area he or she inhabits. Orr (1992) defines an inhabitant as someone who "is part of a system that meets real needs for food, materials, economic support, and sociability" (p. 102). The inhabitant and place mutually shape each other, engaging in a dialogue, "with all the qualities of a good conversation" (Orr, 1989, p. 50).

Learning Processes

As students learn, they achieve deeper understandings, moving from basic knowledge acquisition to synthesis and evaluation. The conventional taxonomy for classifying cognitive development was developed by Benjamin Bloom in his 1956 *Taxonomy of Cognitive Objectives.* "Bloom's Taxonomy," as it is commonly called, describes the progression of understanding from basic to complex with the following categories: knowledge, comprehension, application, analysis, synthesis, and evaluation. This study uses a slightly different and more holistic approach to classifying learning processes, developed by Anne Taylor Associates (2008). Taylor's taxonomy consists of the following categories: observation and discovery, data collection, creative problem solving, valuing, and stewardship. Progressing through each of these stages of learning, the student is engaged wholly, across mind, body, and spirit. This study demonstrates how an edible school garden can be an integrating context for developing each level of this taxonomy.

Nature

The word "nature comes from the Latin *natura*, which is from *nascere (nasci)*, to be born. Therefore, nature refers to dynamic living processes and not to a static view (Crandell, 1993). Nature is not one thing, and therefore, has no opposite. Sorvig (2002) gives several helpful working definitions of nature that are linked to landscape. Two definitions that are perhaps most useful for the purposes of this study are, "the physical world, usually the outdoors, including all living things and phenomena," and "the order, essence, or pattern of all living things" (Sorvig, 2002, p. 4). What is most important to note about these definitions is that they include humans and their interactions with their environments.

For the purpose of discussing ecoliteracy, writers often use a definition of nature that is more exclusive of human beings to make a point. Richard Louv (2005) defines nature as, "wildness: biodiversity,

Fig. 1. The Reciprocal and Regenerative Relationship Between Nature, Culture, and Design. (Van der Ryn, 2005, p. 133)

abundance – related loose parts in a backyard or a rugged mountain ridge" (p. 8). This definition is problematic but also revealing. The romantic quality of the definition shows our tendency to place values on our definitions of nature – most likely based on our own personal experience with what we consider to be 'nature.' Louv's definition is a useful example of how our cultural views shape how we define this word. In turn, our experiences with the natural world have shaped our cultural views. A cyclical process becomes apparent in the shaping and reshaping of our understandings of nature and ourselves.

Corner (1999) discusses this understanding in terms of "the landscape idea," that our surroundings hold eidetic content, "the capacity to contain and express ideas," and therefore reflect and reshape our cultures. **This concept is central to this study because it shows the intimate and reciprocal relationship we have with our surroundings.** Fig. 1 shows the nested and regenerative relationship among nature and culture, with design and technology as mediating processes. Becoming aware of the relationships between nature, culture, and design is an important step in developing into ecologically literate inhabitants (Orr, 1992).

Pedagogy

Pedagogy, as defined by the American Heritage Dictionary, is "the art or profession of teaching; education; instructional methods." Pedagogy is the educational philosophy behind instructional content and methods of teaching. This philosophy describes the roles of student, teacher, community, the learning environment, technology, and family. This study examines how an edible school garden is an important part of a pedagogy for ecoliteracy.

Schoolyard Ecosystem

The definition of a schoolyard ecosystem stems from the existing models of ecoliteracy and place-based education programs. This concept combines existing definitions to produce a more complete model for school design. It is based on an understanding of the school as a nested system, one that is made up of interconnected subsystems and part of countless larger systems. The "schoolyard ecosystem" therefore is part of and supports the entire school and surrounding community

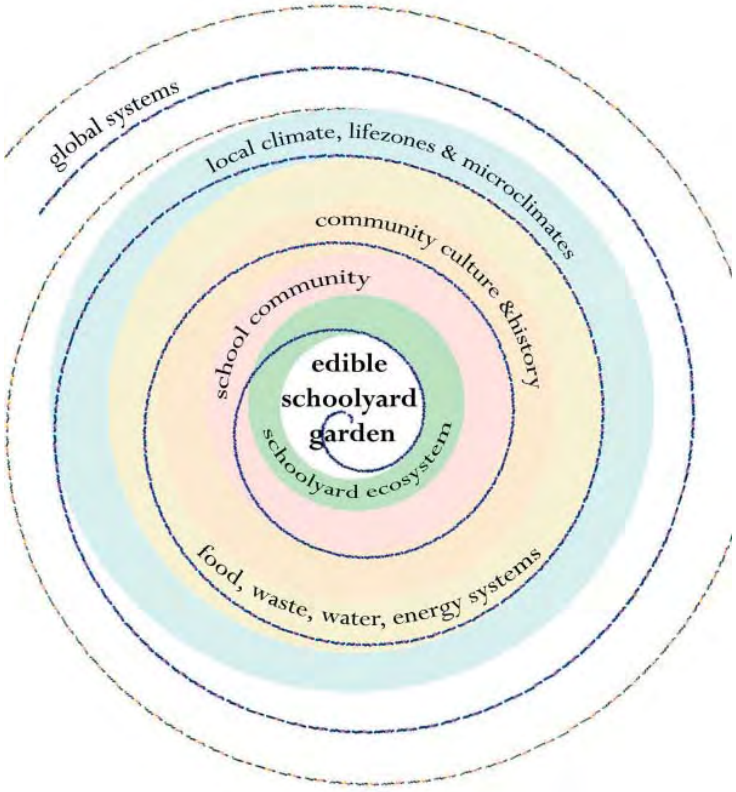


Fig. 2. The Edible School Garden as a Nested System

ecosystems. This definition takes the meaning of the outdoor school environment past ideas of "the outdoor classroom" to an awareness of the countless natural and cultural processes cycling through it. The schoolyard ecosystem involves students, teachers, administrators, and community members in local food, water, waste, and energy systems, while revealing interconnections with the larger surrounding regional and global systems. The schoolyard ecosystem, together with an integrated curriculum, active community partnerships and participation, and green school buildings, helps create an entire school ecosystem that truly serves as a thriving community center. Each schoolyard ecosystem is unique to its own context and is determined by the systems of which it is part (see Fig. 2). This study seeks to show how an edible school garden is an essential and unifying component of schoolyard ecosystem design in Albuquerque.

State Content Standards and Benchmarks

State Content Standards for public education in New Mexico are determined by the New Mexico Department of Education. These standards are based on national standards determined by the United States Department of Education. Educational Content Standards describe what students should know and be able to do at certain grade levels. Benchmarks are the tasks that students must perform in order to demonstrate mastery of the standard, and are also specific to grade level. Schools are required to teach to these standards, which are measured through the process of mandatory standardized testing. These standards help the state measure and compare achievement in schools, allowing for the enforcement of accountability. For kindergarten and first grade, educational content standards are set in the areas of mathematics, science, language arts, health education, and social studies. This study highlights specific benchmarks that can be taught with the design and use of an edible school garden. For a detailed listing of New Mexico State Content Standards and Benchmarks, reference Appendix B.

Survivability

"Survivability" is a term that is useful in providing an alternative to the idea of sustainability. In his chapter on "Landscape and Survival" in *Canyon Gardens*, V.B. Price states that certain interpretations of sustainability, particularly in terms of sustainable development, suggest "a negative stasis or finding ways to make the natural world conform to a static pattern of human action that is, itself, not adaptable" (Price and Morrow, 2006, p. 178). In this case, the use of the term "sustainability" does not increase awareness of interconnectedness, but instead reinforces the idea that we can live outside of natural systems, if only we make use of resources in the correct way.

Instead, Price suggests "survivability" as an alternative approach. Price (2006) looks to the example of the Pueblo people of the Southwest United States as a source for the term: "It is the norm for Pueblo people, not the exception, to consider their surroundings as part of themselves. Their survival has depended on it" (p. 173). Survivability requires keen knowledge of place through direct experience with it. According to Price (2006), "survivability stresses agility, mutability, and a flexible response to the demands of necessity dictated by natural conditions" (p. 178). It requires that we follow Alexander Pope's advice to pay attention to the genius of place, to understand the instructional ability of landscape (Price, 2006). Based on observations of Ancestral Puebloan survival strategies, Price gives the following principles for survivability in the Southwest:

1. **Sunlight:** Orient structures to the southeast.
2. **Site Protection:** Protect against cold and wind.
3. **Redundancy:** Reinforce vulnerable connections in structures and agriculture.
4. **Encircle:** Cluster and encircle for social connections and safety.
5. **Landscape as Guide:** Site analysis for understanding what and where to build.
6. **Waste Not Water**
7. **Don't create blockages:** Retain, recycle, allow for flow.
8. **Culture and Landscape reinforce and reflect each other:** Humanity is synonymous with nature.

Survivability is a key term to this report because it emphasizes the importance of paying attention to, and learning from place.

Sustainability

"Sustainability" is a term that has gained remarkable popularity and frequent use without clear definition. Sustainability has numerous definitions, many of them unclear. Because it is a practice that is understood as an objective for ecoliteracy and ecological design, it is necessary to discuss a workable definition.

The most widely used definition, "meeting the needs of today's population without diminishing the ability of future populations to meet their needs," comes from the Brundtland Report, also known as *Our Common Future* (Brundtland, 1987). This broad definition brings up several pertinent questions regarding whose needs will be met and the difference between needs and desires. These are very

worthwhile questions that highlight the importance of values in defining sustainability. Thompson and Sorvig (2000) acknowledge the challenges of defining sustainability and suggest the definition of "living within our ecological means" (p. 2). This last, simple definition is workable within the scope of this study because it places humans within our ecological community, suggesting that in order to strive for sustainability, we must view ourselves as part of larger natural and cultural ecosystems. If sustainability means long term human survival as part of these systems and our ability to fluctuate and adapt with them, then education for ecoliteracy is a vital measure toward this goal.

Literature Review

Introduction

Edible school gardens have the potential to be much more than "seeds to harvest," or an instructional extra for enthusiastic teachers. An edible garden in the school can represent a microcosm of the larger schoolyard ecosystem and surrounding nested and interrelated systems. Like the self-similar parts of fractal geometry, the edible school garden demonstrates all of the organizing principles of ecology on a smaller scale than its surrounding systems, yet connects to these systems at the same time. The edible garden can provide a limitless amount of hands-on, place-based activities that connect students (and the school community) directly to their environment, revealing interconnections to larger processes and teaching life lessons on multiple scales. In order to understand how an edible school garden can fit into, reveal, and strengthen awareness of and participation in these larger, surrounding ecosystems, it is necessary to discuss recent theory explaining ecosystem concepts, and their significance for the fields of education and design. This review of literature will also examine the history of edible school gardens in America to show how the need for them, and therefore their function, has changed with the dominant worldview. Finally, an investigation of existing integrated edible school gardens and studies that explain the results of these programs will be used to determine a basic framework of components for successful edible school garden design.

Paradigm Shift:
A World Composed of Systems, Processes, and Potentials

While conventional ideas of design describe the designer as a form-maker, ideas of design are expanding to identify designers as place-shapers, educators, and facilitators of process. This broader, more complete understanding of the designer's role can be related to a current paradigm shift and provides the groundwork for the argument of landscape architects as active community builders. Quantum science, with its emphasis on relationships, instead of objects, is a major source of this shift and an origin for new metaphors that could

Fractal Geometry in the Branches of a Fern

fundamentally change the way we go about constructing our world.

In his book *Scientific Revolutions*, Thomas Kuhn first described a "paradigm shift" as the process of how new scientific discoveries fundamentally change cultural worldviews. Thering and Doble (2000) present a feedback loop model for understanding the connectivity between science, worldviews, values, goals, and behavior (Fig. 3).

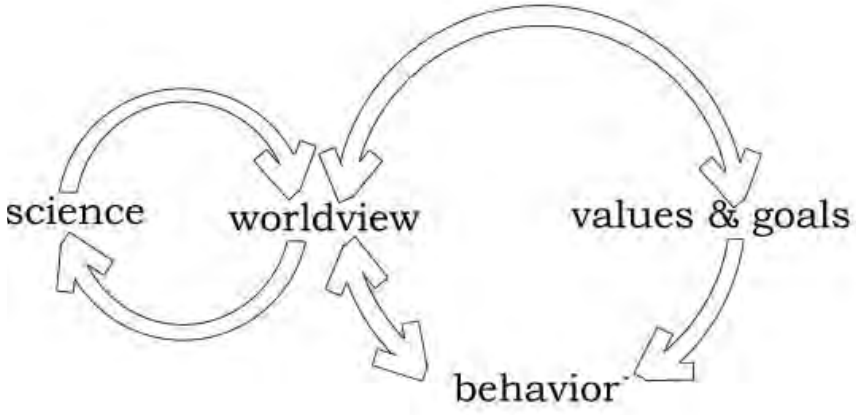


Fig. 3. Paradigm Dynamics
(Thering and Doble, 2000, p. 192)

The authors explain, "The model illustrates how shifts in a society's understanding of structure and function of the natural world, its science, changes that society's understanding of the structure and function of the social world, its worldview" (Thering and Doble, 2000, p. 192). Worldview shapes the values and goals that inform the structure of a society, including its science, technology, economy, infrastructure, politics and education. The diagram also shows how values and goals affect behavior, which, in turn, feeds back into the reconstruction of worldview and new science.

The presiding dominant Western worldview stems from a machine model of science, based on Cartesian and Newtonian science (Wheatley, 1992). Under this worldview, which provided the driving logic behind the Industrial Revolution and subsequent technological and cultural institutions, the world is created of parts that can be dissected and reconstructed. By understanding the parts, one can understand the whole. The materialism and reductionism that characterize this model of science have also characterized almost everything in the Western world in the past three centuries (Wheatley, 1992). This fragmentation has caused a rift in the awareness and understanding of human relationships with their environment. Several aspects of the cultural and built environment reflect this ideology, which is often cited as a root cause of current human-related environmental problems (Orr, 1989).

Early in the twentieth century, explorations into the subatomic

Complexity in Branching Patterns

world began, bringing quantum science into our vocabulary and understanding. New scientific theories currently reshaping our worldview come from the disciplines of physics, biology, and chemistry. Quantum mechanics presents an entirely different picture of the world; not of things, but of patterns of active relationships, particles that shift from waves to mass to energy in response to each other and the environment (Wheatley, 1992). The machine metaphor is no longer relevant in a reality that is made up of relationships, interactions, self-organizing networks, patterns, and constant change. Instead, we now have the opportunity to weave a new worldview based, as Gregory Bateson (1980) suggests, on "the pattern that connects." With this new worldview, "there is no objective reality out there waiting to reveal its secrets. There are no recipes or formulae, no checklists or advice that describe 'reality.' There is only what we create through our engagement with others and with events" (Wheatley, 1992, p. 7). Quantum science tells us what we already know based on our everyday experiences; humans are constantly interacting with their environments, shedding cells, taking in elements to create new cells, breathing, conversing, assimilating information, adapting existing knowledge, and creating new understanding.

Quantum reality and its significance for human-environment relationships bears a striking resemblance to worldviews held by Pueblo cultures in the American Southwest. Swentzell (in Price and Morrow, 2007) describes the philosophy of the Tewa pueblo, Santa Clara, where she was born and raised: "Ideas that characterize the Pueblo human-made and natural environments, then, are that humans and nature are inseparable, that human environments emulate and reflect the cosmos, that creative energy flows through the natural environment (of which every aspect, including rocks, trees, clouds, and people, is alive) and that aesthetics and the cosmos are synonymous" (p. 127). Swentzell's explanation describes the importance of a prevailing worldview on that society's definitions of culture and nature, and the consequent design of social institutions and constructed environments.

Fig. 4 outlines the characteristics of paradigm dynamics in relation to the current shift from an Industrial paradigm to one of ecoliteracy and the associated behaviors in terms

Paradigm	Science	Worldview	Values & Goals	Behaviors
Industrial	Newtonian Machine Model	Hierarchical Global Order	Technological and Economic Progress	Business: Rational, Systematic, Elite-driven, Accountability-driven Education: Knowledge broken down in disciplines, Factory Model, Accountability-driven Design: Form-making, Modernism
Ecoliteracy	Quantum Complexity Ecology	Webs, Networks, Relationships	Sustainability, Cooperation, Stewardship	Business: Participative, Open, Adaptive Education: Interdisciplinary, Place-based, Community Partnerships Design: Participatory, Process-driven, Flexible

Fig. 4. Shifting Paradigms in Western Thought
(Adapted From Thering and Doble, 2000, p. 193)

of business organizations, educational institutions, and the role of designers.

As Fig. 4 demonstrates, the machine model of science supported the Industrial Era, and a worldview of a global hierarchical order. The resulting prevalent values and goals were oriented toward the rational and systematic achievement of technological and economic progress. These values and goals are apparent in the prevailing practices of business, education, and design of the time. The Industrial Era business model is driven from the top down by accountability and efficiency, relying on categorization, mechanization, and standardization. These behaviors are reflected in the organization of public educational institutions that effectively sort students with standardized testing in discrete subject areas. Prominent design theory and practice mirrored these behaviors with the simple, organized, and controlled modernist logic of form-making. However, many designers in the twentieth century, including those with a modernist philosophy, noticed the need to design with and for interconnections. Examples most notably include the work of Frank Lloyd Wright and Ian McHarg. The work of these designers shows how art and design can also influence a shift in worldview.

With new understandings in the areas of quantum science, complexity, and ecology, the shift to an era of ecoliteracy is underway. This science gives us a worldview of networks, interconnections, and relationships. *With a new focus on relationships instead of things*, we are beginning to value the ideals of ecological sustainability, cooperation, and stewardship for our home. Business models are adapting to this new understanding by implementing a participative, open, and adaptive model that takes ecological systems into consideration with the bottom line (Wheatley, 1992 and McDonough and Braungart, 2002). Likewise, in education we are beginning to see more emphasis on interdisciplinary curriculum models, place-based instruction, and community partnerships. Finally, these values and goals are noticeable in the design world's shift toward process-driven, participatory design that is attuned to natural systems. These ideological transformations in major societal institutions stem from new scientific understanding and work toward the goal of ecoliteracy.

Entering the Era of Ecoliteracy

Ecoliteracy is a term used frequently by several authors and leaders in the environmental education community, most notably by Fritjof Capra, cofounder of the Center for Ecoliteracy in Berkeley, California and by David Orr, the Paul Sears Distinguished Professor of Environmental Studies and Politics at Oberlin College. Orr formally introduced the term "ecological literacy" in his book *Ecological Literacy: Education and the Transition to a Postmodern World* in 1992. In this book, Orr presents the notion that "all education is environmental," a concept that both supports the work of educational theorists Jean Piaget and Lev Vygotsksy and appeals to our common sense. Orr defines ecological literacy broadly as "a quality of mind that seeks out connections" (Orr, 1989, p. 51). According to Orr, this quality of mind is derived from the comprehension of the interconnectedness of life, rooted in a sound knowledge of natural history, ecology, and thermodynamics. This comprehension must include understanding of how people and societies have become destructive of the natural world. According to Orr (1989), a program that supports ecological literacy does the following:

1. Recognizes and addresses the importance of the educational environment. Students' understanding of their relationship with their environment and each other is dependent on educational context. In addition to the physical surroundings, educational methods and interactions are a key part of the environment.
2. Employs a curriculum that is project-based, interdisciplinary, and integrated with the educational environment.
3. Emphasizes the study of place as a fundamental organizing concept for education. Students are encouraged to engage in a dialogue with place.
4. Gives students the opportunity to have direct experience with the natural world, whatever local form it takes.

Capra's definition of ecoliteracy is for the most part synonymous with Orr's, but provides a more detailed description of how ecoliteracy is practiced. Capra (1999) defines ecoliteracy in three parts. First, it requires knowledge of the principles of ecology. These principles of ecology, as defined by Capra are:

1. Ecosystems generate no waste.
2. Matter cycles continuously through the web of life.
3. The energy driving these cycles comes from the sun.
4. Diversity and redundancy assure resilience.
5. Life is formed not by combat, but through cooperation, partnerships, and networking.

Second, students must be proficient in systems thinking, or thinking in terms of relationships, connections, and context. Systems thinking is based on the idea that living systems share a set of common properties and principles of organization. These principles are as follows:

1. **Relationships**: An ecosystem is an interdependent community with many relationships. Mapping these relationships leads to patterns.
2. **Form and Pattern:** Form describes patterns, shifting our understanding of the world from one of objects to relationships.
3. **Networks:** Networks describe the pattern of life, which is nonlinear. Through cycles and feedback loops, ecosystems fix mistakes and adapt.
4. **Self Organization:** Ecosystems organize themselves, producing no waste and relying on partnership for survival.
5. **Flexibility and Diversity:** Ecosystems are flexible, continuously fluctuating, finding balance after disturbance. If a major disturbance eliminates a connection in the web, diversity allows for continuity.

(Capra, 1999).

The third, and possibly most important component of Capra's ecoliteracy is that students embody these organizing principles and apply them in the form of ecological values in the daily life of their community. As a result, a successful ecoliteracy program will truly prepare students to be active and beneficial members in their community/ecosystem. Like Orr, Capra asserts that students

gain this understanding through experience in nature and the acquisition of a sense of place, such as occurs through experience with an edible school garden. Instructors serve as facilitators, guiding children in a search for patterns and meaning through a project-based, interdisciplinary curriculum.

Place-Based Education: Learning Ecoliteracy

Place-based education is a method for achieving student and community ecoliteracy, as outlined by David Sobel in his book, *Place-Based Education*. Sobel (2005) defines this method as "the process of using the local community and environment as a starting point to teach concepts in language arts, mathematics, and other subjects across the curriculum" (p. 7). Using this method, students observe how landscape, community infrastructure (local food, water, waste, and energy systems), and cultural traditions all interact and shape each other.

School curriculum derives directly from the surrounding environment, which serves as an integrating context for all subject areas. The school's surroundings and community provide the framework within which students can construct their own learning, guided by teachers and administrators using proven educational

Picking the Perfect Pumpkin,
Monte Vista Elementary School Garden, Goleta, California

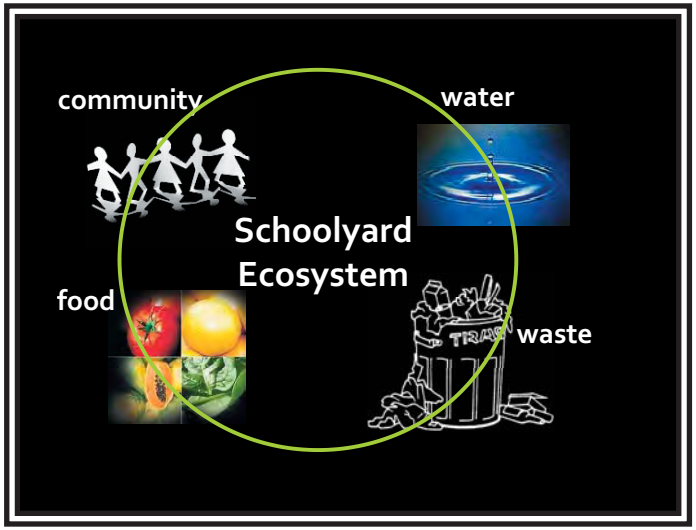


Fig. 5. Sustainability in the Schoolyard

practices (Lieberman and Hoody, 1998). Place-based education is also developmentally appropriate for elementary school age children, according to Piaget's Cognitive Theory. Children at this age are in a period of "concrete operational" cognitive development, in which they think logically about concrete and real features of their world (Berger, 2000). Hands-on, project-based learning within the available, surrounding world enables students to think abstractly in following years. In addition, this kind of learning allows students to see the impact of their actions on their surroundings, to know that their actions matter, thus increasing their commitment to be active, contributing community members (Sobel, 2005). Because each school environment is different, it is up to each school community to design its own program to best fit that particular place.

Based on his experience with community building with place-based education in East Coast schools, Sobel (2005) describes four essential elements for developing a place-based educational program.

1. **Curriculum integration:** Classroom, school, and community environments are integrated into an interdisciplinary curriculum.
2. **School Enhancement:** A healthy school allows the learning environment to extend from classroom to community,

providing limitless educational opportunities.

3. **Community-Based Education:** Maximize leadership through partnership. Successful programs usually involve partnerships between school districts, community organizations, local businesses, and higher educational institutions.
4. **School Sustainability:** View the entire school as a system, full of smaller sub-systems and interconnected with larger surrounding systems. Create a true school ecosystem in which food is produced and prepared, energy and water are conserved and recycled, and waste is reduced, reused, or recycled (Fig. 5).

These elements, in combination with the guidance provided by Orr and Capra's definitions of ecoliteracy, provide the basis of a framework for developing methods of successful school ecosystem design and for understanding how edible school gardens reinforce and unify that design. This study will use the terms "place-based education" and "education for ecoliteracy" interchangeably.

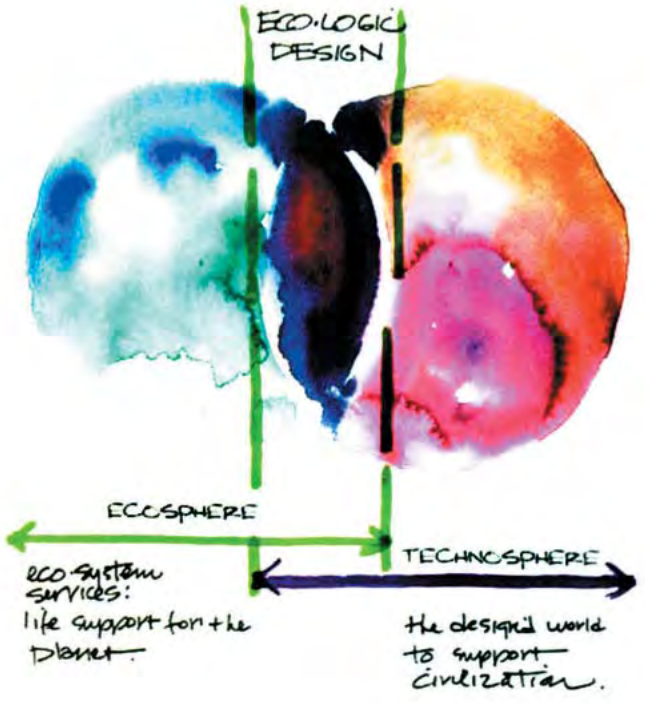
Ecoliteracy in Landscape Architecture

Although many do not see themselves as such, landscape architects are educators. Through their relationships with clients, landscape architects have the opportunity to increase awareness of how people are connected to their surroundings, and the chance to share information about the characteristics, function, and impacts of particular methods and materials. The design of the world around us is a powerful educational tool that greatly influences the changing shape of our culture. Corner (1999) asserts, "landscape architecture is not simply a reflection of culture but more an active instrument in the shaping of modern culture" (p. 1). If, like Corner, we begin to see landscape architects not as object makers but as choreographers of cultural and natural systems, processes, and relationships, then it is clear how landscape architecture can and should further the goal of ecoliteracy. This view of landscape architects allows us to see how both designers and teachers are facilitators of cultural processes. Orr (1992) concisely describes the relationship between landscape architecture and education; "Landscape shapes mindscape… Knowledge of place is intertwined with knowledge of who you are" (p. 130).

Using a process of "ecological design" is a way for landscape architects to design for ecoliteracy. In their book *Ecological Design*, Van der Ryn and Cowan (1995) define ecological design as "any form of design that minimizes environmentally destructive impacts by integrating itself with living processes" (p. 18). The authors argue that design has played a central role in the current environmental crisis, and therefore rethinking the practice of design can play a significant part in creating positive change. The four main tenets of ecological design are:

1. Solutions grow from place.
2. Make nature visible.
3. Ecological accounting informs design.
4. Everyone is a designer.

(Van der Ryn, 2005, p. 77)



Ecological Design: Merging Ecology and Technology (Van der Ryn, 2005, p. 143)

Using these guiding principles, designers have a foundation upon which to exercise their responsibility to wisely merge the ecosphere and technosphere in ways that support the networks of nature and culture (Van der Ryn, 2005). Comparing these principles to those of ecoliteracy reveals several important similarities. Ecological design works toward the goal of ecoliteracy by emphasizing the importance of place, knowledge of and cooperation with natural systems, and hands-on interaction with the surrounding environment. Like Capra, Van der Ryn and Cowan (1995) advocate systems thinking as a way to frame our ways of being and acting in the world.

Orr (2007) argues that designers must begin to see themselves as designers of systems. A good deal of recent landscape architectural theory, particularly in the areas of sustainable design and landscape urbanism, support this claim (Lyle, 1985). In his argument for landscape urbanism, Corner (2006) argues for a shift in the landscape designer's view to understand that processes (how things work in space and time) shape our constructed environments. In order to do this, Corner suggests thinking of constructed human environments as ecological systems, with complex interactions and conditions, in which dynamic relationships create form. This argument allows us to begin to see the potential for landscape architects to design school environments as natural and cultural ecosystems that connect and flow across multiple scales while allowing for flexibility and adaptation over time.

A Brief History: Edible School Gardens in the United States

Edible school gardens are a little known part of landscape architectural history in the United States. Despite their absence in most history books, the role these gardens played during the early twentieth century in America provides a valuable model for understanding their potential to reflect and change the dominant worldview and resulting values, goals, and behaviors today.

Designed gardens and excursions into the natural landscape were important educational components of the original kindergartens started by Freidrich Frobel in early nineteenth century Germany (Herrington, 2001). Frobel, a quintessential romantic thinker, based his kindergartens on the idea that experience with nature would reveal a child's divine essence. In early twentieth century Industrial America, this pedagogy was translated for American schools through a lens of rationalist thought, concerns about a growing unskilled immigrant population, and the need to address a polluted and unhealthy urban environment. As a result, edible school gardens were mainly seen as vehicles for economic profit, patriotic training, city greening, and cultural assimilation. In these gardens, the natural world was dissected and consumed in an orderly, garden-shaped package (Herrington, 2001).

The early history of school gardens in the United States (from 1891-1920) establishes school gardens as an important national phenomenon, part of early educational reform, the Back to Nature Movement, and the Progressive governance (Trelstad, 1997). Reformers such as Fannie Griscom Parsons and her son Henry initiated a number of these efforts, which eventually grew into a few national organizations that promoted urban school gardens. By 1915, three separate bureaus of the Federal Government provided funds and support for these programs (Trelstad, 1997). Edible school gardens were located in the middle of America's biggest cities and were cultivated by students under the supervision of teachers or garden directors. Instructors used the edible school garden to give children experience in nature, to green the growing industrial city, to Americanize immigrants, and to instill the ethics of hard work and patriotism. Children could take the harvest home for their family to eat, or they could sell the produce for profit. These programs provide an important example of how school garden pedagogy can reflect and reinforce broader views held by society (Herrington, 2001).

The push for widespread edible school garden programs in America came from the Nature Study Movement, made up of a group of educators whose goal was to make learning more interactive through the use of nature in the classroom (Trelstad, 1997). This goal grew from the practical need for children to stay on the farm. Consistent with John Dewey's assertion that nature study should connect students with their environments, the Nature Study Movement anticipated that children's direct exploration of nature would foster further curiosity and sympathy for natural surroundings. Lacking the romantic view held by Frobel, the Nature Study Movement focused more on children's rational study of botany and biology. Edible school garden programs were also supported

by several organizations including those supporting civic reform, educational reform, planning, and the early conservation movement. Like other city greening projects, the gardens provided both physical and emotional relief from the industrial city. The edible school gardens had the capacity to alleviate health problems caused by living in an industrial slum and empowered the urban poor by providing an opportunity for them to transform their immediate surroundings. However, the industrial worldview of hierarchical order was clearly represented in the belief that these edible school gardens also provided an "orderliness and cleanliness that would soon assert its supremacy over disorder, dirt, and debris" (Bachert, 1977, p. 58).

In 1917, the United States School Garden Army was created to help provide food for the war effort. At this time, over sixty thousand acres were converted to productive land, and government support was at an all-time high (Trelstad, 1997). In addition to school-run efforts, "victory gardens" were also growing in popularity. These edible gardens were mostly planted at residences and were intended to reduced the pressure on food supply during both World War I and II. Victory gardens also served as morale boosters, giving people a sense of control and empowerment during wartime (Victory Seed Company, 2008).

At the end of World War I, the School Garden Army was shut down, funding disappeared and the resultant school gardens vanished with it. Trelstad (1997) suggests that several other factors, including general improvements in city conditions, decreased need to assimilate immigrant children, expansion of cities into suburbs, increased appreciation for private home gardens, and a lack of trained garden educators contributed to the gardens' disappearance. While many civic groups supported edible school gardens, none fully embraced them as part of their agendas. Landscape architecture, a burgeoning profession at the time, also supported the gardens, but did not yet fully understand their educational and cultural benefits (Trelstad, 1997). Teachers began to worry about the unsightly nature of untended garden areas and expressed preference for the easier maintenance and tidy appearance of turf grass (Bishop, 1912).

During World War II, several public park areas such as Golden Gate Park in San Francisco, Riverside in New York City, and the Back Bay Fens in Massachusetts were plowed for public garden plots. The Fenway Victory Gardens, still in existence today, are the last remaining example of these gardens (Fenway Victory Gardens, 2008). While not directly associated with edible school gardens, the victory gardens represent a similar core impulse: raising edible crops in a public space for the collective good of the community.

An additional educational movement that developed in the early twentieth century is also worth mentioning. From 1905 to 1914, 4-H Clubs had been established in nearly every state in the U.S. (National 4-H Council, 2008). 4-H clubs emphasized the importance of practical skills such as growing, cooking, and preserving food, sewing, and raising livestock. Current 4-H clubs have redirected their main goals from simply teaching agricultural technologies toward developing personal growth, citizenship, and leadership skills in their members (National 4-H Council, 2008). These clubs continue to be popular across the nation, but are separate from school activities and daily curriculum, and are viewed as a kind of vocational education.

Vocational education is related to the age-old tradition of learning through apprenticeship and focuses more on mastery of practical skills instead of theory or conceptual learning. Up until the end of the twentieth century, vocational education focused on specific trades such as an automobile mechanic or welder (National Center for Education Statistics, 2000). Historically, vocational education was included in middle schools and high schools in the form of home economics and wood shop. However, the recent emphasis on school accountability and meeting state educational content standards has placed more importance on academics. The result has been reduced funding for these classes, and subsequent disappearance from many schools. Vocational education has been viewed, in the past, as a separate and alternative educational path. Currently, a national effort is being made to integrate academics into vocational education in order to more adequately prepare students for employment (National Center for Education Statistics, 2000). Perhaps vocational education should be given the same weight for improving academic learning in public schools.

The brief history of edible school gardens in early twentieth century America demonstrates how an edible school garden can reflect the dominant worldview. Not only were the gardens used to

educate children about the machine model of science, they appeased the desire for order and met goals of technological and economic progress. Perhaps a major reason for the decline of these gardens was that they were not viewed as a critical part of many larger natural and cultural systems. Additionally, if the practical knowledge gained from the organizationally distinct 4-H clubs and vocational education had been integrated more into the goals for public education instead of being viewed as separate, we might see a very different educational system today. The incorporation of hands-on, real world education with academics is needed in today's schools as well as the kind of cooperation and community partnership exercised in the cultivation of victory gardens. As the industrial worldview shifts to one of ecological literacy, we can see again a rise in the need for and popularity of edible school gardens.

Harvesting Corn, Merriewood Children's Center Garden Lafayette, California.

Edible School Gardens in America Today: A Response to the Industrial Era Worldview

The school garden movement has recently gained significant popularity and momentum in several regions across America. Today, edible school gardens are addressing very different needs than those presented during the Industrial Revolution. These gardens are supporting a particular kind of environmental education that is based on learning from place, using hands-on methods, and emphasizing interconnections and relationships (Sobel, 2005). It could be argued that a great deal of the need for place-based education in edible school gardens comes from problematic behavior caused by the reductionist industrial worldview (Bowers, 1995). Place-based education in an edible school garden addresses the following problematic Industrial Era values, goals, and behaviors:

1. **The separation of humans from their environments**
2. **The factory model of education**
3. **The separation of knowledge into individual disciplines**
4. **Elite-driven organizations**
5. **Short term goals for economic and technological progress**

Edible school gardens today are responding to these problematic values, goals, and behaviors in the following ways:

1. **Edible school gardens connect people with their environments.**

The mechanistic view of the industrial paradigm considers humans as separate from their environments, or more specifically, nature. It is a common assertion that this misunderstanding is a root cause for unsustainable human behavior and the resulting environmental problems, including global climate change, loss of arable land, air and water contamination, deforestation, and loss of biodiversity (Saul, 2000). First and foremost, education for ecoliteracy addresses these concerns by giving students the ability to use systems thinking, understand their interconnections with their environments, and experience the consequences of their actions, thus preparing the world's future leaders to deal effectively with the above named issues (Orr, 1994).

Rain Gauge, Monte Vista Elementary School Garden, Goleta, California

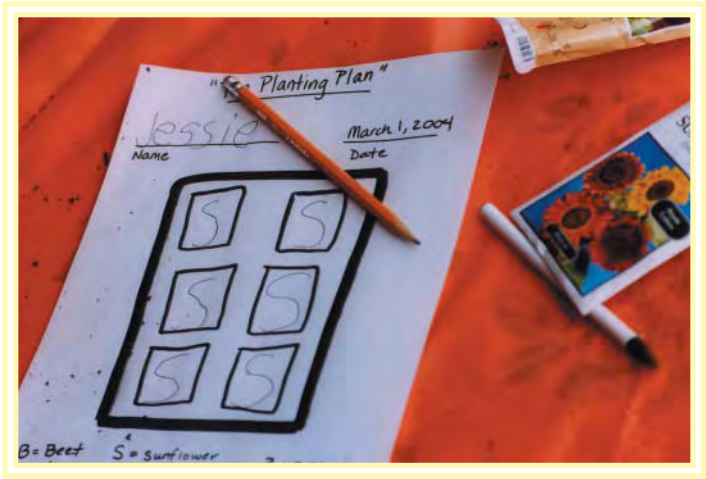
Edible school gardens, as part of a larger school ecosystem, including place-based curriculum, also address the rising concern about American children's decreasing experience in nature. Louv (2005) explains, "Children need nature for the healthy development of their senses, and therefore, for learning and creativity" (p. 54). While not in accordance with a definition of 'wild' nature, the edible school garden experience provides young children with an accessible and safe introduction to many natural ecosystems within the garden. Children connect directly with the plants, animals, and non-living elements of the garden by designing, planting, tending, playing in, observing, harvesting and eating.

Professor Robin Moore asserts that sensory interaction with nature is what truly connects children with their environment; "Children live through their senses. Sensory experiences link the child's exterior world with their interior, hidden, affective world" (quoted in Louv, 2005). Because the natural world is a principal source of sensory stimulation, children need the chance to explore, learn, and play in a natural environment in order to develop in a healthy manner. In addition to connecting personally with the edible garden, children can also discover their connections to larger cultural and infrastructural systems if the design of the edible garden reveals local water and waste (compost and recycling) systems. This, in effect, reveals connections for the students outside of school as well.

2. **Edible school gardens support place-based, student-centered education.**

Holt (2007) calls the factory model of education "fast school," and compares it to fast food, driven by tests and targets to produce standardized products. The factory model of education, characterized by standardized curriculum and testing and performance standards, focuses more on product than process. The result, according to Holt (2007) is standardized students who are bored with school and unprepared for the real world, parents who are alienated from their child's educational experience, and teachers who are demoralized and exhausted. The problem with the factory model of education is, of course, that students are not products. As Holt explains, "manufacturing high standard products is a technical problem, while

Waiting to Harvest Wheat, Monte Vista Elementary School Garden, Goleta, California.



Student Planting Plan, Monte Vista Elementary, Goleta, California

educating students is moral" (p.2).

The most recent call for school accountability, in the form of the No Child Left Behind Act of 2001 (NCLB), has increased the importance of standardized testing and put pressure on teachers to educate for these tests. As a result, funding for environmental education programs (which are often seen as an extra instead of integrative) has been dramatically reduced (Chesapeake Bay Foundation, 2007). The No Child Left Inside Act of 2007, written by Congressman John Sarbanes of Maryland and Senator Jack Reed of Rhode Island, is a response to this concern. If the act passes, it would provide Federal funding for edible school gardens as part of educational programs for ecoliteracy. Additionally, environmental educators have responded to the NCLB by conducting studies to show how interdisciplinary, hands-on lessons actually increase students' scores on standardized tests, particularly in math and reading (Glenn, 2000 and Lieberman and Hoody, 1998). Perhaps the next step for schools, as they continue to move away from the factory model of education, is to find a system for building accountability into the process of curriculum (Holt, 2007). Integrated curriculum associated with edible school gardens is inherently place-specific and aids a system of portfolio assessment, which would further this goal.

3. Edible school gardens are an integrating context for all disciplines.

Edible school gardens provide an integrating context and are a wellspring for interdisciplinary lessons that meet educational content standards in a meaningful way. As many educators from Socrates forward have understood, the goal of education is not mastery of distinct disciplines, but mastery of one's self (Center for Ecoliteracy, 1999). The separation of disciplines, while helpful for increasing specialization, can be problematic for students trying to find connections between their education and their reality. Hands-on, project based, interdisciplinary education has been shown to be highly effective in improving critical thinking skills, increasing test scores, and increasing student enthusiasm for learning (Lieberman and Hoody, 1998). Children become active participants, fully engaging with their environment. Pranis and Ocone (1990) explain that in the garden, "children are observers, questioners, doers, and problem solvers" (p. 3). The processes and flows made visible by an edible school garden merge disciplines and connect educational process and content to reality on multiple levels. Orr (1992) explains, "the study of resource flows transcends disciplinary boundaries; it connects the foreground of experience with the background of larger issues and more distant places; and it joins empirical research on existing behavior and its consequences with the study of other and more desirable possibilities" (p. 105). Not only does time in the edible school garden give children the knowledge and skills to make connections, it gives them the hope and ability to act for a better world.

4. **Edible school gardens require grassroots community support and participation, as well as partnerships on multiple levels.**

Edible school gardens turn the notion of elite-driven organizations upside down, because they most often emerge from grassroots community efforts, strengthening partnerships and cooperation between school and community. As with the urban poor who cultivated edible gardens during the Industrial Revolution, people today are finding empowerment in their ability to reshape their surroundings to better suit the physical and emotional needs of their community (Orr, 1994). The edible school garden is an expression of community values and a source of pride. Almost any successful edible school garden project is most likely the result of many partnerships

between students, teachers, administrators, parents, community members, local organizations, and businesses (Sobel, 2005). While it is clear that administrative and institutional support is needed for successful edible school garden projects, continued community support from the ground up is also essential to establish and maintain a school garden (Johnson and Bjornson, 2005).

5. Edible school gardens teach a "long view", supporting sustainability for future generations.

Experience with an edible school garden instills an ethic of hard work and patience, providing a "long view" for progress, and suggesting that process itself can be a reward (Pranis and Ocone, 1990). Students are encouraged by this understanding that hard work can produce concrete and enjoyable results, even if they have to wait several weeks before eating their crop. The edible school garden brings up issues of sustainable agriculture, biodiversity, and organic farming methods. As caretakers of the garden, students learn about their role as stewards and ability to promote longevity of the living things and connected systems in the garden as well as continuation of the garden experience for future students. As Alice Waters explains, gardens, "teach redemption through a deep appreciation for the real, the authentic, and the lasting" (quoted in Center for Ecoliteracy, 1999). Edible school gardens instill an environmental ethic, one that questions short term economic and technological gain, and searches for the best long-term solutions.

Children's Seedlings, Monte Vista Elementary, Goleta, CA

Exemplary Edible School Gardens

Edible school gardens, as part of programs for ecoliteracy, are becoming ever more popular and widespread across the nation. In particular, California is leading the movement with legislation for "A Garden in Every School" (California Department of Education, 1991). Currently, about 40% of California's schools have edible gardens (Kawamura, 2007). The success of edible garden programs has spurred the government in California to make them a priority, providing funding for teacher training and in the form of grants. In many other states, including Illinois, Texas, Massachusetts, Michigan, and Vermont, edible school gardens are growing as central features for healthy schoolyards and interdisciplinary curricula. Reviewing these examples of edible school gardens is inspiring and educational, but there are too many to name for the purposes of this study.

Two exemplary programs, however, model full integration of an edible school garden into the larger school ecosystem and surrounding community. These examples are worth studying in depth in order to gain an understanding of what elements make up a successful edible school garden, as well as the impact an integrated program has on students and surrounding community. The first example, the Edible Schoolyard at Martin Luther King Jr. Middle School in Berkeley, California, models the integration of food systems into all daily activities of students and staff at the school. The second program, Common Roots, has been implemented in several schools in Vermont, and addresses the different kinds of education an edible school garden can support for grades K-6. The Edible Schoolyard represents an integrated edible school garden in an urban and racially diverse context, while the Common Roots program is located in a rural setting with a predominantly white population.

Exemplary Program 1: The Edible Schoolyard, Berkeley, CA

Context

Located in downtown Berkeley, California, Martin Luther King Jr. Middle School represents diverse demographics typical in Berkeley public schools, with over 900 students in 6th, 7th, and 8th grades. 37%

are White, 36% African American, 16% Latino, and 10% are Asian American. 12% of these students speak English as a second language and almost 30% qualify for the free lunch program.

History

In 1994, principal Neil Smith initiated the program with a phone call to Alice Waters, chef and founder of Berkeley's world-renowned Chez Panisse restaurant. Principal Smith had heard a radio interview in which Waters expressed her dismay at the dirty, graffiti-stained, shabby state of King Middle School. Waters agreed to meet with Principal Smith, and as she toured the campus she began to formulate a plan for an entirely new ecological curriculum – an edible school garden linked with a school lunch program (Center for Ecoliteracy, 1993).

Principal Smith recognized that it was important to take the program one step at a time, and it developed slowly. He thought the garden was a good place to start, because he knew the community would get behind it. After the garden was successfully integrated into the curriculum, they could move on to the school lunch program. The school held a design charette in March of 1995. Local landscape architects, teachers, restaurateurs, food growers, and others attended (Center for Ecoliteracy, 1999). The charette determined the location for the garden. That December, the school invited the community to a planting celebration with Aztec dancers and drumming. The seeds planted were primarily fava beans and other cover crops to cleanse and amend the soil.

At this point, the Center for Ecoliteracy (CEL) awarded the Edible Schoolyard a grant that made it possible to hire program staff. CEL has remained a major supporter ever since, as the groundwork for the integration of garden, kitchen, and curriculum is outlined in cofounder Fritjof Capra's definition of ecoliteracy. Capra recognized the value of the edible school garden immediately:

"Gardens and food systems were an ideal project for CEL. We realized that students can learn the facts without that affecting their lives. You need to instill a certain passion for nature. You can't do that in the classroom alone. By growing and eating vegetables, they learn to see themselves as part of natural cycles. Our health depends on the health of our food, which depends on the health of the soil. Children learn that we are embedded in the soil. They see that we are not apart from nature, but a part of it, and that therefore we must play our part" (quoted in Stone, 2007, p. 1).

A true partnership was formed between CEL leaders, Alice Waters, and King Middle School staff, students, and community. The mission of the garden became "to create and sustain an organic garden,

Panoramic View of The Edible Schoolyard in March, 2007

Edible Schoolyard Kitchen Door

landscape, and kitchen classroom that are wholly integrated into the school's curriculum and lunch program" (Stone, 2007, p. 1). Students and community volunteers were responsible for the initial construction of the garden and its continued maintenance. Today, every student is involved in the processes of farming, harvesting, recycling waste, preparing, serving, and eating food from the Edible Schoolyard.

In 1997, the school's 1930's kitchen was renovated to become the school's new kitchen classroom, and 1999 brought plans for a new dining commons and additional garden kitchen. Parents' initial worries that the garden would take away from the "real" curriculum vanished as students raved about the garden as their favorite part of school, and attendance and grades improved (Murphy, 2003). In addition to normal school hours, the Edible Schoolyard runs summer programs and after school programs in the garden. The vision for a fully integrated garden and school lunch program has been realized, with a one- acre organic garden and kitchen where students prepare their own food.

Important Features

Several prominent features characterize the Edible Schoolyard program and foster its success. Examining these characteristics is helpful for comparing it with other programs and developing a framework for successful edible school garden design. These features are: garden pedagogy, school environment redesign, curriculum integration, and community participation.

Garden Pedagogy

At the root of this program's success is the pedagogy behind it. The goal of education is seen as developing the whole person, and the importance of the educational environment (the hidden curriculum) is recognized. Alice Waters, in her initial dismay at the run-down state of King Middle School, asked, "How can we expect kids to respect themselves, or each other, or the community at large, when they are schooled in increasingly derelict places, many of which are much, much worse than King?" (quoted in Center for Ecoliteracy, p. 12). The program fully embraces the understanding that kids learn by example and from the educational environment. Waters describes the goal of education, as embodied by the Edible Schoolyard program:

Garden Pedagogy: Philosophy of Alice Waters Posted on the Kitchen Wall

Community Participation: Seasonal Community Classes Offered at the Edible Schoolyard

Student Ownership and Pride

Outdoor Oven

Rainwater Harvesting Barrel and Student-Made Plant Identification Signs

"The aim of education is to provide children with a sense of purpose and a sense of possibility, and with skills and habits of thinking that will help them to live in the world. A key way to learn these skills and habits is to learn how to eat well and how to eat right. A curriculum designed to educate both the senses and the conscience – a curriculum based on sustainable agriculture – will teach children their moral obligation to be caretakers and stewards of the finite resources of our planet. And it will teach them the joy of the table, the pleasures of real work, and the real meaning of community" (quoted in Center for Ecoliteracy, 1999, p. 17).

Also central to the Edible Schoolyard pedagogy is the goal of ecoliteracy. The Center for Ecoliteracy assisted King Middle School in developing a framework for the program that follows Capra's guidelines for becoming ecologically literate. The program teaches the principles of ecology and applies a systems thinking approach to organization of the school, including curriculum integration and community building. Through their daily life at school, students and faculty practice these ecological values. The Edible Schoolyard pedagogy recognizes that the educational process is a cyclical process, in which everyone involved is learning (teachers, students, and community) (Capra, 2007). The garden provides a place for children and adults to work together, meaning education is not strictly controlled or formally carried out. Instead, it happens through countless interactions, observations, and experiences (Center for Ecoliteracy, 1999).

School Environment Redesign

The starting point for the Edible Schoolyard program was in the redesign of the schoolyard to include an edible garden. King Middle School Administration understood that the garden was a good way to gain community support, bring the community together, and build partnerships. Involving students in the design and construction of the garden fostered pride and ownership in the project, and subsequent enthusiasm for learning in the garden environment (Center for Ecoliteracy, 1999). In addition, the educational environment was altered further to construct a garden classroom, a new cafeteria, and a kitchen garden.

Curriculum Integration

Central to the Edible Schoolyard program is comprehensive integration of curriculum with the edible school garden. Hands-on, project based learning gives the students real experience with sustainable agricultural methods, water and waste recycling systems, and the cultural and practical lessons of cooking. At the same time, they learn math, science, language arts, social studies, health education, arts, and the interconnections between these subjects. Math lessons involve counting the number of seeds in a harvested tomato – and then the lesson is applied to the students' own lives by asking them to compute how many people those seeds could feed (Center for Ecoliteracy, 1999). A Spanish class experiments with Venezuelan cooking, speaking Spanish while cooking. In drama class, the students are given the same ingredients, and asked to 'improv' different recipes (Stone, 2007).

Community Participation

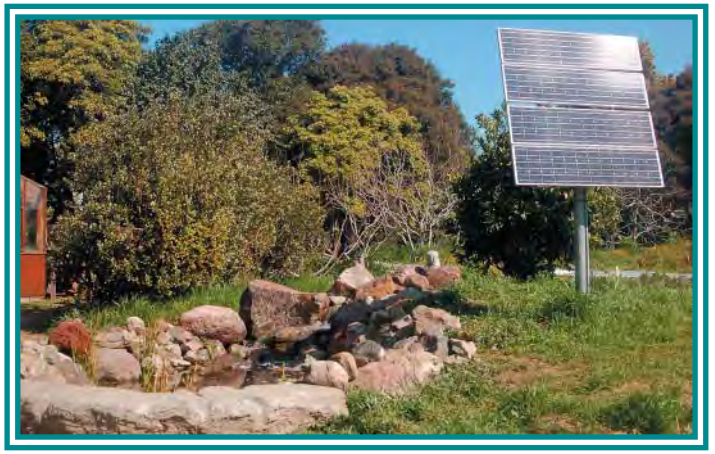
Community involvement and support is key to the success of the Edible Schoolyard. Community volunteers aid in the maintenance of the garden. The health of the soil was built (and continues to be built) by contributions of compost from the city of Berkeley's recycling program. Neighbors express their appreciation for weekend visits to stroll through the garden by donating plants and seeds. The garden is open for all to visit when school is not in session, and visitors are simply asked to respect the hard work of the students. The Edible Schoolyard is also supported by several community businesses and organizations, including Alice Waters' Chez Panisse Foundation, The Center for Ecoliteracy, Berkeley Chamber of Commerce, Berkeley Horticultural Nursery, Martin Luther King Jr. School PTA, Acme Bread Company, Smith and Hawken, and Whole Foods (to name a few).

Evaluating the Success of the Edible Schoolyard

In 2003, The Center for Ecoliteracy funded a study to evaluate the success of the Edible Schoolyard program in fostering ecoliteracy. The study conducted a series of surveys and interviews and compared King Middle School's grades, test scores, and attendance records with those of schools without edible garden/kitchen programs. The following findings were reported:

Multiple Uses: Drinking Fountain Hose Hookup

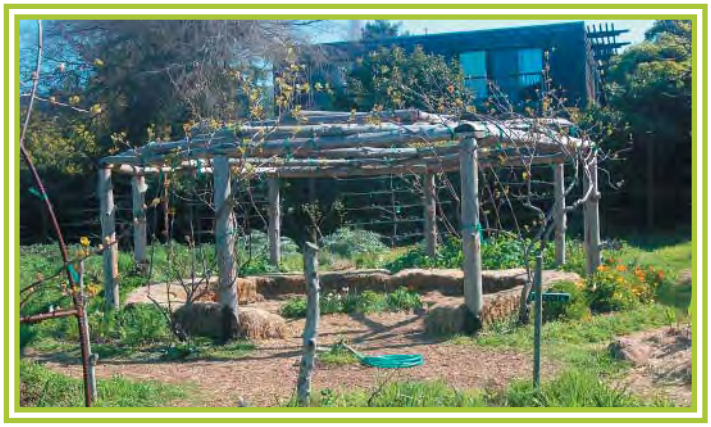
Waste Systems: Garden Produced Compost Piles



Water and Energy Systems: Solar Powered Pond

1. Students achieved an overall higher grade point average, and individual grades improved significantly in the subject areas of math and science.
2. Psychosocial adjustment improved.
3. Teachers rated the school as more conducive to learning than other schools in which they had taught.
4. Students reported an improved sense of place and understanding of sustainable agriculture.
5. Students showed a significant improvement in food choices, increasing the number of servings of fruit and vegetables in their daily diet.

Schoolyard Redesign: The New Cafeteria and Adjacent Garden Area (In Orange Fencing)



Central Gathering Area, Edible Schoolyard

Exemplary Program 2: Common Roots, Vermont

Context

The Common Roots program has been adopted in several predominantly rural Vermont schools in many different districts. At the time of this study, participating schools include Barnet Elementary, Main St. Middle School, Rumney Memorial Elementary, Duxbury Elementary, Newport Town Elementary, Orange Central, Peacham, Pomfret, Waits River Valley, Wardsboro, Warren, Wheeler School and Washington Village (Kiefer, 2008). While some differences exist, the majority of these schools have fewer than 300 students with a mostly white population. The Wheeler School, in particular, serves a low-income urban population (Kiefer, 2008). The percentage of students on a free lunch program varies.

History

The Common Roots program was established in 1987 by Joseph Kiefer and Jeff Teitelbaum, principal of Barnet Elementary. Their goal was to establish an approach to school restructuring that would address the fundamental connections between food, community, and ecological stewardship. These themes serve as the basis of an integrated curriculum that is the focal point of student learning and community involvement for students grades K-6. In order to work toward this goal, Joseph Kiefer and Martin Kemple established Food Works in 1987. Food Works is an organization that has developed an interdisciplinary curriculum framework for elementary schools that involves students designing, tending, and maintaining edible school gardens as well as harvesting, preparing, and eating their crops. The curriculum framework was developed in order to address what Kiefer, Teitelbaum, and Kemple saw as an increasing and worrisome sense of disconnectedness in their home communities. Each participating school implements the curriculum framework in a way that works best for its unique situation.

Important Features

As with the Edible Schoolyard, the Common Roots Program has several key characteristics that are useful for understanding the role an edible garden can play in education for ecoliteracy. These features

are: garden pedagogy, integrated curriculum, redesign of the school environment, emphasis on site-specificity, and community participation.

Garden Pedagogy

The Common Roots program is driven by the educational philosophy that children learn by doing (Kiefer, 2008). It employs hands-on learning, critical thinking, multiple assessment, empowerment of teachers, and parent/community involvement combined with outdoor and indoor theme gardens that serve as the focal point for curriculum. Another important feature of the Common Roots pedagogy is the belief in the strong connection people need to have with their environment and that schools should have with their surrounding community. Like the Edible Schoolyard, the curriculum is based on the goal of revealing and strengthening interdependencies through direct experience. Interdependence is used as the root metaphor for understanding how energy is exchanged within the connected web of ecosystems as well as how an individual exists within his or her community. As Bowers (1995) explains, "the Common Roots curriculum provides both the experience of being an interdependent member of a human/biotic community and the understanding that interdependence is the basic relationship that connects past, present, and future generations" (p. 199).

Integrated Curriculum: Theme Gardens

Theme gardens that demonstrate how different groups adopted different agricultural and cultural practices and adapted to the particular bioregion over time serve as the focal point of the Common Roots curriculum (Bowers, 1995). From their interactions with these indoor and outdoor gardens, students learn practical skills and an integrated approach to history, literature, math, science, folklore, art, and more. The youngest students start with a garden representing the agricultural and cultural practices of the earliest known inhabitants of the region, with each subsequent year introducing a more recent stage. While each school molds the curriculum to match its specific region, a general example of the yearly progression is as follows:

Grade K: The Kinder Garden, planted with sunflowers, carrots, and pumpkins.

Grades 1 and 2: The Native American Garden, planted with corn, beans, and squash.

Grade 3: The Community Heritage Garden, planted and tended cooperatively by students and community elders with crops from the community's past.

Grade 4: The Historical Garden, planted in heirloom varieties of crops once planted by the region's first settlers, such as wheat and oats. Students also experiment with antique gardening tools.

Grade 5: The Organic Kitchen Garden, planted with herbs, flowers, and kitchen vegetables that were popular in early America in an intensive raised bed garden.

Grade 6: Sustainable Garden Ecosystem, in which students apply sustainable garden practices.

(Bowers, 1995, p. 198).

In addition, a Market Garden is maintained throughout the summer months by students and community members. Produce is either sold to the community or donated to those who need it (Kiefer, 2008). Part of the curriculum of each grade level is associated with an Ecology Action Research Station located in an adjacent outdoor setting, where students learn about different kinds of ecosystems. Here, students learn how natural systems outside the garden ecosystem work and how human activities can alter these systems (Bowers, 1995).

School Environment Redesign

Again, while each school uses the curriculum as it best sees fit, some forms of edible school gardens need to be constructed on the school grounds. Food Works strongly suggest that students design the gardens, because of the many possibilities to teach math and science during the design process. The need for an Ecology Action Research Station also requires some thought and planning concerning what locations in the schoolyard would be suitable, and if there may be any potential for restoration projects.

Emphasis on Site-Specificity

The Common Roots program is designed to be adapted to virtually any site or existing curriculum. Its flexibility is intended to best serve the needs of each particular community (Kiefer, 2008).

Community Participation

Before being introduced into the existing curriculum, school administrators, teachers, parents, community members, and local businesses meet to review the Common Roots program. Each of these groups must agree to participate in the introduction and development of the curriculum in their school (Kiefer, 2008). A two hour workshop orients school communities to the program and teachers attend seasonal in-service training programs to further the integration and evolution of the curriculum. Local businesses are encouraged to donate materials for the gardens, while community members aid in construction and maintenance. Community elders play an important role in illuminating local heritage, further shaping the content of the curriculum.

Evaluating Success of the Common Roots Program

A comprehensive study similar to that for the Edible Schoolyard does not as yet exist for the Common Roots Program. However, participating schools report an increase of 20-30% in parental and community involvement with their children's education (Kiefer, 2008).

Exemplary Edible Garden Programs: Conclusions

A comparison of these two examples reveals several similarities and differences. Located on opposite sides of the nation, each example presents a different demographic composition, student age groups, and physical and cultural climate. While the Edible Schoolyard presents a specific example of how one school redesigned their school campus and curriculum, Common Roots provides an example of a curriculum framework adoptable by virtually any interested school. Both programs use interdependence as a metaphor for learning, but the Edible Schoolyard is more soundly rooted in the main principles of ecoliteracy. The Common Roots program gives more weight to the site-specific, historical and cultural view of place, as well as the importance of community elders, giving students a sense of how they are part of "a communal order of memory" (Bowers, 1995, p. 199).

These examples show how an edible schoolyard garden can be a central and unifying feature of the schoolyard, the school curriculum, and the surrounding community. From this examination, it is clear that both programs share several important features that are worth noting. First, each program follows a particular kind of pedagogy for educating with an edible garden, one that is based on relationships, knowledge of natural systems, the power of example, and experiential learning. Second, both programs involve some kind of schoolyard/school environment redesign to include an edible garden, and a place to cook and eat the harvest. Third, both examples show how the edible garden can be fully integrated into the curriculum as the source of countless interdisciplinary, place-based lessons. Fourth, each program recognizes that the edible garden and associated curriculum grows from place, reflecting and building community history, values, and goals. Fifth, each program demonstrates the importance of community involvement in the edible garden program. Both examples highlight how an edible garden can bring a community together, building partnerships to make the program stronger, effective, and long-lasting. Finally, both programs stress the importance of sustainable agriculture and social responsibility .

Edible School Garden Crop: Purple Cabbage

Edible School Gardens:
A Unifying Feature of Schoolyard Ecosystem Design

While both the Edible Schoolyard and the Common Roots programs show convincing evidence of how an edible schoolyard garden can be an essential part of a schoolyard ecosystem and ecoliteracy program, additional literature supports this claim as well. *The Preliminary Report on the Standards and Guidelines for Sustainable Sites*, is the result of a collaboration between a diverse group of experts in the fields of landscape architecture, horticulture, conservation, sustainable design, civil and environmental engineering, ecology, hydrology, forestry, soils, planning, public health, outdoor recreation, and other disciplines. This report suggests that edible gardens can be central features for environments that support human well-being. The report gives several goals for areas including soils, hydrology, vegetation, materials, and human well being. In the report, Human Well-Being Goal #1 is stated as, "Design and maintain conditions to promote health and physiological benefits" (Sustainable Sites Initiative, 2007, p. 55). Strategies to achieve this goal include providing opportunities for interaction with nature, providing spaces for physical activity, and supporting on-site food production in healthy environments. Clearly, edible school gardens directly support this goal.

In 2000, the Education Development Center (EDC) and the Boston Schoolyard Funders Collaborative conducted a study called *Schoolyard Learning: The Impact of School Grounds* to better understand the effects of schoolyard educational programs on academic learning and child development. The study consolidated existing research on the impact of schoolyards and conducted a survey to explore the capacity of schoolyards to facilitate academic learning, cognitive development, environmental stewardship, and safety. As a result of this exploration, the study found that, "well-designed school grounds appear to make a big difference in academic performance and child development" (EDC, 2000, p. 1). Schoolyards facilitating all or most of these processes were characterized as high quality schoolyards. The study developed an outline of the most common characteristics of high-quality schoolyards. These characteristics include:

1. **A Collaborative Design Process:** Educators, landscape design specialists, community members, and students are all involved in the design process.
2. **Multi-use and Multi-task:** The schoolyard is flexible and adaptive.
3. **Community Involvement and Partnerships:** The schoolyard brings together students, teachers, administration, community members, businesses and organizations.
4. **Curriculum Integration:** The schoolyard is an important part of daily curriculum and the educational planning process.
5. **Continuity of Use:** The schoolyard is used for other community purposes in addition to school needs.
6. **Sustainability:** The design and maintenance of the schoolyard employs sustainable techniques to conserve and recycle materials, ensuring longevity of the site.

The study reported that edible school gardens were the most commonly reported feature of successful schoolyards (EDC, 2000). Comparing this list to that describing the qualities of place-based education yields interesting results; *characteristics of high-quality schoolyards and essential components for place-based education are almost the same*. The characteristics of a successful schoolyard also mirror many of the important features of the exemplary edible school garden programs, namely: curriculum integration, community involvement, and sustainable practices. Edible school gardens, education for ecoliteracy, and healthy schoolyard ecosystems clearly go hand in hand.

Conclusions:
A Guiding Framework for Edible School Garden Design

This framework is comprised of a series of components based on a synthesis of information from the reviewed literature, including investigations of exemplary edible school garden programs, studies on features of successful schoolyards, and the experience of organizations such as the Center for Ecoliteracy, Community-based School Environmental Education (COSEED), and the American Society of Landscape Architects (ASLA). An integrated edible school garden that has its foundation in this framework is, by definition, an essential and

unifying element of a schoolyard ecosystem, and a highly influential means toward the goal of ecoliteracy. Components of a integrated and unifying edible school garden are as follows:

1. Garden Pedagogy:

The educational philosophy behind the edible school garden is based on the goal of ecoliteracy, using a systems approach and the environment as an integrating context. Using a guiding metaphor of interdependence, the program is founded in the idea that children construct their learning through direct experience with their environment and each other. The learning process is cyclical, in which education is a constant dialogue between student, teacher, and place.

2. Curriculum Integration

The edible school garden serves as the integrating context for formal curriculum and is incorporated into daily activities of students and school staff. Garden-related lessons meet state educational content standards in an interdisciplinary and meaningful manner (see Fig. 6: Content Standards), and help students develop a wide range of learning processes and skills (see Fig. 7, Learning Processes). Curriculum reaches every student by engaging all of Gardner's eight multiple intelligences (see Fig. 8, Multiple Intelligences).

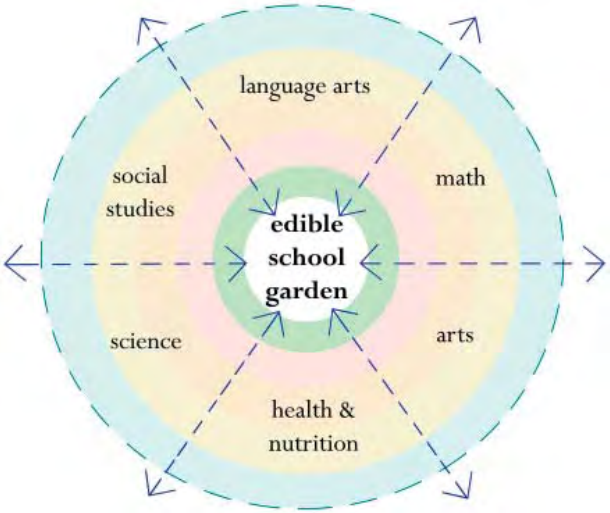


Fig. 6. Integrating Content Standards (Adapted From Hexom, Taylor, and Enggass, 2000, p. 80)

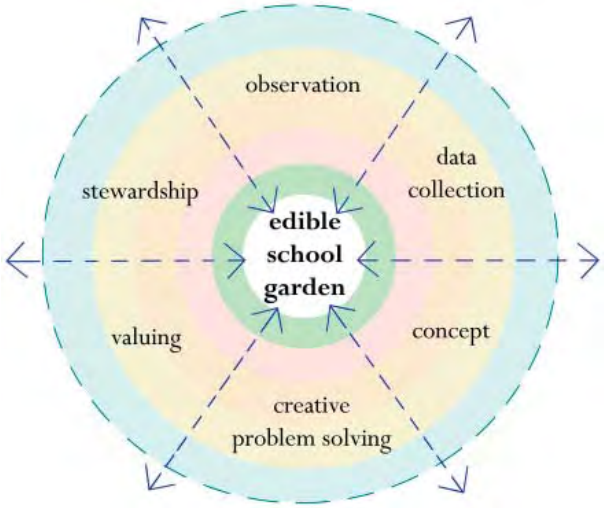


Fig. 7. Learning Processes
(Adapted From Hexom, Taylor, and Enggass, 2000)

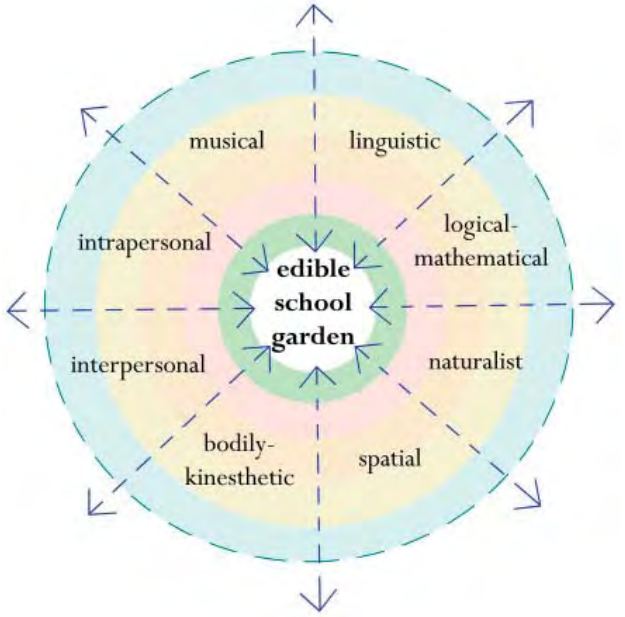


Fig. 8. Multiple Intelligences
(Adapted from Hexom, Taylor, and Enggass, 2000).

3. Collaborative and Adaptive Design Process

The edible school garden is created to reflect the needs, wishes, values, and goals of the school and surrounding community. Therefore, students, teachers, school administration, parents, and community members should all participate in the design, construction, use, and maintenance of the garden. Edible garden design should be adaptive and flexible to meet changing needs. Basic design concepts and related activities are integrated into the curriculum. The Edible Schoolyard in Berkeley took shape and grew over a period of several years, and it continues to change based on changing needs and goals. Most edible school garden projects will need to be implemented in phases, based on funding and increased school and community involvement.

4. Schoolyard Redesign

The addition of an edible school garden requires consideration of the existing schoolyard environment. The collaborative design process should take into consideration the larger schoolyard context for size and placement of the garden, as well as how it connects to the surrounding circulation, food, water, waste, and energy systems. The design and construction of an edible school garden could highlight concerns about the existing schoolyard environment and serve as a starting point for further improvements.

5. Community Partnerships

Community support and involvement with the edible school garden is critical for the success of the program. Leadership is maximized through partnership, which strengthens the edible garden program, and school –community ties. Monetary support, donations, and volunteer time can all come from community members, organizations, and businesses. In addition, an active and supportive community will address security and maintenance needs when school is not in session. In return, the edible school garden provides a gathering place and a source for local food production, consequently involving the whole community in education for ecoliteracy. The stretch of time during the summer when school is not in session is a major challenge for school garden programs everywhere. Following the model of the summertime Market Garden of the Common Roots program, it becomes clear that community support during the summer is needed, but can be a valuable resource for food and social activity in a community. An integrated and unified edible school garden would have a plan that involved the community during the summer. One possibility would be to have community members rent plots to cultivate over the summer. In return for access to tools, healthy soil, and a summer harvest, community members would provide maintenance and security for the garden.

6. Institutional Support

While community support provides form and purpose for an edible school garden, governmental and institutional support is also necessary. Federal and State governments should provide assistance for edible school gardens in the form of legislation that provides funding, curriculum development, assessment methods, and teacher training. State and local school districts can greatly influence the amount of this kind of support schools receive. School districts can be a critical resource to schools wishing to implement edible school garden programs. Institutional support can also aid in the dilemma of the summer growing season by creating and implementing summer educational programs that use the garden as a focal point.

7. Multiple Uses

The edible school garden should provide a place to grow food, play, observe, learn, explore, rest, and work together with fellow gardeners. In addition, it should provide healthy habitat for garden creatures such as worms, birds, butterflies, and other insects. The edible school garden can be a place for community gatherings and celebrations, gardening classes, and other educational workshops. The more uses an edible garden has, the more successful it will be.

8. Food Production

The edible school garden should be a source of food for the school, and possibly the surrounding community. Harvested fruits and vegetables should be used to supply a school lunch program or provide healthy school-time snacks. Students should be involved in the entire growing, harvesting, preparing, cooking, and eating processes. Extra produce and flowers can be sold at a school market or donated to local

food banks or similar organizations.

9. Water Systems are Revealed, Integrated, and Sustainable

Edible school gardens need water to stay alive and present a valuable opportunity to reveal to students the sources and destinations of water in their community. Students should be aware of where the garden water comes from and be active participants in its use and conservation.

10. Waste/Recycling Systems are Revealed, Integrated, and Sustainable

Vermicomposting is a relatively simple system to set up that can teach children about the life cycles of various garden creatures (including worms, beetles, ants, sow bugs, and others). Composting in an edible garden introduces students to the concepts and problems of waste storage, removal, and pollution in a relevant way, while suggesting solutions that are attainable. This kind of close-to-home experience is needed for students to deal effectively with these issues on a larger, global scale later in life.

Figure 9: Developing the Whole Person
(Adapted from Hexom, Taylor, and Enggass, 2000, p. 79).

11. Developmental Needs Are Met

Edible school gardens address a wide range of developmental needs. If the garden is intended for a particular age group, it can be tailored to address the specific needs of that group. Fig. 9 demonstrates how an edible school garden helps to develop the whole person by meeting developmental needs for mind, body, and spirit (see Fig. 9, Developing the Whole Person).

12. Safety and ADA

While edible school gardens are generally safe places, it is important that students be informed of garden rules and safe behavior in the garden. Ideally, students should take part in the development and enforcement of garden rules. Edible garden areas should be supervised by teachers, trained individuals and community members. Each community should develop garden guidelines that are respected, followed, and made clear to visitors. Because edible school gardens are places that foster development of the whole person, regardless of age or ability, measures should be taken to ensure the garden is accessible for everyone regardless of his or her abilities.

This study will use this framework, combined with an analysis of precedents, existing site conditions, and developmental and academic requirements as a guide for creating an edible school garden design adapted for kindergarten and first grade at Oñate Elementary in Albuquerque, New Mexico.

Chapter Three

Context of the Study
Precedent Study
Pilot Study

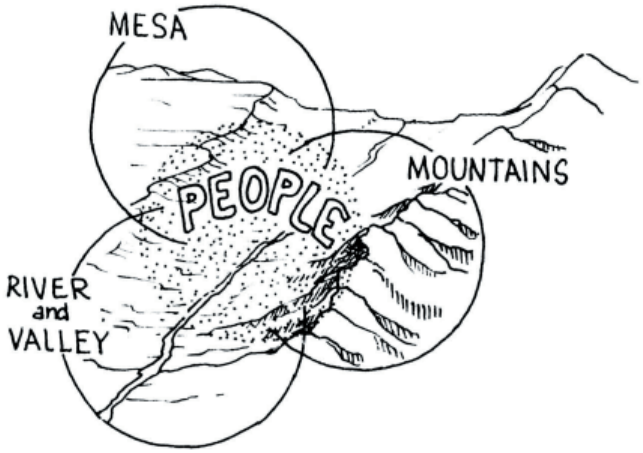
Context of the Study

Albuquerque, New Mexico

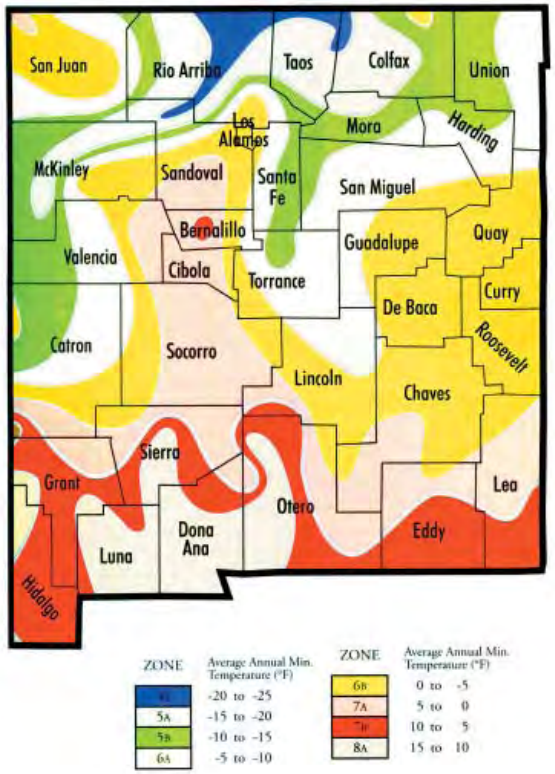
This study seeks to develop a framework for edible school garden design as a unifying component of the schoolyard ecosystem in Albuquerque, New Mexico. Therefore, it is necessary to outline the broader physical and cultural climate of the area in order to understand how an edible school garden can connect to existing systems. While each school site in Albuquerque is different, they are all situated within this larger context.

Physical Location and Climate

Albuquerque is located in the central part of the state of New Mexico, positioned between the Sandia and Manzano Mountains, the Rio Grande Valley, and the volcanoes on the West Mesa. These diverse geographic features create an environment with four distinct seasons, four different life zones, and three major geologic regions. Albuquerque's elevation ranges from 4,900 feet in the South Valley to over 6,000 feet in the foothills. The diversity of Albuquerque's environment results in a wide variety of smaller environments across the city. A school located close to or in the Rio Grande Valley will have a very different micro-climate than that of a school in the foothills of the Sandias.



Albuquerque's Major Geographic Features (Rosner et.al., 1985, p.7)



USDA Cold Hardiness Zones (Phillips, 2001, p.19)

The average daily range of temperatues in Albuquerque is wide, but extreme temperatures are uncommon. Summer temperatures reach 100 degrees Fahrenheit, but rarely exceed it. Winter temperatures may also drop to 0 degrees Fahrenheit, but seldom drop far below it (Rosner et. al., 1985). As shown in the zone map above, Albuquerque is located in USDA Zone 7B, with an average annual minimum temperature of ten to five degrees Fahrenheit. Low average humidity and sunny skies characterize daily weather. Albuquerque receives an average of eight or nine inches of rainfall every year. However, every 1,000 foot gain in elevation yields a three degree drop in temperature and a few inches' increase in rainfall (Phillips, 2001). Because most storms cluster along the mountains, areas in the foothills receive more precipitation than those in the valley. While schools in the valley may be able to tap the river and its adjacent irrigation ditches for a water source, schools in the foothills are more likely to reap the benefits of rooftop water harvesting.

Morrow (1995) outlines the four major natural landscape types in the Albuquerque metropolitan area as the following:

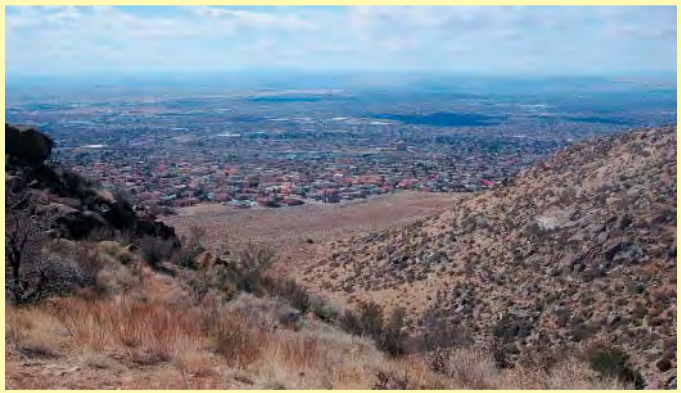
1. **The Rio Grande Valley:** Cultivated since the thirteenth century, this floodplain is characterized by agricultural fields, cottonwoods, and willows.
2. **The West Mesa:** Mostly desert grassland, this area generally has sandy soil, a few scattered washes with singleseed junipers and desert willows, grasslands with Indian ricegrass and sand dropseed, dalea, fourwing saltbush, and threadleaf sage.
3. **The East Mesa:** This grassy plain is covered in shortgrass species such as grama, wheatgrass, dropseed, Indian ricegrass, fluffgrass, and galleta. Prickly pear, cholla, globemallow, desert baileya, and purple aster are also present.
4. **The Foothills:** Stony, loose, alluvial soil characterizes the lower areas of the Sandias and Manzanos. A large variety of plant species are found here, including oaks, sages, beargrass, juniper, chamisa, pinon pine, prickly pear, and cholla.

The microclimates in each of these areas support different kinds of life. A schoolyard ecosystem reflects and supports its surrounding environment accordingly. For the purpose of this study, the ecosystem of most interest is that of the foothills, where Oñate Elementary is located.

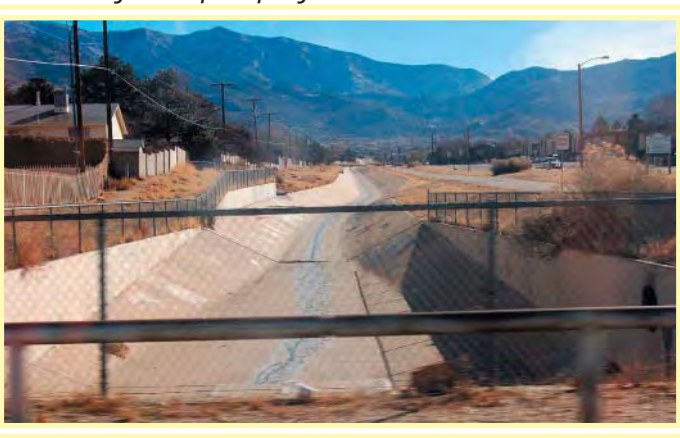
Albuquerque's growing season lasts "a remarkable 194 days" (Morrow, 1995). Many varieties of edible crops, including chile, tomatoes, corn, beans, and squash thrive in Albuquerque (see Appendix C for a listing of recommended crop varieties). Unfortunately, a good part of the growing season occurs during the summer, when most schools are out of session. However, the growing season can be extended through the winter for cold season crops such as lettuce, spinach, and chard with the use of cold frames and row cover systems.

Cultural History and Climate

Like its geography, Albuquerque's cultural environment is enriched by a diversity of cultures and subgroups. The Pueblo peoples, whose ancestors have lived in the region for many millennia, are descendants of the first people to enter the Americas nearly 13,000



View of Albuquerque from the Sandia Foothills



Viewing The Sandias From One of Albuquerque's Many Arroyos

Volcanoes on the West Mesa

years ago. Pueblo villages became established in Albuquerque around the time of A.D. 900 (Rosner et. al., 1985). The Pueblo people took full advantage of their arid environment, using various methods to cultivate land from the rich soil of the valley to the seemingly barren land of the mesa and foothills. Current residents of Albuquerque can learn much about how to live safely and sustainably from the ancient Puebloan architectural and agricultural techniques (Price, in Price and Morrow, 2006).

After the conquest of Mexico, Spanish explorers moved north to what is now New Mexico. Coronado led the first expedition into the Rio Grande Valley in 1540. In 1598, Don Juan de Oñate (namesake of Oñate Elementary) was given permission to establish the first Spanish colony in the area, near the present day San Juan Pueblo (Rosner et.al., 1985). A capital was set up in Santa Fe, and New Mexico became part of the Republic of Mexico in 1821. During Spanish rule, society was dominated by a caste system and rules of the Franciscan Church (Rosner et.al., 1985). Attempts to assimilate and enslave the native population were met by several, mostly unsuccessful, Pueblo revolts. Hispanic and Pueblo communities remained spatially distinct.

In 1848, Albuquerque officially became part of the United States, but most Anglo influence did not reach the region until after the Civil War. In 1880, the railway (later the Santa Fe Railroad) came to Albuquerque, creating new access and increased market for materials. By 1900, the city contained some 6,000 people and continued to grow over the next century. Many people were drawn by the health benefits of Albuquerque's dry climate, and the city became a kind of mecca for those suffering from tuberculosis (Rosner et.al., 1985). Growth boomed after World War II as a result of the war economy and the creation and maintenance of the Los Alamos Laboratories in Northern New Mexico.

Today Albuquerque is home to over 450,000 people (US Census Data, 2000). The population is predominantly Anglo and Hispanic, with a diverse mix of African Americans, Native Americans, Asian Americans, Pacific Islanders, and others. Kirtland Air Force Base and Sandia Laboratories provide significant support to Albuquerque's economy, while the growing movie industry has also been a recent source of income. Located at the intersection of Interstate 25 and Interstate 40, the city continues to serve as a major hub for transportation. In addition, the University of New Mexico brings students from all over the world to study in Albuquerque.

Agricultural traditions from both the Puebloan and Hispanic periods of Albuquerque's history provide valuable precedents for edible school garden design in the region today. Some methods, such as the acequia system (irrigation from ditches adjacent to the Rio Grande) are still used by farms in the valley. Puebloan methods, such as pocket, terrace, and streamside diversion dam gardens are not frequently used, but could be employed (Morrow, in Price and Morrow, 2006). These methods of agriculture, as they focus on harvesting available water, are appropriate models for schools in the foothills and mesa environments. The Mexican method of irrigating fields with porous clay pots, or ollas, is also making a comeback in Southern New Mexico agricultural practices. It is sensible to use these methods as models for food production in Albuquerque, not only because they have been developed, tested, and adapted specifically for this region, but also because they can be used to familiarize students with the cultural history and traditions of the area.

Acequia Irrigation Ditch and Cornfield at Las Golondrinas Ranch, Santa Fe

Precedent Study:
Existing Edible School Gardens in the Albuquerque Area

A handful of edible school gardens currently exist in the Albuquerque area. A precedent study of three select programs was conducted to investigate how these programs work with the local climate and their surrounding communities. Precedents include Alvarado Elementary and Dragon Farm in Albuquerque and the Earthworks Environment at the Santa Fe Children's Museum in Santa Fe. Each program was considered using this framework for unifying edible school garden design, as determined in the Literature Review. As outlined in the final section of the Literature Review, components of a unifying edible school garden are as follows:

1. Garden Pedagogy
2. Curriculum Integration
3. Collaborative and Adaptive Design Process
4. Schoolyard Redesign
5. Community Partnerships
5. Institutional Support
6. Multiple Uses
7. Food Production
8. Water Systems are Revealed, Integrated and Sustainable
9. Waste Systems are Revealed, Integrated, and Sustainable
10. Developmental Needs are Met
11. Safety and ADA

Results from this precedent study and the pilot study at Oñate Elementary will be used to create a more regionally specific framework for unifying school garden design. This research will ultimately produce specific design goals and criteria for an edible school garden design for kindergarten and first grade at Oñate Elementary in Albuquerque.

Precedent 1: Alvarado Elementary, Albuquerque

Setting and History

Alvarado Elementary is located in the North Valley of Albuquerque, adjacent to the Los Poblanos Fields Open Space. Alvarado's school garden program was started in 2000 with a partnership between the University of New Mexico's Elementary Education Professor Quincy Spirlin, Alvarado teachers, and the Rio Grande Community Farm (RGCF). Spirlin suggested that the RGCF contribute a portion of the agricultural land bordering Alvarado Elementary's school grounds for a school garden. RGCF agreed to provide a 1/8 acre plot and that summer ten teachers from Alvarado attended a garden training workshop.

Aerial of Alvarado Elementary, Albuquerque

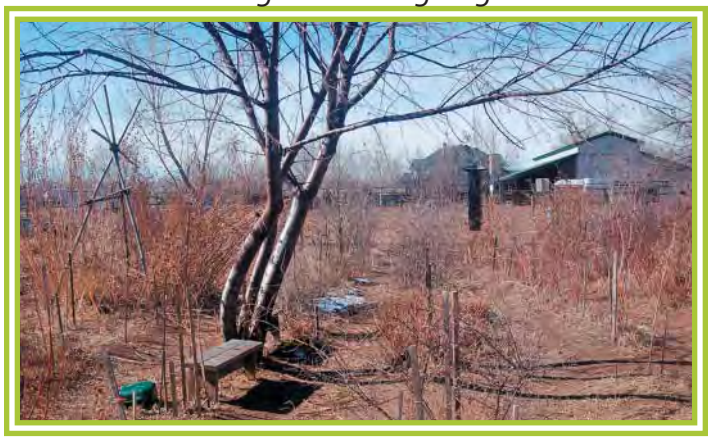
At first, the garden program was unorganized, with each teacher using the garden space for different purposes. Some tried growing edible crops, but found that the timing of the school year left the crops unattended during summer, the most productive time of year. Patrick Huggins, first grade teacher, decided to designate the garden as a 'habitat' garden, instead of an edible school garden. Huggins says, "The garden is edible, not for the students, but for the birds, snakes, lizards, and insects that live there" (P. Huggins, personal communication, Feb. 6, 2008).

The main goal for Alvarado's garden is to create habitat for creatures living in the Los Poblanos Fields Open Space. In the spring, students plant annuals such as sunflowers, cosmos, and zinnias. Parents and other community volunteers aid in the planting process and provide some maintenance over the summer. When students return in the fall, they find a maze of eight foot tall flowers. Woody shrubs such as currant and rose line the edge of the garden and create additional hiding places for birds and other animals. A major irrigation ditch lies to the north of the garden plot, separating Alvarado's school grounds from the open space. This ditch is tapped using traditional acequia irrigation methods to flood irrigate Alvarado's garden and the adjacent Rio Grande Community Garden Plots. In the winter, local Boy Scout troops help to clear the dead debris, adding to the compost piles on the north end of the garden. These compost areas serve to create additional habitat. Each year the Alvarado PTA gives $400 to the garden program, providing for seeds, plants, tools, and bird food.

Huggins explains that there is actually more for his students to do in the winter garden, because of all the birds that come to graze the agricultural fields, including cranes and geese. Smaller birds, such as goldfinches, rustle in the woody shrub habitat of Alvarado's garden, while hawks peer down from the cottonwood branches above. Students take binoculars out to the garden to bird-watch. When they return to the classroom, students generate a "word bank," a collection of words and phrases that describe their observations. Each student keeps a garden journal with writing and illustrations that they share with their fellow students. Hikes in the open space reveal pottery shards and other clues to the area's rich agricultural past. Many classes at Alvarado also use the garden and open space fields for hikes and outdoor lessons.

In addition, Huggins' first graders plant fast-growing edible crops, such as radishes, lettuce, and scallions, in raised bed containers next to their portable classroom. The school district had previously provided raised bed planters, but placed them in a base of concrete, making the height of the planters difficult for little gardeners and creating an uncomfortably hot gardening environment. These planters are not used by any classes. It appears that Huggins' class is the only class at Alvarado that is gardening in additional edible garden beds.

Welcome Sign and Bird-sighting List

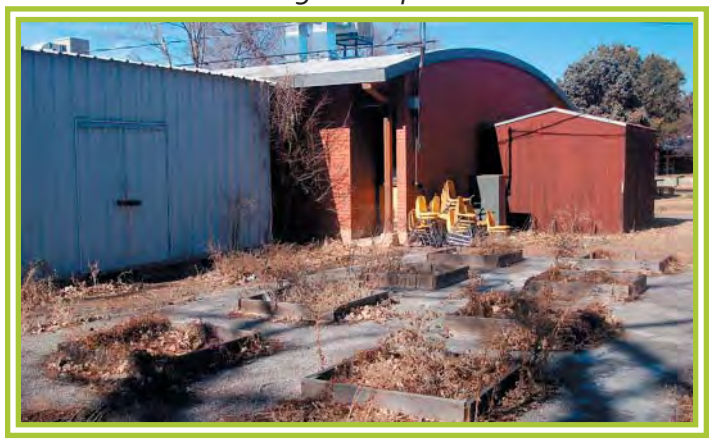


Alvarado Wildlife Garden in Winter

Gathering Area

Geese in Los Poblanos Fields Open Space

Irrigation Pipe



Failed Garden Beds in Concrete Pad

Components of A Unifying Edible School Garden At Alvarado Elementary

1. Garden Pedagogy

At least one teacher at Alvarado Elementary, and possibly more, has adopted an interdisciplinary approach to teaching in the garden and surrounding fields. However, the school and garden program lack a cohesive agreement on guiding principles for the purpose and function of the garden. The school's mission is, "Alvarado Elementary School will create an educational, safe and nurturing environment that will foster self-esteem and mutual respect by instilling a joy for learning in an atmosphere of cooperation." While this statement hints at some of the major themes of systems thinking and ecoliteracy, it does not address them directly.

2. Curriculum Integration

Mr. Huggins' class uses the wildlife garden and edible raised bed gardens as part of their daily curriculum. It is unclear how many other teachers fully integrate the garden into their class work, especially because it is not part of the school's overall mission. Many other teachers conduct class in the garden on a regular basis, although some see it as an 'extra' for which they don't have time as test preparation is more important.

3. Collaborative and Adaptive Design Process

The design process for Alvarado's garden was and continues to be relatively unorganized. However, because of the students' and community volunteers' involvement in planting, harvesting and composting, it is primarily a community and school-based design effort.

4. Schoolyard Redesign

The wildlife garden is not located on the school grounds and so did not require any improvements to the schoolyard or grounds. The edible garden beds have minimal impact on the surrounding school environment. Huggins noted that the beds are movable, which will be important when he has to move out of the portable classroom to make room for a new kindergarten building next year. Because of the beds'

portability, he will be able to take them to his new classroom for use there. Huggins' raised beds provide an interesting example for "portable edible school gardens." While soil cultivation is a long-term process and edible school gardens are ideally permanently located, portable edible gardens are a thought-provoking response to the impermanence and transportability of portable classrooms so prevalent in Albuquerque schools.

5. Community Partnerships

The community is very involved with Alvarado's wildlife garden. The garden is located next to community garden plots and an open space accessible to the public, increasing its visibility and support for the project. Partnership with the University of New Mexico and the Rio Grande Community Farm were critical to the program's inception. Community volunteers and local Boy Scout troops maintain the garden during the summer, making it possible for Alvarado students to enjoy it in the fall. In the second year of the program, the field needed to be laser-leveled, and the garden area lost a good deal of nutrient-rich topsoil. The school received help from Soilutions, a soil and compost supplier in Albuquerque's South Valley, to replace the much-needed topsoil. Other local businesses donate birdseed and tools to the program. Alvarado Elementary is a good example of how community support strengthens and shapes a school garden program. However, the edible raised bed gardens appear to be an isolated activity for Mr. Huggins' class and do not involve any community members.

6. Institutional Support

While the Albuquerque Public School District (APS) appears to support the existence of edible school garden programs, their efforts to help in this situation did not specifically address the needs of the school and resulted in unused and overgrown raised garden beds. It appears that improved communication between the school community and APS could result in the construction of an edible garden beds that are well-designed and useful. No additional curricular or monetary support is provided from APS for Alvarado's garden.

7. Multiple Uses

The wildlife garden serves a number of purposes, including providing habitat for local wildlife, an outdoor classroom for Alvarado Elementary students, a place for community gathering and service, and a place for recreation. The edible garden beds are separate and do not serve many uses except for Mr. Huggins' class.

8. Food Production

The wildlife garden does not provide any food production for the school population. The edible garden beds provide healthy snacks for Mr. Huggins' class, but not for the rest of the school or surrounding community.

9. Water Systems are Revealed, Integrated and Sustainable

The acequia irrigation system reveals the source of irrigation water in a way that supports sustainable agricultural method and is traditionally and culturally educational for students. However, students are not usually present during the flooding of the fields because of concerns about muddy feet. Therefore, the water systems are not as fully integrated into the curriculum and garden activities as they could be.

10. Waste Systems are Revealed, Integrated, and Sustainable.

Most of the clearing and composting of dead debris occurs during the winter, and is done by community volunteers. Students experience the composting systems through their observation of the wildlife that lives in the compost piles. Compost is not recycled in the fields to improve the soil or used to amend the edible garden beds. While there are obvious safety concerns surrounding young children participating in clearing large amounts of garden waste, students could be more involved in the process. Additionally, the compost could be used in more applications to support the health of the whole system.

11. Developmental Needs are Met

Children in grades K-5 use the garden area. No specific design elements of the wildlife garden are oriented toward particular developmental needs. However, the wildlife garden consists of a

variety of 'loose parts,' elements of an educational environment that create open and diverse opportunities for play and learning. This less formal educational environment is shown to be more supportive of creative play and associated cognitive, social, and physical development for children in this age group (EDC, 2000). Additionally, children in this age group benefit from direct contact with nature as it stimulates all the senses and highlights interconnections (Louv, 2005).

12. Safety and ADA

Students visit the garden under the supervision of their teachers, who determine guidelines for appropriate garden behavior beforehand. The garden area does not meet ADA requirements for all areas. Travel routes to the garden area appear accessible, but movement among garden rows is not.

Additional Components:

The Alvarado Elementary Garden Program suggests that a wildlife habitat component adds more possibilities for curricular experiences and provides a useful solution to the problem of a mismatched school year and growing season. However, many schools in Albuquerque do not have the advantage, as Alvarado does, of bordering agricultural open space. This additional component should be considered as part of the "Schoolyard Redesign" component, as most schoolyards house some kind of opportunity for wildlife habitat and/or restoration. Using the existing schoolyard as a place to learn about nature shows students how they have a direct effect on the natural systems around them. As a result, schoolyard restoration projects could supplement the edible garden program, creating a more diverse, resilient, and healthy schoolyard ecosystem.

Precedent 2: Dragon Farm, South Valley Academy, Albuquerque

Setting and History

Dragon Farm is located on the campus of the South Valley Academy (SVA), a charter school that bases its curriculum on service learning. As its name implies, it is located in the South

Aerial of Dragon Farm, Albuquerque

Valley of Albuquerque and serves an ethnically diverse population of predominantly low-income families. The idea for Dragon Farm emerged in 2006 when a student suggested creating an organic farm on the school's campus. Art teacher Richard Brandt responded to this request by launching a project to build a one-acre organic farm that serves as a CSA (Community Supported Agriculture), a place for high school-aged students to perform meaningful work producing food for their community, and an integrating environment for interdisciplinary curriculum at South Valley Academy (R. Brandt, personal communication, Feb. 15, 2008).

Brandt kick-started the project by working with Don Bustos, owner of the Santa Cruz Farm in Española and one of the region's most knowledgeable farmers, to start to work the land, preparing for its first crops. Simultaneously, Brandt collaborated with UNM's Landscape Architecture Program. Incoming students in the Landscape Architecture Program worked on several designs for the garden and its integration into the school campus. UNM students consulted with teachers and students at SVA to produce designs to fit the school's needs. At the end of the semester, the UNM students presented their designs to the school, and SVA teachers and students chose a favorite design. Although

this design is not actively being pursued, it brought about support for the project and actively engaged the school community in planning for the creation of a farm on campus.

Currently, the farm has eight CSA members, who pay a yearly fee to receive monthly installments of seasonal fruits and vegetables grown on the farm. Members have the option of helping on the farm, but their participation is not required. Produce includes a seasonal sampling of beets, bell peppers, bok choy, broccoli, cabbage, carrots, chile, cucumbers, eggplant, green beans, herbs, okra, onions, peas, potatoes, radishes, salad greens, spinach, and tomatoes.

The farm is not yet integrated into the daily curriculum. Students can choose to work on the farm for a few hours during a Friday afternoon "choice" period. Students carry shovels and rakes out to the farm to even out planting rows. Some students rototill rows for new planting, and others adjust the frost protective cloth covering the winter lettuce crop. During choice period, several teachers from different disciplines come out to help as well. These teachers all expressed interest in conducting lessons related to the farm. Like Alvarado Elementary, Dragon Farm gets its irrigation water from a nearby ditch, also employing the traditional method of acequia irrigation. The ditch water is distributed throughout the field with drip emitters. It appears that at this time, students have little to do with the irrigation process.

Brandt also gets help working the farm, managing the CSA, and selling produce at local farmers' markets from a New Mexico Forum for Youth in Community intern. They are in the process of creating a non-profit organization to maximize opportunities for the farm to serve both SVA and the surrounding community. Brandt and his coworkers are also currently working to create an interdisciplinary curriculum that will integrate the farm into the school's daily activities. Partnerships with the University of New Mexico continue, as students in UNM's Sustainability Studies design and maintain the compost systems for the farm and will later work their own plot at the farm. Neighbors of the farm have also expressed interest in caring for a select plot in the farm, adding to the growing number of community stakeholders.

Two of Dragon Farm's Five Composters

Diverting Irrigation Water From the Ditch

Rototilling to Prepare for Spring Planting

Lettuce Rows Covered in Protective Cloth

Potential for an Outdoor Classroom

Components of a Unifying Edible School Garden at Dragon Farm, South Valley Academy.

1. Garden Pedagogy

The South Valley Academy is based on a philosophy that requires each student to take control of his or her learning by developing a personal learning plan, which includes goal-setting and in-depth teacher evaluation. In this way, multiple learning styles are recognized and encouraged. Students also participate in service learning for all four years, actively engaging them with their community. While this pedagogy supports education for ecoliteracy, it does not state ecoliteracy as a unifying objective, or articulate how the edible garden component supports the school's goals.

2. Curriculum Integration

Although it is a future goal for the farm to be fully integrated into SVA's curriculum, working there is currently equivalent to an extra-curricular activity.

3. Collaborative and Adaptive Design Process

Partnerships with UNM's Landscape Architecture Program sparked enthusiasm for the project and involved SVA students and teachers in the visioning process. Because the program is fairly new, it remains to be seen how much voice the school community will have in the evolving shape and purpose of the farm.

4. Schoolyard Redesign

While the farm is located on school property, it is not part of the school's regular grounds. Even though UNM students addressed the entire campus in their designs, the garden has currently had little effect on the condition of the schoolyard.

5. Community Partnerships

Dragon Farm is supported by a number of important community partnerships including UNM, CSA members, the New Mexico Forum for Youth in Community, farmers' market shoppers, and local neighbors.

6. Institutional Support

Because SVA is a charter school, it operates independently of APS. This relationship makes district support somewhat less important, but highlights the strong potential of community support.

7. Multiple Uses

The farm currently serves several purposes - namely, providing food for CSA members, produce to sell at the Farmer's Market, and an alternative extra-curricular activity for students.

8. Food Production

Dragon Farm produces food for community members and farmers' markets, not for SVA staff or students. It is unclear whether food production for the school is a future goal for the farm.

9. Water Systems are Revealed, Integrated, and Sustainable

Like Alvarado, garden irrigation is revealed and traditionally sustainable, but does not involve the students as much as it could.

10. Waste Systems are Revealed, Integrated, and Sustainable

UNM Sustainable Studies students have implemented a composting system that decomposes garden waste at high temperatures and fast rates. While this process supports sustainable methods, is used to amend the farm soil, and is visible to students, it is not an activity that engages them in the process of waste recycling.

11. Developmental Needs are Met

As the program has yet to be integrated into the curricular activities of South Valley Academy's academic program, it is unclear how the design of the farm will address the specific developmental needs of students.

12. Safety and ADA

Students are supervised by several teachers while working the farm. Most of the farm area is relatively flat, but access from the schoolyard occurs over multiple levels, with steep slopes. The ground area is soft and muddy. None of the farm area appears to address ADA accessibility requirements.

Additional Components:

Dragon Farm presents a dramatically different model than previously discussed examples of edible school gardens. Geographically separate from the schooolyard, and organizationally separate from the school district, Dragon Farm is its own entity. However, the success of the farm is highly dependent upon community support and involvement. Although service learning is not currently part of the farm program, the case of the South Valley Academy brings up the potential for an edible school garden to foster community service learning. Once SVA students are versed in the organic agricultural methods of Dragon Farm, they could use their talents to create edible gardens in other neighboring schools as part of their service learning curriculum. This additional potential for edible school gardens will be included in the Community Partnerships section, as service learning is a powerful way to create partnerships and strengthen community ties.

Dragon Farm also demonstrates the ability of an edible garden to be productive year-round, even in Albuquerque. Protective cloth prevents frost from settling on cold-tolerant crops such as lettuce, spinach, arugula, chard, and mustard greens. This model shows that several crops could be planted and harvested within a regular school year, giving students experience with the entire cultivation and harvesting process.

Precedent 3: Earthworks Environment, Santa Fe Children's Museum

Setting and History

It should be noted here that the Earthworks Environment at the Santa Fe Children's Museum is not a school garden in the sense of being located on school grounds. It is also located in Santa Fe, not Albuquerque, so slight climatic and cultural differences do exist. However, many schools visit the museum, and the space is designed primarily for educational and play purposes, similar to school grounds. The Earthworks Environment was chosen as a precedent because it presents a number of creative and interesting solutions to common

Santa Fe Children's Museum Entrance

Cistern Collecting Roof Runoff

Concrete Channels Collect Water...

challenges facing edible school garden programs in Albuquerque, including methods for revealing and integrating water and waste systems and providing a safe combination of play environments and garden areas. The museum also provides a valuable example of how indoor systems can be connected with outdoor systems, increasing educational opportunities and efficiency of facility operations.

The Museum was started in the early 1980's by four educators who wanted to create a place "where children learn through active exploration and open-ended play. They wanted to create a physical environment with both inside and outside spaces that supported creative thinking and problem solving for all ages" (Stine, 1997, p. 125). The design was a collaborative process with architect Jeff Harner at the lead, including input from children, program directors, program staff, and the surrounding community. The acre of land to the south of the museum building was acquired in 1992, and was designed with the goal of connecting the inside of the museum with natural spaces outside (Stine, 1997). Systems inside and outside the building are revealed and connected. For example, a maze of concrete channels inside the museum connects with channels that collect water outside for storage in visible cisterns. Runoff from the roof is collected in a 10,000 gallon cistern that provides a water source for the whole outside area.

The series of paths in the Earthworks Environment leads

...and Carry it to Aluminum Aqueducts to Irrigate the Edible Garden Area

children through a variety of different local ecosystems for the Santa Fe area, including a mountain zone, a grassland, a greenhouse with a vermicomposting (worm-driven) system, a small wetland, small adobe houses, and a vegetable garden

Several 'loose parts' exist within each of these ecosystem zones, including child-sized wheelbarrows and shovels, tires for stacking, and a wide variety of plant materials. A neighbor recycled his dead cottonwood tree by cutting it into circular stumps, resulting in visually interesting and inviting seating elements in the theatre area and stepping stones to the inside of the adobe houses. A colorful mosaic sundial invites visitors to use their shadow to determine the time of day. Adobe brick and glass bottle houses built by local high school students beckon children to climb inside, enjoy the shade, and marvel in the play of light from the colorful bottles.

Components of a Unifying Edible School Garden at the Earthworks Environment, Santa Fe Children's Museum

1. Garden Pedagogy

The goal of the museum is to provide a place for families, children, and community to learn together in an environment that encourages creative thinking and exploration. Activities in the garden area include scavenger hunts in which children pretend to be certain types of animals. While the edible garden certainly seems integrated into the physical environment, it does not seem to be a main factor in the museum's educational programs. The garden appears to be just another 'loose' element, representing an important ecosystem and providing a place for open-ended play.

2. Curriculum Integration

While the museum leads 'environmental education' activities in the edible garden and greenhouse areas, it is unclear what role actual cultivation of edible crops plays in the curriculum. A problem presented by an edible garden in a museum environment is that children do not have the chance to observe the growth and change in the garden daily, cannot provide the consistent maintenance that is needed, and therefore do not develop the sense of ownership and pride that comes from constant contact with the garden.

3. Collaborative and Adaptive Design Process

The museum provides a good example of successful collaborative and adaptive design. The original design stemmed from community vision and continues to change as the museum requires. The open-ended nature of the Earthworks' many environments provides for flexibility on many levels. At the time of this visit, the greenhouse was being reconstructed in order to better deal with temperature changes and encourage more use.

Earthworks Welcome Murals, Painted by Local Artists

Adobe and Glass Bottle Houses , Built by Local High Schoolers

Mosaic Sundial, at the Museum Entrance

Cottonwood Stump Seating Elements

4. Schoolyard Redesign

The Earthworks Environment was the result of a design for an entire acre, with the goal of connecting the museum building with the outdoors. It provides a noteworthy model for the ability of school grounds to be engaging and open-ended educational environments.

5. Community Partnerships

The museum funds its operations and programs from membership, admission fees, funding from the Santa Fe Chamber of Commerce, and other city and state organizations. Community support allows the museum to continue to provide its services. Community members aided in the design and continuing construction of elements in the garden, and local artists add color and life with mural paintings.

6. Institutional Support

As mentioned in the previous section, city and governmental support is key to the success of the museum.

7. Multiple Uses

Countless opportunities for different activities exist in the Earthworks Environment. However, they are all museum-controlled and do not necessarily invite spontaneous community gatherings or other kinds of educational workshops.

8. Food Production

While the Earthworks Environment has an edible garden component, it is unclear how the produce is used. No gardening or cooking classes are listed specifically in the museum's catalog of activities. It is likely that children are able to graze from the crops during their visit.

9. Water Systems are Revealed, Integrated, and Sustainable

The Earthworks Environment successfully reveals sustainable water collection and transportation systems through its series of channels, aqueducts, and cisterns. The openness of these systems allows children to play in the water and control flow with child-powered hand pumps.

10. Waste Systems are Revealed, Integrated, and Sustainable

Several composting bins and a vermicomposting box invite children to learn about waste recycling. The 'worm box' is especially engaging and fun, because children can dig for worms and learn about the rich compost worms create when they eat our leftover food.

11. Developmental Needs are Met

The loose, open-ended quality of the Earthworks Environment meets a range of developmental needs for children of all ages (including adults).

12. Safety and ADA

Much of the Earthworks Environment is not ADA accessible because of narrow pathways and erratic and sometimes steep changes in slope. As most children visit the museum with their parents, they are supervised by both museum staff and their guardians.

Additional Components:

The museum model of an educational environment offers a fresh perspective on what school environments could look like. With a variety of open-ended activities available, children can direct their own play and learning experiences while directly engaging with their local natural environment. The Earthworks Environment inspires a schoolyard design that includes not only an edible garden, but also other eco-revelatory components, such as a sundial, compass, water channels, solar panels, construction areas, cisterns, and lookout towers. While this example does not add any components to the framework for a Unifying Edible School Garden design, it suggests more creative and developmentally appropriate design solutions for engaging children with their environment than are conventionally employed in schoolyard design.

Conclusions

Even though these precedents do not encompass *all* of the components for unifying edible school garden design, they do provide valuable insight into the challenges and potentials for edible school garden design in the Albuquerque area. Helpful conclusions can be made in the following categories:

1. Garden Pedagogy

None of the examples show a garden pedagogy with ecoliteracy as a clear goal. However, the precedents do show how alternate pedagogies and educational goals can support an edible school garden. Each example demonstrates that if the edible garden as part of an ecoliteracy program is not a central part of the school's goals and methods, it is not used to its full potential.

2. Curriculum Integration

Some classes at Alvarado Elementary are using their garden as an integrating context to teach interdisciplinary lessons. Teachers at SVA are figuring out how to do the same with Dragon Farm. Many teachers still see these kinds of lessons as extras. Curriculum development and corresponding teacher training is needed for the state of New Mexico to help teachers meet standards using the edible garden and schoolyard environment as an integrating context.

3. Community Partnerships

Each precedent demonstrates that community involvement through partnerships, active participation, and support truly strengthen and guide an edible school garden program. They also reveal that Albuquerque presents a number of opportunities for partnership not just with neighborhood community members, but also with businesses (such as Soilutions), agricultural organizations (such as the Rio Grande Community Farm and Santa Cruz Farm), other local organizations (such as the Boy Scouts) and the University of New Mexico.

4. Schoolyard Redesign

The Earthworks Environment at the Santa Fe Children's Museum is the only example of how edible gardens require schoolyard redesign and encourage further improvements to the outdoor educational environment. The edible garden has many connections with other systems in the schoolyard (water, energy, etc.) and these connections should be made visible and utilized for their educational value. The museum's model of an interactive and eco-revelatory

outdoor educational environment demonstrates possibilities for Albuquerque edible school design as part of a larger schoolyard environment.

5. Institutional Support

Lack of institutional support was a clear detriment to the program at Alvarado Elementary while strong institutional support provides a backbone for the Santa Fe Children's Museum. The general scarcity of edible school garden programs in Albuquerque shows that the Albuquerque Public School District does not see edible gardens as a priority for funding or a consideration for facilities design and operations. However, current attitudes do not exclude this kind of support from happening in the future. If national funding for garden programs and teacher training becomes more available as a result of the *No Child Left Inside Act*, perhaps the school district will become more supportive.

6. Multiple Uses

Each example shows how an outdoor educational environment that includes an edible garden can serve many uses. The more uses an edible garden has, the more partnerships it creates, building a stronger program overall.

7. Food Production

Alvarado has habitat creation at the core of its garden, but only one teacher supplements these experiences with an edible garden that produces minimal food for students. Dragon Farm produces a large quantity of produce that feeds, for the most part, the surrounding community and not the school itself. It is unclear how big a role food production plays in the Santa Fe Children's Museum's programs. Following the Edible Schoolyard's lead, each of these programs could employ food production, preparation, and consumption as a valuable and unifying part of the daily curriculum and school activities.

8. Water and Waste Systems

Each of the examples demonstrates that water conservation and recycling are critical in the Southwest. Both schools are located near the Rio Grande and can utilize the traditional irrigation method of tapping the ditches for water. Most schools in Albuquerque, however, are not so fortunate as to be located next to existing irrigation systems. Santa Fe receives a significantly larger volume of rainfall making water harvesting in cisterns a more viable process than in Albuquerque. Creative solutions for water collection, conservation, and distribution are needed to address this component of a unifying edible school garden in Albuquerque.

All of the precedents suggest the possibilities for waste recycling, but only the Santa Fe Children's Museum example shows how children can actively engage in the process. Vermicomposting is a highly educational process that requires student involvement and can teach several subjects. Student-run 'worm boxes' show children how their food waste can be recycled, quickly and cleanly, resulting in high quality compost for the edible garden.

9. Developmental Needs

These precedents do not specifically address developmental needs, but the 'loose parts' inherent in garden activities and nature play address several cognitive, social, emotional, and physical developmental needs of many ages. Likewise, while each environment was adequately supervised and apparently safe, none of the precedents gave examples of completely accessible environments. Edible school gardens provide excellent educational opportunities for children with special needs. Therefore, the design of these environments should make every effort possible to create an accessible environment for children with varying abilities.

Pilot Study:
Edible School Garden Design for Kindergarten and First Grade at Oñate Elementary, Albuquerque.

Setting

Oñate Elementary is located in the northeast foothills of Albuquerque. The school campus is sited on approximately two acres of dramatically sloping land. One acre supports the school buildings while the other provides an expansive schoolyard. The school grounds are

Oñate Elementary Location Map, Albuquerque, NM

relatively bleak compared to the surrounding backdrop of the Sandia Mountains to the east and the city, volcanoes, and Mt. Taylor to the west.

Oñate serves grades K-5 and had 275 students enrolled for the 2006-2007 school year. Enrollment is small compared to the majority of Albuquerque elementary schools. Students are predominantly Anglo

Oñate Elementary Campus Aerial

(60%), with 30% Hispanic, 4% African American, 3% Asian-Pacific, and 3% Native American comprising the remaining student population (APS, 2007). One-third of the student population participates in the Free/Reduced Price Lunch Program. Oñate Elementary's mission is "To educate all students to become responsible, literate, thinking and contributing members of a multi-cultural society through excellence in teaching and learning."

This pilot study was intiated through a UNM service learning course in the School of Architecture and Planning called "Architecture and Children," taught by Dr. Anne P. Taylor. In this class, UNM students study ways to teach concepts of design in Albuquerque schools. After a few weeks of training, UNM students begin teaching interdisciplinary design lessons to students in grades K-12.

Oñate first grade teacher David Dallas (a UNM Architecture Graduate) contacted Dr. Taylor in the summer of 2007. Dallas expressed interest in a UNM Landscape Architecture student coming to Oñate to design a garden for their first grade and kindergarten classes. The section of land adjacent to the first grade and kindergarten building (B-Building) at Oñate had recently been a construction site.

B-Building Garden Area, Looking North

Construction fences came down in late September and a 3,700 square foot plot of land was left barren.

Late in September I went to meet with the kindergarten and first grade teachers at Oñate. We looked at the future garden site together and discussed their vision for the project. All teachers were interested in having an edible component to the garden. Many also showed interest in creating a native plant habitat, or a sort of 'nature trail' that was integrated with the edible garden. Keeping their students' interests in mind, teachers requested a colorful plant palette that would attract hummingbirds and butterflies. After everyone had a chance to contribute, we agreed on the basic concept of an edible garden in raised beds, surrounded by a habitat garden consisting of native or naturalized, low water use plants.

After discussing goals for the garden, I explained how Dr. Taylor's service learning course worked. In addition to helping design the garden, I would visit a class once a week to teach garden design lessons. This way, we could include students in the design process, while teaching math, science, and other content standards. All of the teachers expressed interest in design lessons for their students. There are three kindergarten classes and three first grade classes at Oñate, each with about 18 students. Each kindergarten class has a head teacher and at least one classroom aide, and first grade classes each have one head teacher.

We decided that the best method for reaching all of the students would be to have my visits rotate between classes. Each week, I would visit one kindergarten and one first grade class, each for about a half-hour or 45 minutes. Teachers of the classes not visited would receive the lesson plan for the week and teach it to their class. That way, every class in B-Building would be learning garden design concepts and would have a chance to participate in the design process.

Each week, I developed a lesson plan that taught basic garden design and natural systems concepts while meeting New Mexico State Educational Content Standards for kindergarten and first grade. These lessons were also designed to engage multiple intelligences and give students practice with different learning processes. Teaching the lesson to at least two classes provided the opportunity to evaluate the lesson and make appropriate revisions. The result of this curriculum development is a set of lesson plans that kindergarten and first grade teachers can use to assist in the development and design of a school garden for chidren ages five to seven (see Appendix A for the revised and completed set of lesson plans).

As these lessons revealed students' desires in regards to their edible garden, they informed the garden design process. The following record illustrates each visit to Oñate's kindergarten and first grade classes, additional meetings with teachers, and the presentation of a preliminary, or "Phase I" garden design to teachers and students.

B-Building Garden Area, Looking South

September 20, 2007

The first lesson was designed to raise interest among students for the creation of an edible garden at their school. The lesson was called "What Will We Grow in Our Garden?" We began by gathering as a group, closing our eyes, and imagining we were tiny sunflower seeds that slowly grew up through the soil, stretched up toward the sun, and burst open with a great vibrant sunflower. This activity, entitled "Growing Up!," was used at the beginning of every visit in order to awaken students' enthusiasm for growing things and help them make connections between their own growth and the growth of other living things around them. On subsequent visits, students were given the chance to choose what kind of plant they would pretend to be.

The second part of the lesson focused attention with the reading of *The Tiny Seed* by Eric Carle. After reading, we had a class discussion about plants the children had grown before and what kinds of plants they eat everyday. Students then had the opportunity to draw pictures of the plants that they wanted to grow in their school garden. After students were done drawing (many took up both sides of the 11X17 page), they had a chance to share their drawings with the rest of the class. We divided them up in groups: flowers, fruits, vegetables, and non-edibles. Students were surprised to find themselves in more than one group. Most classes decorated their classroom walls with the drawings. When they were taken down, they became the first page in students' garden journals.

"What Will We Grow in Our Garden?
Student Drawing (Kindergarten)

After every class participated in the lesson, I compiled the following list of desired plants and garden features :

trees (in general)	potatoes	clouds
apple trees	carrots	shade
olive trees	spinach	wind
cherry trees	onions	rain
grass (in general)	plants (in general)	butterflies
tomatoes	lettuce	birds
cucumbers	strawberries	hummingbirds
watermelons	blueberries	bees
pumpkins	raspberries	snakes
flowers (in general)	grapes	worms
roses	soil	lizards
sunflowers	sunshine	children

Evaluation / Revisions:

The lesson was successful in raising student enthusiasm and for determining features the children would like to have in their garden. To further understand what kind of garden environment the children envisioned, a discussion about why they wanted each particular thing would have been helpful. An extension of the lesson could include a discussion of desired garden activities. Additional assessment of what the children already like and don't like about their existing schoolyard would have been useful as well.

"What Will We Grow in Our Garden?
Student Drawing (First Grade)

"What Will We Grow in Our Garden?" Student Drawings

September 27, 2007

The second lesson was called "Starting Observation Journals," and introduced the idea of spending quiet time in the garden area to observe what happens there. The lesson began with "Growing Up!" and a quick review of what the children did the previous week, reminding students of the garden area location and what they wanted to grow in it. Each student received a journal with white paper pages fastened together with yarn. As a group, we traveled out to the garden area, where students were instructed to find a place to sit, at least two arms length from their neighbor. As they sat quietly, students concentrated on using their senses and recorded their observations; what they saw, smelled, heard, and felt. After about ten minutes, we returned to the classroom to discuss our experience. With a group discussion, we made a list of all the things the students observed (trees, rustling leaves, cars, sunshine, dirt, etc.). After making the list, we went back through it and classified each thing as plant, animal, or man-made. The children discovered that many of their observations didn't fit into these categories (soil, rocks, sun, clouds). As a result, we discussed possible categories for these things.

After this discussion, students were given the chance to add to their drawings. Teachers were encouraged to take students out for regular observation times during which students could add to their journals and record changes over time.

Evaluation / Revisions

Students, especially the kindergarteners, had a difficult time sitting quietly and not moving around. More preparation was needed before leaving the classroom in terms of reviewing the five senses and how they would use them to collect observations. Breaking up the quiet time in sections, in which the instructor guides students through one sense at a time ("close your eyes and listen," "cover your ears and watch," etc.), would probably be more successful. Visiting the garden area in small groups might be less distracting for the children as well. Some students filled their journals with drawings during this first short visit, so the journals should be designed to add pages easily.

October 4, 2007

The third lesson introduced students to another way of observing their garden area, through measurement. The lesson was titled "Human Rulers: Measuring With Your Body." After the "Growing Up!" activity, we reviewed the previous week's lesson. We briefly discussed how they used their senses and what they experienced. The importance of measurement was introduced with a discussion of how designers need to record the size of the place they are designing, making it important to know how to measure a site.

As a group, we discussed concepts of measurement: things we measure, tools for measuring, distance (near and far), ways to describe measurement, and how to estimate a measurement. Students had a chance to examine rulers, triangles, a meter stick, and a measuring tape. Students were asked, "what if you have to measure something, but you forgot to bring your ruler?" Designers often use their own bodies to measure things when they don't have their measuring tape.

Students were introduced to the idea of using their hand span to measure. They compared the size of their hand span with their neighbor and searched the classroom for one thing that was the same size as their hand span. As a group, they shared the different things they found. Students were asked to think of what they would use their hand span to measure in a garden (distance between plants or growth, for example.)

Students then received a twelve inch long piece of string and were asked to find one thing in the classroom that was the same length as the string. As with the hand span hunt, students shared their findings. Students were then asked to think of ways that they could measure larger areas. The method of pacing was introduced, and in groups of four, students counted off the paces it took to cross the group meeting area. The whole class counted and compared different pace lengths. Finally, as a group, we traveled outside to pace off the width of the garden area. Students were asked to count silently in their mind, and share their results at the end.

Evaluation / Revisions

Students visibly enjoyed using their own bodies to measure, especially when they got to count off paces. Results of pacing the garden area should have been recorded. More discussion was needed at the end regarding why measurement is important in design.

October 9, 2007

Today's lesson was called "Shapes in the Garden." Building from the idea that measurement helps draw a map of a space, this lesson introduced students to the idea of shapes representing exising features and possible design features. The class was split into two groups for this activity.

For this lesson, each group used a 30X42 plan view of B-Building and the garden area. Imagining they were birds flying over their school, students began to understand the plan view of their building and garden area. Students each received two colored shapes (squares, triangles, circles, and rectangles). One at a time, they were asked to come up to the map, identify the name of their shape and what they would like it to represent, and place it somewhere in the garden area. The shapes could not go over the edges of the garden area or overlap another shape. When all the shapes had been placed, each group discussed the resulting design among themselves. We

"Shapes in the Garden"
Kindergarten Design

"Shapes in the Garden"
First Grade Designs

examined which shapes fit well, and which shapes did not. Each group decided what they would like to share with the other group about their design. At this point, we rejoined as a whole class and placed the plans up where everyone could see. Members from each group had a chance to tell the other group about their design and comment on the similarities and differences between them.

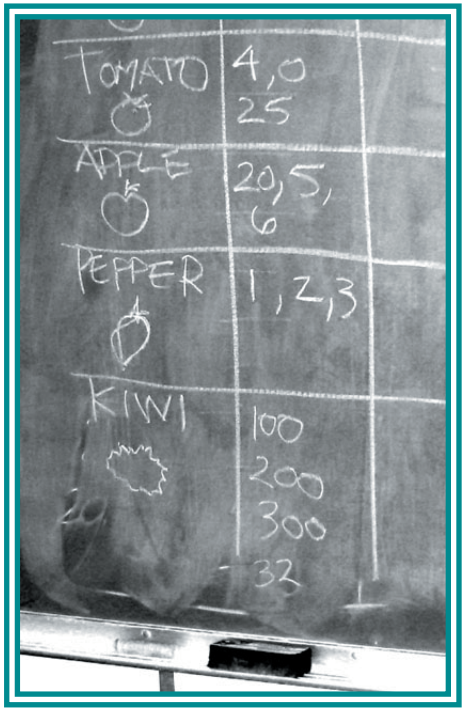
Evaluation / Revisions

This activity introduced a concept that is fairly abstract for children in kindergarten: the idea of a plan view map. Many children had trouble understanding what the map represented. A 3D model that the children could look down on would make the concept easier for them to grasp. Additional introductory lessons would also help. A felt board would provide a better map base. Construction paper with removable glue was used (like a post-it note), which made the shapes stick together and to the children's fingers. Finally, this activitiy needs a lot of space. In the first grade classroom, children were crowded which made taking turns difficult. Chairs and desks should be rearranged to allow ample room for the lesson.

November 8, 2007

Fall break and parent conferences caused a month-long gap between my visits to Oñate. We started up again with a lesson called, "Where Seeds Come From." This lesson aimed to bring students' attention back to the cycles of living things by demonstrating where seeds come from and the part they play in the plant life cycle. Students were very excited to act out the growing process, and in the spirit of Halloween, we pretended to be "Growing Pumpkins" instead of sunflowers. After becoming scary, happy, and crazy jack-o-lanterns, we began the lesson.

The main ingredients for this lesson included a variety of fruits with varying numbers of seeds. We used tomatoes, oranges, apples, kiwis, and bell peppers. As I held each fruit up, students identified them and I recorded the different types on the blackboard. Then, students were asked to give their prediction of how many seeds were inside each fruit. We recorded their predictions on the blackboard.



First Grade Predictions

Students broke into pairs to do the seed counting. Each pair received one half of one kind of fruit. They worked together, using craft sticks to dig seeds out and count them. As groups finished counting, they came up to record the amount of actual seeds in their fruit up on the blackboard. First graders were encouraged to write the numbers themselves. When all the groups had finished, the whole class figured out the total number of seeds in each fruit by doubling the numbers on the board. Then we compared the actual numbers to their predictions. The kiwi, by far, had the most seeds (over 200), while some of the oranges didn't have any at all.

Counting Seeds

After discussing the results of the seed-counting experiment, students were asked to explain where seeds come from. "Fruit!" they yelled, as a group. When asked to explain where fruit comes from, they responded, "Plants!" Then, they were asked to describe where plants come from. "Seeds!" they replied. During this question-answer session, I drew a corresponding diagram of the plant life cycle, including the seed, the plant, and the fruit on the blackboard. We discussed how the plant life cycle continues, with each plant making more seeds, which in turn grow into more plants. The lesson was concluded with a reading of *A Seed is a Promise,* by Claire Merrill.

Evaluation / Revisions

Students worked very well in pairs, sharing the task of seed counting. They enjoyed getting sticky hands while discovering how close their predictions were. Several predictions were very close to the actual seed counts. Even though the grocer assured me that the oranges I bought were not seedless, some oranges did not have seeds. This would have left some groups with no seeds to count, but luckily there were extra peppers. Students should be asked to draw their own version of the plant life cycle and include it in their garden journal. Another way to help them learn the plant life cycle would be to place

Digging for Orange Seeds

graphic representations of different stages of the plant life cycle in a circle on the floor. As students move around the circle, they would name their stage in the growth process: seed, plant, flower, fruit, and so on. This lesson could also be extended with an art lesson of drawing the cross-sections of the fruits, introducing concepts like light, shade, and shadow.

November 15, 2007

The lesson for this week was entitled, "Parts of Seeds and Bulbs." In this lesson, students explored parts of a lima bean to discover where plants come from and what the different parts of a seed are called. Students were also introduced to the different parts of a bulb in order to prepare them for planting bulbs in the garden area. To supplement the bulb planting, I brought already planted bulbs - one amaryllis and one paperwhite to each classroom. This would allow the students to watch the growth of the bulb daily inside their classroom.

Students each received two lima beans: one that had been soaked overnight and one that was dry. They were asked to describe the similarities and differences between the two beans. Then, students peeled the seed coat off of the bean. We discussed why the seed might need a coat (to stay warm, protected). Students then split the bean open, revealing a tiny baby plant. Each student was given a magnifying lens to locate and observe the tiny plant up close. Students were asked to explain how the seed gets food until it can send its roots down to the soil. Most were amazed (and a little grossed-out) to discover that the tiny plant eats its own body (cotyledon).

Each student received a worksheet with the outline of a bean. On this worksheet, they were asked to draw in each part of the seed, and label it. An example was provided up on the blackboard so they could copy spelling if needed.

Discovering Parts of a Seed with Dr. Taylor

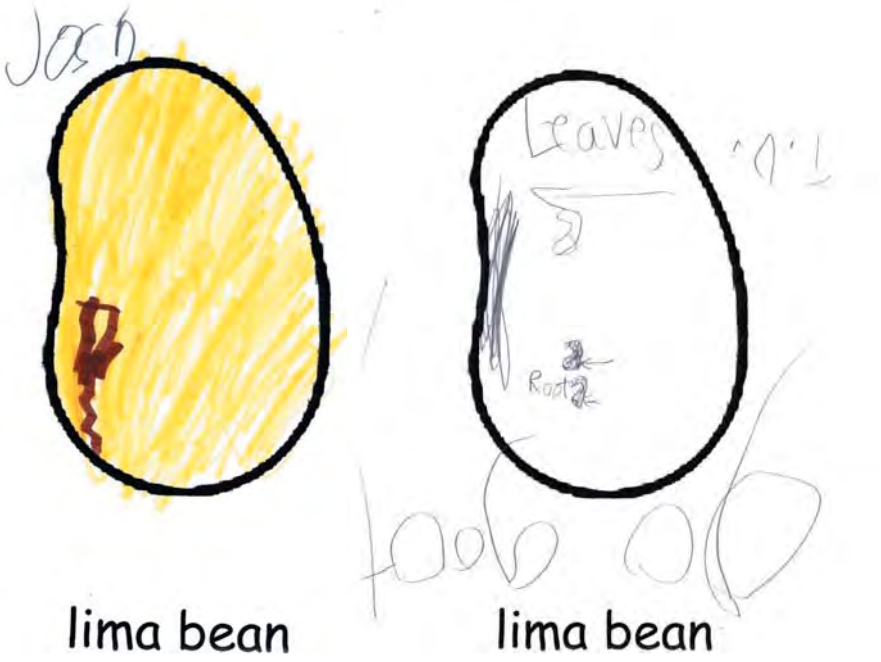
After students finished their drawings, we gathered as a group to look at the parts of a bulb. Using a bulb that was cut in half, we identified the tunic (the dry, papery outer part), the scale leaves (moist, inner part), and the roots.

Finding the Baby Plant

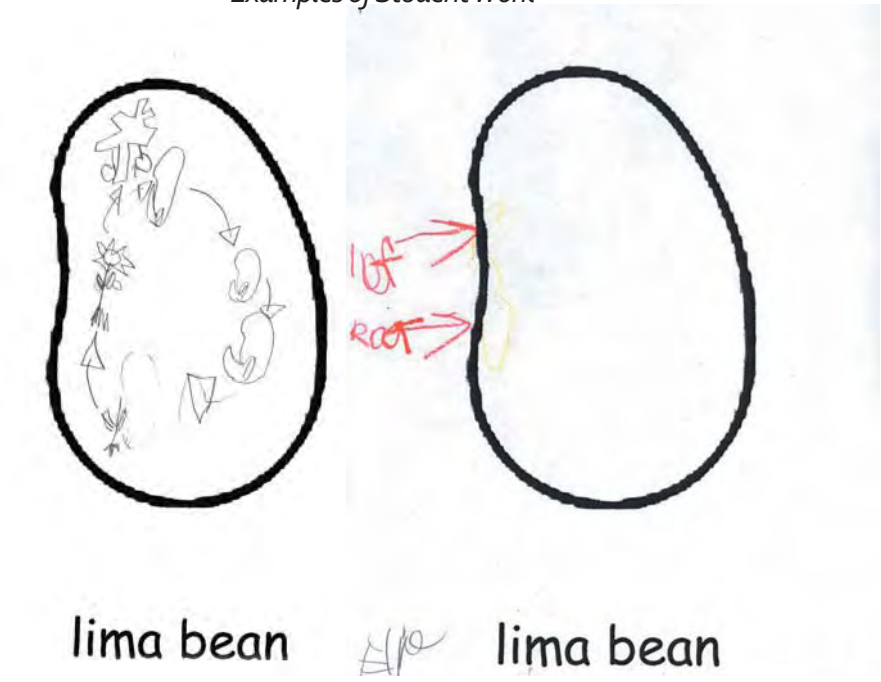
Evaluation / Revisions

Dr. Anne Taylor came to observe one of the classes during the "Parts of Seeds" activity. She suggested that I draw the life cycle of the bean, and how the tiny plant grows up on the chalkboard. The drawing of the bean growth was very helpful for several children in understanding how the little white thing in the bean became a plant. Also, many children handled the lima beans roughly and accidentally broke off the baby plant before they had a chance to examine it with their magnifying lens. Emphasizing caution with the beans would be a good idea at the beginning of the lesson, and several extra beans should be on-hand.

Drawing the Bean Growth Cycle



"Parts of A Seed"
Examples of Student Work



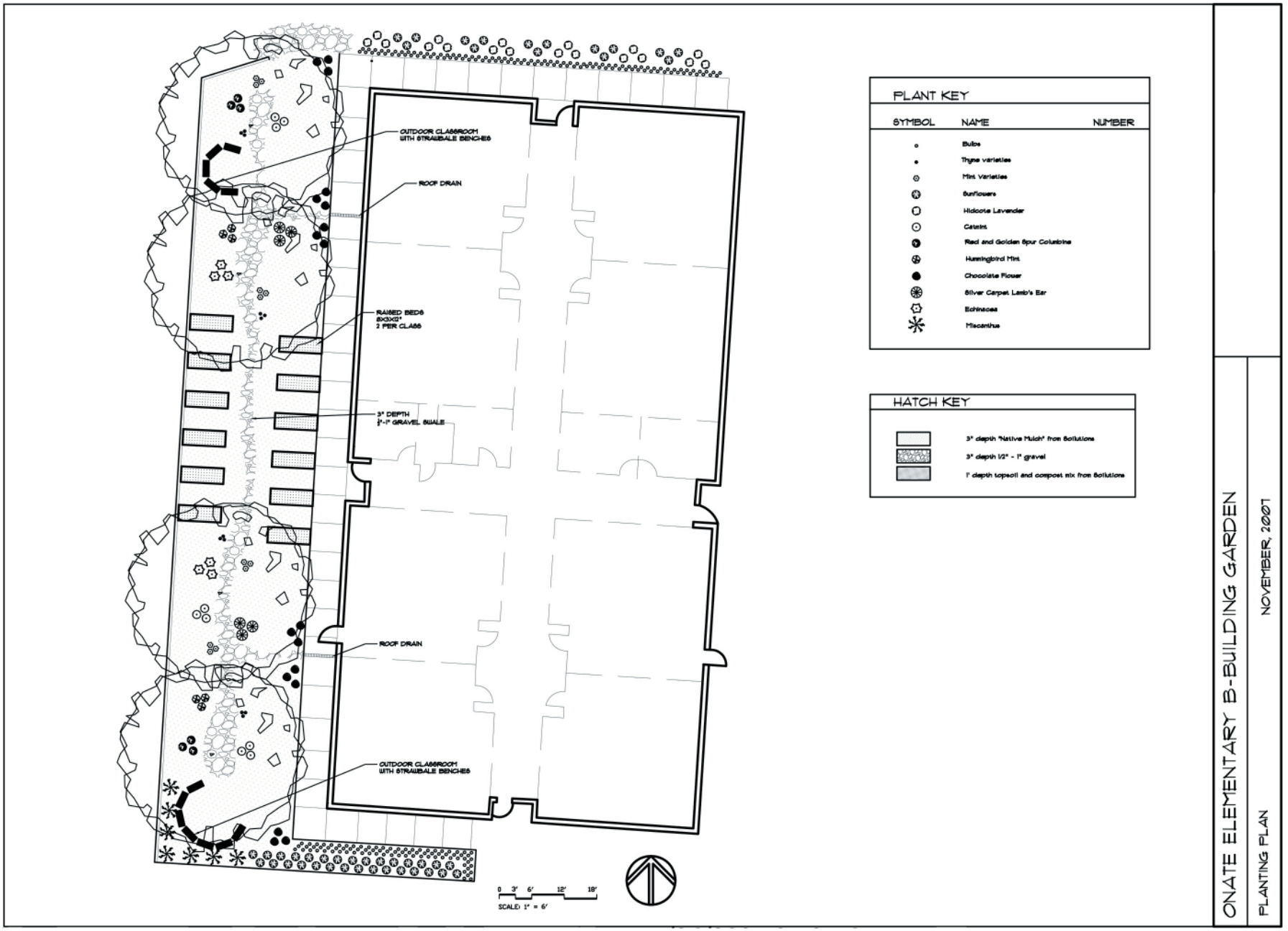
November 28, 2007

Today I met with all the kindergarten and first grade teachers to present a preliminary "Phase I" garden design, including a plant palette and a budget. This design and budget were to be helpful in writing proposals for grant money and gaining support from the Oñate PTA.

The main idea for the garden design followed the conclusions from our meeting in September, including raised beds for edible crop cultivation surrounded by native or naturalized herbs and flowers. A cobble swale, bordered with native plants and herbs, would accent the existing drainage patterns in the garden area and utilize the water harvested from the school roof. To further save water and deal with maintenance issues, an olla irrigation system would be employed, using a combination of the traditional clay pots and donated, recycled, plastic milk jugs with holes cut out. This system prevents any irrigation water from evaporating and could easily be adapted to work with a drip system in the future. School maintentance currently hand irrigates the existing mulberry trees as no automatic irrigation system is in place. Additionally, straw bale seating arranged in semi-circles would provide temporary outdoor classrooms and gathering areas until more funding becomes available for more permanent seating elements. As the bales deteriorated, they would be replaced, and used as much-needed mulch.The design presented to the teachers included color renderings in plan view and section. A black and white copy of the plan is included in this report. Additionally, a plant palette and irrigation techniques board was provided, as shown on the following pages.

Teachers responded positively to the design, but were a little concerned about the budget. However, grant funding and community donations will likely make the project a reality. A study done in California showed that most school gardens cost an average of $2,000.00 (Chu, 2007). The teachers said that they would plan to meet with the PTA to present the project and discuss funding opportunities. We posted the design in the main hallway for students, parents, and visitors to see. Teachers individually discussed the design plans with their classes.

The most important part of the design for the moment was the placement of the bulbs. We had planned a bulb planting activity


OUTDOOR CLASSROOM WITH STRAWBALE BENCHES
ROOF DRAIN
RAISED BEDS 8'x3'x12" 2 PER CLASS
3" DEPTH ¾"-1" GRAVEL SWALE
ROOF DRAIN
OUTDOOR CLASSROOM WITH STRAWBALE BENCHES
0 3' 6' 12' 18'
SCALE: 1" = 6'
PLANT KEY
SYMBOL NAME NUMBER
Bulbs
Thyme varieties
Mint Varieties
Sunflowers
Hidcote Lavender
Catmint
Red and Golden Spur Columbine
Hummingbird Mint
Chocolate Flower
Silver Carpet Lamb's Ear
Echinacea
Miscanthus
HATCH KEY
3" depth "Native Mulch" from Solutions
3" depth 1/2" - 1" gravel
1' depth topsoil and compost mix from Solutions
ONATE ELEMENTARY B-BUILDING GARDEN
PLANTING PLAN
NOVEMBER, 2007

B-BUILDING GARDEN

November, 2007

ONATE ELEMENTARY

HERBS


wooly thyme


creeping thyme


lime thyme


silver thyme


spearmint


chocolate mint


apple mint


pineapple mint

GRASSES


blue avena grass


miscanthus

FLOWERS


catmint


echinacea


chocolate flower


red spur columbine


yellow spur columbine


agastache / hummingbird mint


sunflowers


lamb's ear


hidcote lavender

OLLA/CLAY POT IRRIGATION

B-Building Garden Program Proposed Budget

Oñate Elementary

Nov. 23, 2007

Item	Unit	Unit Cost	Number	Total Cost
CONSTRUCTION				
strawbale benches	EACH	$4.00	12	$48.00
swale gravel	CU.YD	$25.00	3	$75.00
2x12X16' boards	EACH	$18.00	36	$648.00
hardware	LUMP SUM			$50.00
olla pots	EACH	$12.00	10	$120.00
milk jugs	EACH	$0.00	40	$0.00
topsoil blend	CU.YD	$28.00	10	$280.00
compost	CU.YD.	$32.00	1	$32.00
native mulch	CU.YD	$20.00	20	$400.00
subtotal				$1,653.00
10% contingency				$165.30
SUBTOTAL				**$1,818.30**
GARDENING				
plants	EACH	$6.00	80	$400.00
watering cans	EACH	$13.00	3	$39.00
small shovels	EACH	$5.00	10	$50.00
seeds	EACH	donated		$0.00
egg cartons	EACH	$0.00		$0.00
subtotal				$489.00
10% contingency				$48.90
SUBTOTAL				**$537.90**
GRAND TOTAL				**$2,356.20**

for all the classes in order to raise the school community's awareness of the garden project in the spring. During this meeting we designated spaces for each class to plant their bulbs. Kindergarten classes planted their bulbs near the entrance on the south side of the building, and first grade classes planted on the north side. After our meeting I worked with some of the teachers to loosen the soil where we planned to plant.

Kindergarteners' Bulbs Emerging in the Spring

November 29, 2007

Today was the day the children had been waiting for, the day for planting bulbs. Unfortunately, the weather was cold and rainy. A reporter from Albuquerque Public Schools had come out to Oñate to hear the story of the garden and photograph the children planting. The story would be run in APS news the following week, and in the Albuquerque Journal shortly after (see Appendix E). We decided that a little rain wouldn't keep us from planting the bulbs.

Before heading outside, we reviewed the parts of a bulb. Students were asked to demonstrate which side of the bulb went down into the soil, and which part should face up. Rulers with tape marks showed students how deep to plant their bulbs. We also discussed rules for planting in the garden area. Children came up with ideas like "no pushing, and no tripping," to show care for their fellow students. "Use the shovels safely" showed concern for their own safety, as well as that of others. "Don't step on the bulbs," demonstrated care for the plants in the garden. After establishing a basic set of rules, we sang a round of "The Plant the Bulbs Song." For words to the song, see the "Planting Bulbs" lesson in Appendix A.

We planted in groups of five so students could use their own shovels. Students planted several bulbs each. Teachers used classroom funds to purchase bulbs and some bulbs were donated. We planted a mixture of daffodils, tulips, crocus, and hyacinth. Approximately 200 bulbs were planted.

Evaluation / Revisions

Planting in small groups worked smoothly and children enjoyed the process. The area in which the bulbs were planted needed something to distinguish it from the surrounding areas and inform other students that plants are sleeping there. The orange flags used to label each classroom's area were flimsy and didn't work. Possible solutions include mulching the area above the bulbs and lining it with wooden logs or beams to define the area and keep feet out.

Planting Bulbs: Digging the Holes
Photo by John Miller, APS Reporter

Planting Bulbs: Patting Down the Soil
Photo by John Miller, APS Reporter

December 6, 2007

Today's activity was called "Parts of a Plant." In this lesson students learned the four major parts of a plant, investigated how the different parts work together to help keep the plant alive, and reviewed the plant life cycle. This lesson began by showing students two potted plants: one with a healthy root system and one that has been cut from its roots. One student was asked to come up and gently push on the two plants. When one fell over, I asked students to explain why that might have happened. Students agreed on the idea that the plant must not have any roots, and it was going to die. Gently removing the healthy plant from its container allowed students to observe the root system of the plant. In this case, we used a pansy, and the students were shocked to find that the roots were white.

As a group, we identified the remaining parts of the plant: the stem, the leaves, and the flower. For each of these parts, students identified how they keep the plant alive. We sang the "Parts of the Plant" song to reinforce these ideas. Words to this song can be found in the "Parts of the Plant" lesson in Appendix A.

The students now had a chance to create their own collage/ drawing of the four parts of the plant. With brown paper, glue, craft sticks, crayons, and markers, they drew their own plant diagram, complete with labels for each part. An example was provided up on the blackboard to help guide students with spelling.

Evaluation / Revisions

During this lesson it became clear that some children do not like to sing and can be given the choice not to participate. It was important to continue singing the song without making them feel bad, or embarrassing students that do enjoy singing. Otherwise, the collage making activity was fun and engaging. It was clear that students were becoming more proficient in their writing skills.

Parts of a Plant Diagram

Examining Roots
Photo by Beate Ortley, UNM Architecture Program

Students Share Their Work

January 10, 2008

After winter break, we did an activity in which the children were able to grow some snacks. This lesson was called, "Soak and Sprout Snacks," and reviewed parts, properties, and functions of seeds and plants while connecting the recent plant lessons to everyday food. After "Growing Sunflowers," we reviewed the parts of a seed and a plant with a Bean Pop-Up Book.

Students then learned that they would have a chance to grow their own classroom snacks. Each student received a plastic bag with a paper towel in it. Each table group received a bowl with a variety of sprouting seeds, including mung beans, peas, radish seeds, and sunflower seeds. Students were instructed to first wet the paper towels and then count out a certain number of seeds (20 for kindergarteners, 50 for first graders). They then placed these seeds on half of the paper towel, folded the paper towel over, and then placed the paper towel back in the plastic bag, closing the zipper. Each student wrote his or her name on their sprout bag and the bags were placed under the window. Students guessed about how many days it would take for the seeds to sprout and how the sprouts would taste.

Evaluation / Revisions

This activity was much more of a challenge than expected. Students had great difficulty maneuvering the wet paper towel. Additionally, the activity took place right before a long weekend. Teachers were concerned the sprouts would grow too big and sent them home with students, making it difficult to judge the success of the lesson or if the children enjoyed eating the sprouts (or ate them at all). A better method might be to use a number of glass jars to sprout several seeds, shared by the class. Students could see through the glass, unlike the paper towel, and therefore observe the sprouting process.

January 17 & 24, 2008

Seasons have changed, meaning it was time for another observational experience in the garden area. The lesson for these days was titled, "Winter Word Walk and Poetry Cubes." We began by discussing poetry and sharing poems we know. I brought a poem about changing seasons and read it out loud. We discussed how the seasons had changed since the students had started school. I told them that we were going on a "Winter Word Walk," in which we would use our senses to observe the garden area. We reviewed our five senses and got ready for a quiet walk around the garden area.

After returning to the classroom, students shared their observations. Each observation phrase was written on one side of a poetry cube (a large cardboard cube with different colored paper on each side). To ensure that each child got to contribute a phrase, several words and phrases were written on each side of the cube. We also discussed the concept of a cube, 2D squares vs. 3D cubes, and how many sides those shapes have. After the cube was full, each student took a turn rolling the cube. Then they could choose a phrase that landed on the up-side. Taking turns, the class created a poem using these phrases. I wrote the poem in large letters up on the board. After everyone rolled the cube, the poem was finished. Together, as a class, we read the poem out loud. Students were pleasantly surprised at their poetry and how it described the environment outside, remarking that it was "like a song."

Imagine we are tiny seeds...

... pushing the soil off, we see the sun...

Photo Series by Beate Ortley, UNM Architecture

A poem written by one of the first grade classes was particularly rhythmic:

nest in the tree
windy and cold
snowy
clicking cars
bird on the fence
brown leaves
humming sound
muddy ground
muddy ground

Evaluation / Revisions

This lesson was very popular with students and teachers. It was successful in merging a number of subjects (language arts, geometry, and science) in a way that helped students connect with their school environment. Teachers remarked that they would continue to use the poetry cube to conduct observation and journaling activities as the seasons continue to change. Later, during the "Mapping My Classroom lesson, students identified the cube as an important part of their classroom. I taught this lesson two weeks in a row. At this point in the year several teachers had been occupied with testing and did not have a chance to keep up with the new lessons every week.

February 7, 2008

Continuing with the theme of connecting the students to their environment, today's lesson, "Circle Snacks," was aimed at helping students find circles in the world all around them, including in their food. The activity began by asking the students to sit in a circle. We discussed how that felt, if they liked it or didn't. We agreed that it was helpful to sit in a circle, because everyone could see each other. I presented a circular paper cut-out and a ball and asked students to describe the difference between the shapes (2D and 3D). Students were asked to identify circles and spheres in their classroom. Then I showed the students a number of pictures of circles in our environment (water drops, bubbles, a nest with eggs, bicycles, a kiva at Bandelier, and others). After that, I asked them to think of circles that we wear (belt buckles, earrings) and circles that we eat.

Students then returned to their desks where they could choose from a variety of circular and spherical snacks (raspberries, blueberries, blackberries, tomato halves, cucumber and carrot slices). They were allowed to choose one of each kind, but before they ate it, they had to identify the circles and spheres by drawing them on their paper. If they saw additional shapes, they could draw those as well. After they were done snacking, each table held up their drawings and shared their favorite circle snack with the rest of the class.

Evaluation / Revisions

This lesson went very smoothly. The students became excellent circle sleuths, discovering circles within circles (spots on the eggs) in places I hadn't even thought of. Although at first they were a bit dismayed that the snacks were fruits and vegetables, they enjoyed them in the end, grinning as raspberry juice dripped down their chins. In order to run smoothly, this activity requires a great deal of preparation (fruit and vegetable cutting).

...which gives us energy and makes us stretch...

... and we sway in the breeze as our roots keep us in place.
Photo Series by Beate Ortley, UNM Architecture Program

February 21 & 28, 2008

On both of these days, I taught the "Mapping My Classroom" lesson. This lesson introduces students to basic concepts of mapping and the use of 2D shapes to represent real things in space. To begin, we sat in a circle and discussed maps, what they are and what they are used for. Then, I asked the students to pretend they were birds flying very high in the sky. We looked at maps of the globe, zooming into the United States, and New Mexico. Finally, after a detour for a treasure hunt on a deserted island, we reached Oñate School. The students were delighted to see the map of their classrooms and the garden area. We pretended to be birds with x-ray vision, seeing through the roof of the school building. Together, we highlighted with a colored marker where their classroom was located.

I told the students that we were going to create a map of their classroom, so they needed to start thinking of all the major features that they should include (doors, windows, desks, etc.). I placed a 24x36 white piece of paper on the floor in the middle of the circle. We began with the walls and traced the contours of the classroom, leaving space for the window and the door. Then, students offered ideas for major features to include, and the shape these features should be. For example, some desks were square, some tables were round, and others were hexagonal. When students suggested adding the chalkboard or pictures on the wall, we discussed how they might not be able to see them from above, but we could draw a line to represent the feature, if it was determined to be an important part of the classroom.

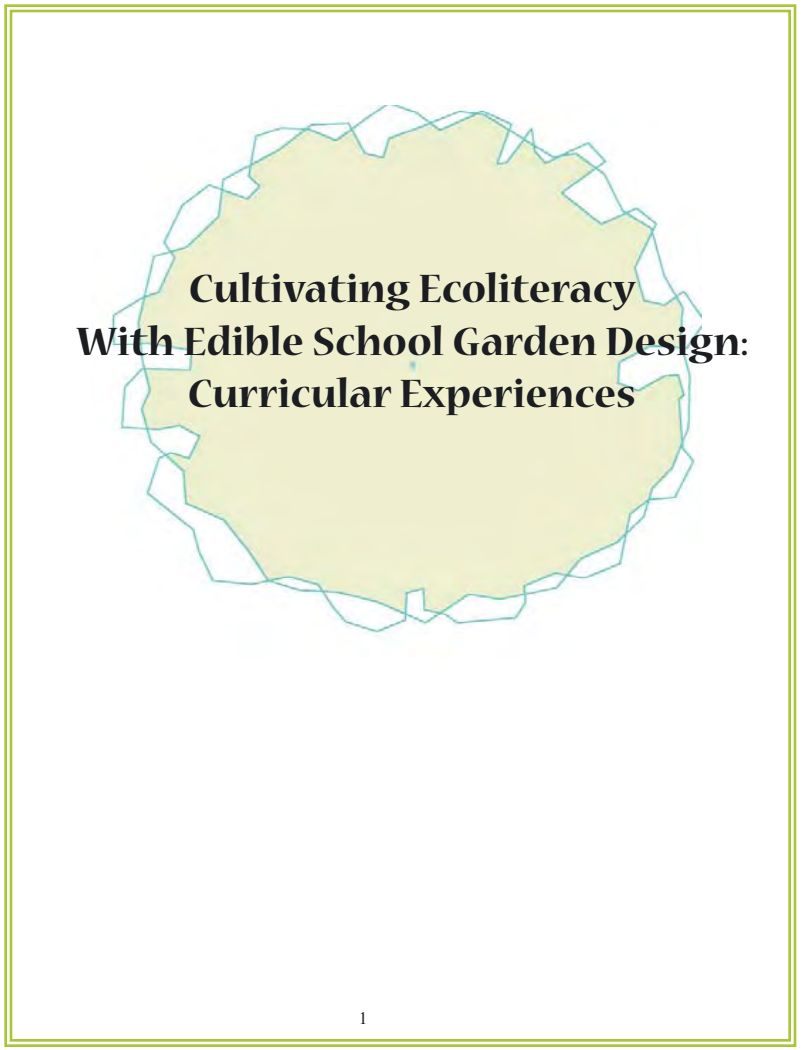
After completing the map, I pinned the map up on the board. Then, I asked everyone in the classroom who was wearing purple to walk to the place I pointed to on the map. I asked the remaining students to verify that those who had gotten up had traveled to the right location in the classroom. After everyone had a chance to locate a place physically from the map, we discussed what the students thought about their classroom map.

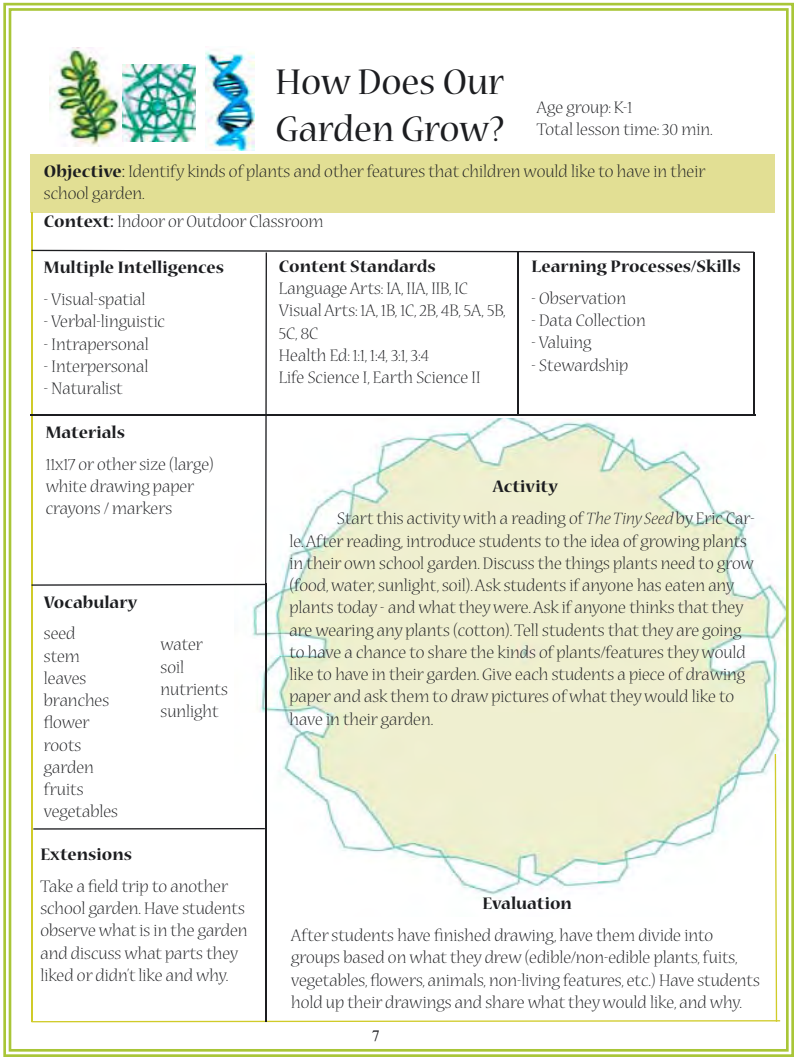
Evaluation / Revisions

If given the chance, students would have created a map that included everything in the classroom. They expressed great desire to include even the tiniest details. This enthusiasm showed me how closely students are attached to various areas, objects, and features in the classroom environment. When asked what they thought of the map, they said that they really liked it and would like to map more of their school. They especially liked learning architectural symbols for things like doors, windows, and chairs. Kindergarteners really enjoyed pretending to be birds and flapping their wings. As a follow up assignment, teachers asked students to draw their own map of their bedroom at home. Another extension of the assignment would be to map various parts of the school, including the schoolyard. In retrospect, it would have been helpful to conduct this lesson before the "Shapes in the Garden" lesson.

Covering the Bulbs
Photo by John Miller, APS Reporter

For the full, revised set of lesson plans developed through this pilot study, please reference Appendix A: "Cultivating Ecoliteracy with Edible School Garden Design: Curricular Experiences." This series of curricular experiences is intended to serve as a unit of instruction that introduces students to important concepts of garden design and natural systems and cycles. These lessons could be used in conjunction with designing and constructing a new edible school garden. They could also be used with an established garden program. A reduced image of the cover and a sample lesson plan are included below.





Chapter Four

Synthesis: A Framework for Edible School Garden Design in Albuquerque

B-Building Garden Site Analysis

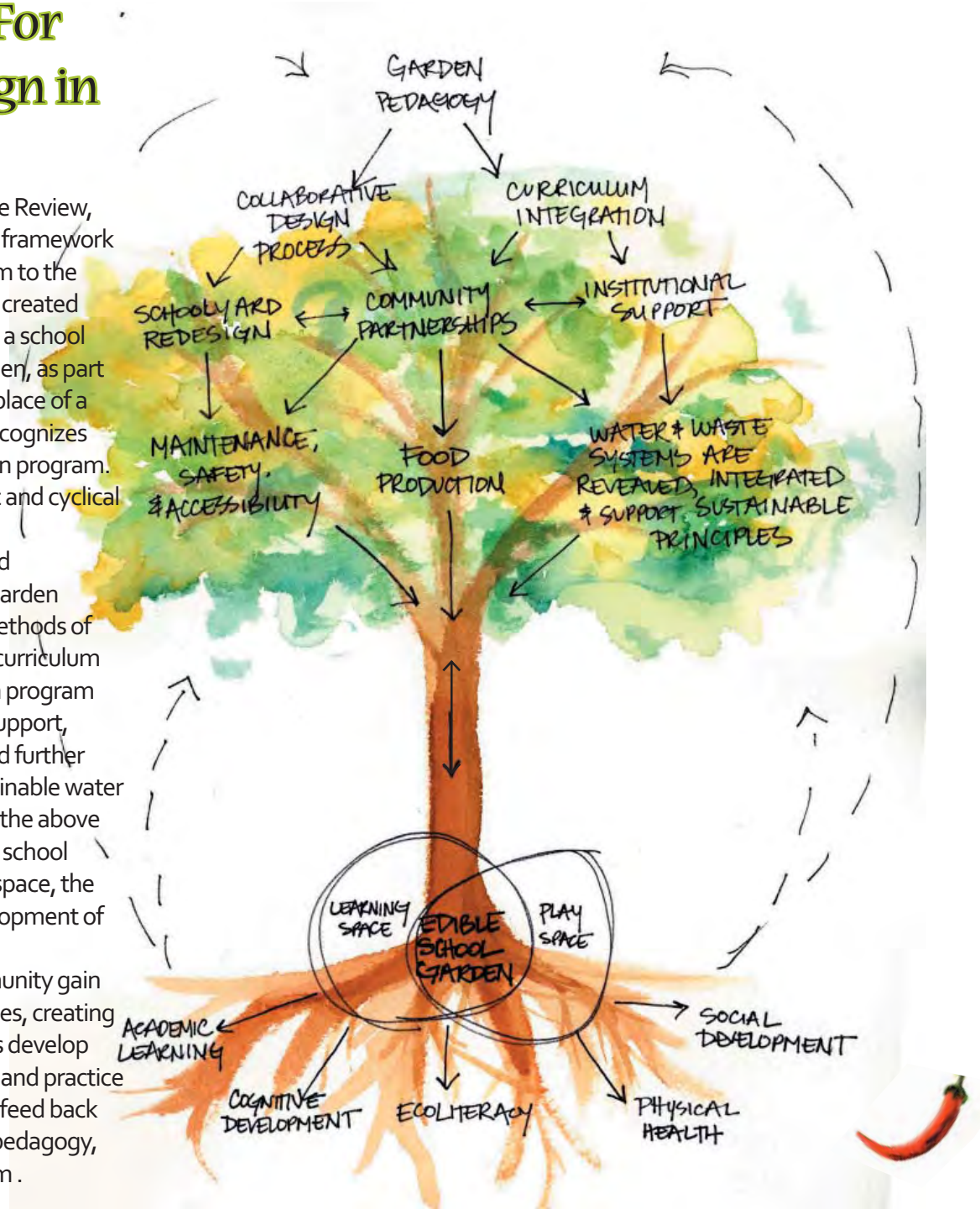
B-Building Garden Design

Synthesis: A Framework For Edible School Garden Design in Albuquerque

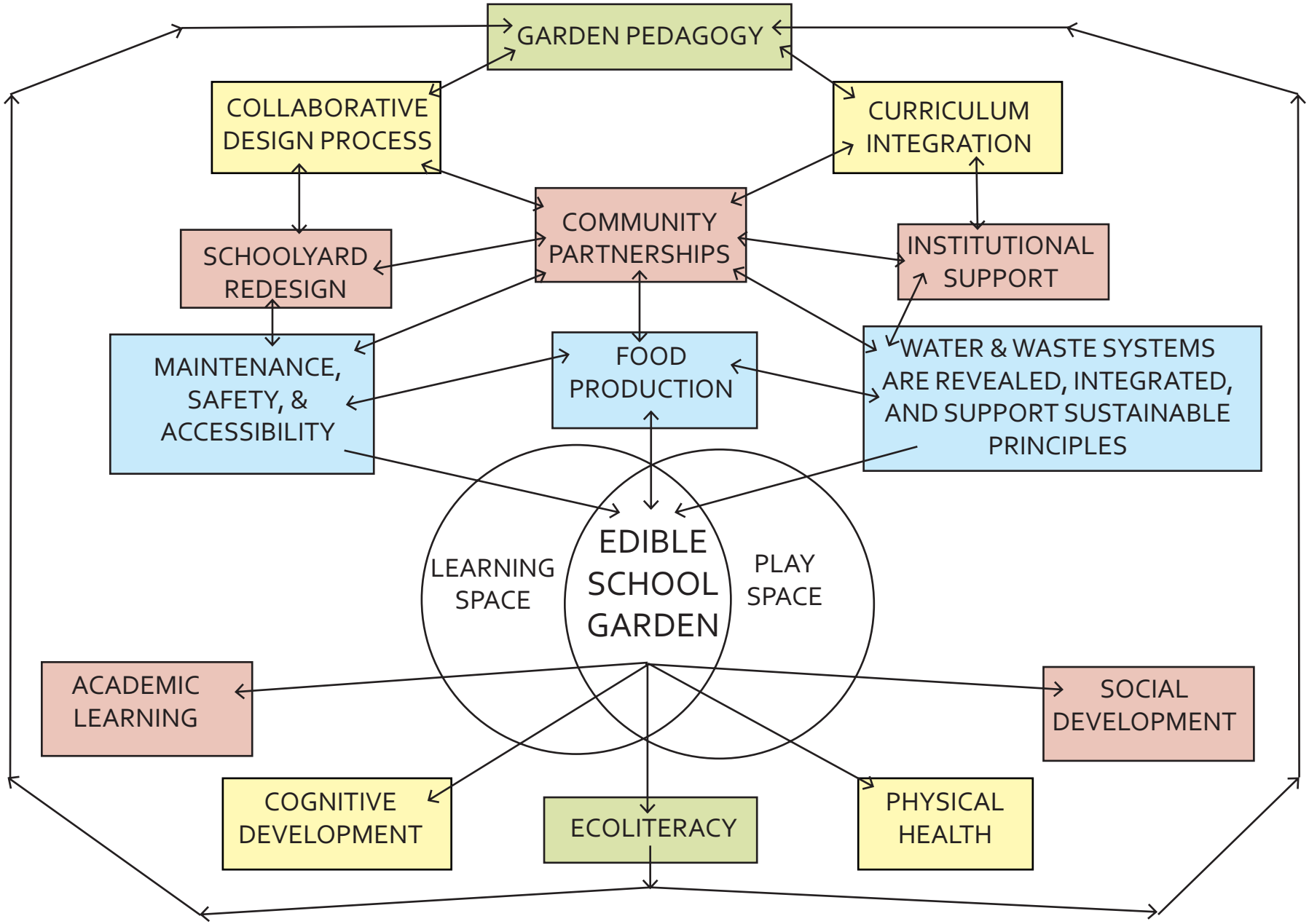
A synthesis of information gained from the Literature Review, Precedent Study, and Pilot Study led to the formation of this framework for Edible School Garden Design in Albuquerque. The diagram to the right demonstrates the causal pathways and feedback loops created within the framework. This framework describes the process a school community can follow to create their own edible school garden, as part of a larger schoolyard ecosystem. This framework takes the place of a step-by-step guide for starting a school garden, because it recognizes the site-specificity central to a successful edible school garden program. The metaphor of the tree is used to demonstrate the organic and cyclical nature of this framework

This study has shown that the fundamental goals and philosophy (the garden pedagogy) behind an edible school garden program provide guidance for the structure, purpose, and methods of the program. The garden pedagogy is then furthered by full curriculum integration and a collaborative design process for the garden program *and* physical site of the garden. These components rely on, support, and create community partnerships, institutional support and further schoolyard redesign. Food production, the inclusion of sustainable water and waste systems, and a safe, accessible design result from the above components and provide core physical features of the edible school garden. Striking a balance between play space and learning space, the edible school garden becomes a setting that facilitates development of the whole person, as an active member of their community,

As a result, students, teachers, and the school community gain experience with the principles of ecology in their everyday lives, creating an ecologically literate community. Simultaneously, students develop socially and cognitively, learn important academic concepts, and practice healthy physical habits. All of these steps in the process then feed back into the further development and adaptation of the garden pedagogy, edible school garden program, and the schoolyard ecosystem .



Causal Pathways Diagram:
Edible School Garden Design Feedback Loops



Applying the Framework: Oñate Elementary B-Building Garden

The following design for an edible school garden for kindergarten and first grade at Oñate Elementary (B-Building Garden) was developed using the Framework for Edible School Garden Design as a guide. Each component of the framework was addressed in the design process, although the outcomes are undetermined at the time of this report.

Garden Pedagogy:

The fundamental garden pedagogy for the design follows a philosophy of education based on the organizing principles of ecology and community as defined by Fritjof Capra and modeled by the Edible Schoolyard in Berkeley, CA. The main goal of the garden pedagogy, as shown in the framework, is community ecoliteracy.

Collaborative Design Process:

The design process was a collaboration between the author, Oñate kindergarten and first grade teachers and their students.

Curriculum Integration:

As described in the Pilot Study section of this report, curriculum development accompanied the design process in order to integrate the design process into daily lessons. Reference Appendix A for the full set of lesson plans.

Community Partnerships:

The idea for the project began with a collaboration between Oñate teachers and the University of New Mexico School of Architecture and Planning. Funding for the project initiated a few community partnerships, such as Oñate PTA support and donations from local businesses such as Jericho Nursery, Plants of the Southwest, and Morrow Reardon Wilkinson Miller Landscape Architects. Actual construction of the first phase of the project will strengthen these partnerships through the participation of parents, interested community members and the local Boy Scout Troop. As the design will provide a place for community gathering, gardening, and educational activities, it will further establish community support.

Institutional Support:

Institutional support was provided by cooperation with the school principal and the Facilities Planning Director for the Albuquerque Public Schools District.

Schoolyard Redesign:

The edible school garden design raised interest in additional similar projects for other grade levels at the school, and may have an influence on further schoolyard redesign. General suggestions for schoolyard redesign projects that will strengthen connections on campus and to the Oñate school community are provided in the Campus Connections diagram as part of the Site Analysis section of this report.

Food Production, Waste and Water Systems:

The physical characteristics of the garden design will prioritize food production and the integration of sustainable waste and water systems.

Maintenance, Safety, and Accessibility:

Ease of maintenance, safety, and accessibility are all important programming goals.

Developmental Needs:

Finally, the edible school garden design will strike a balance between play space and learning space, creating an environment that will allow for both formal, structured instruction and open-ended, student directed learning. Organizing the space and including elements to specifically address the developmental needs of kindergarten and first grade students, the garden design will create a place that facilitates ecoliteracy and development of the whole person.

Site Analysis: Oñate Elementary B-Building Garden

Site Analysis for the design of the B-Building Garden was done in the following areas:

1. Context: Oñate Elementary School Campus and Surrounds

- Keyed Plan with notes and site photos
- Campus Map
- Campus Connections

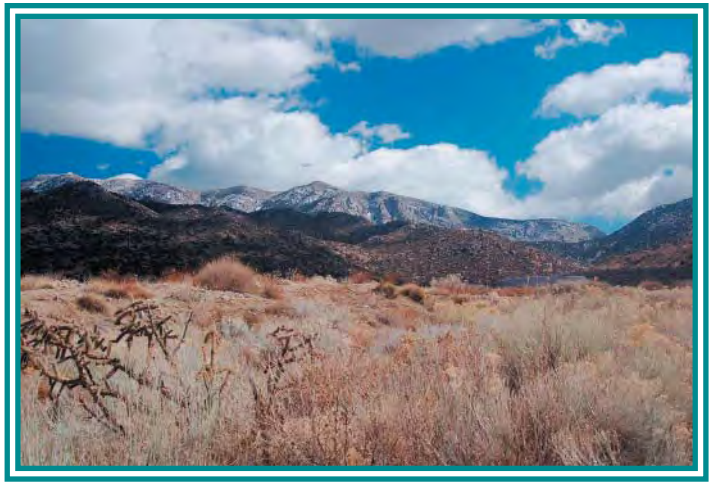
2. Existing Conditions: B-Building and the Garden Area

- Garden Area Keyed Plan with notes and site photos
- Site Flows Diagram

3. Developmental Considerations: Kindergarten and First Grade

- Developmental Characteristics of Five and Six Year Olds
- Design Considerations for Five and Six Year Olds.

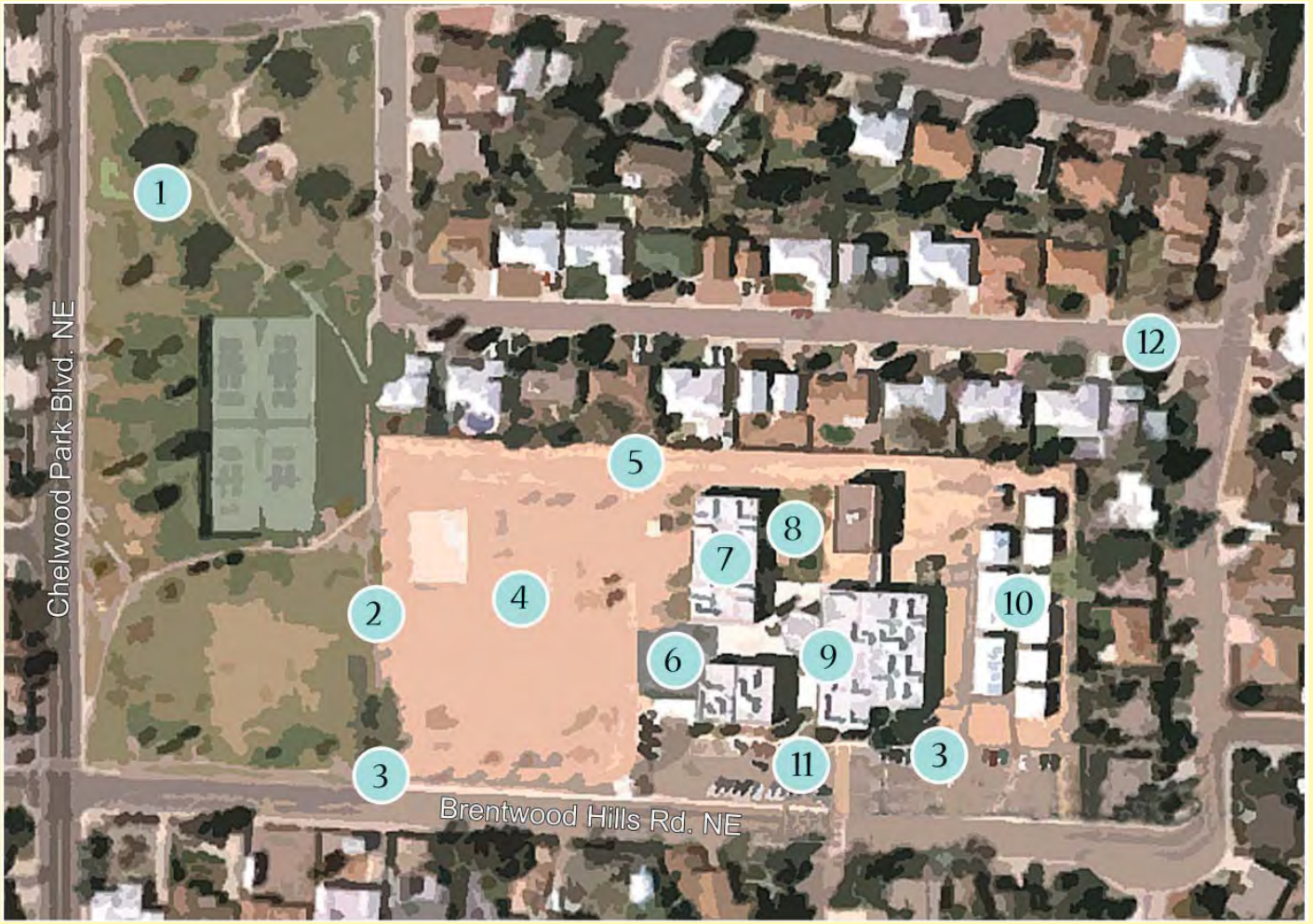
Oñate Elementary Playground



Oñate Elementary Environment: The Sandia Mountains Foothills

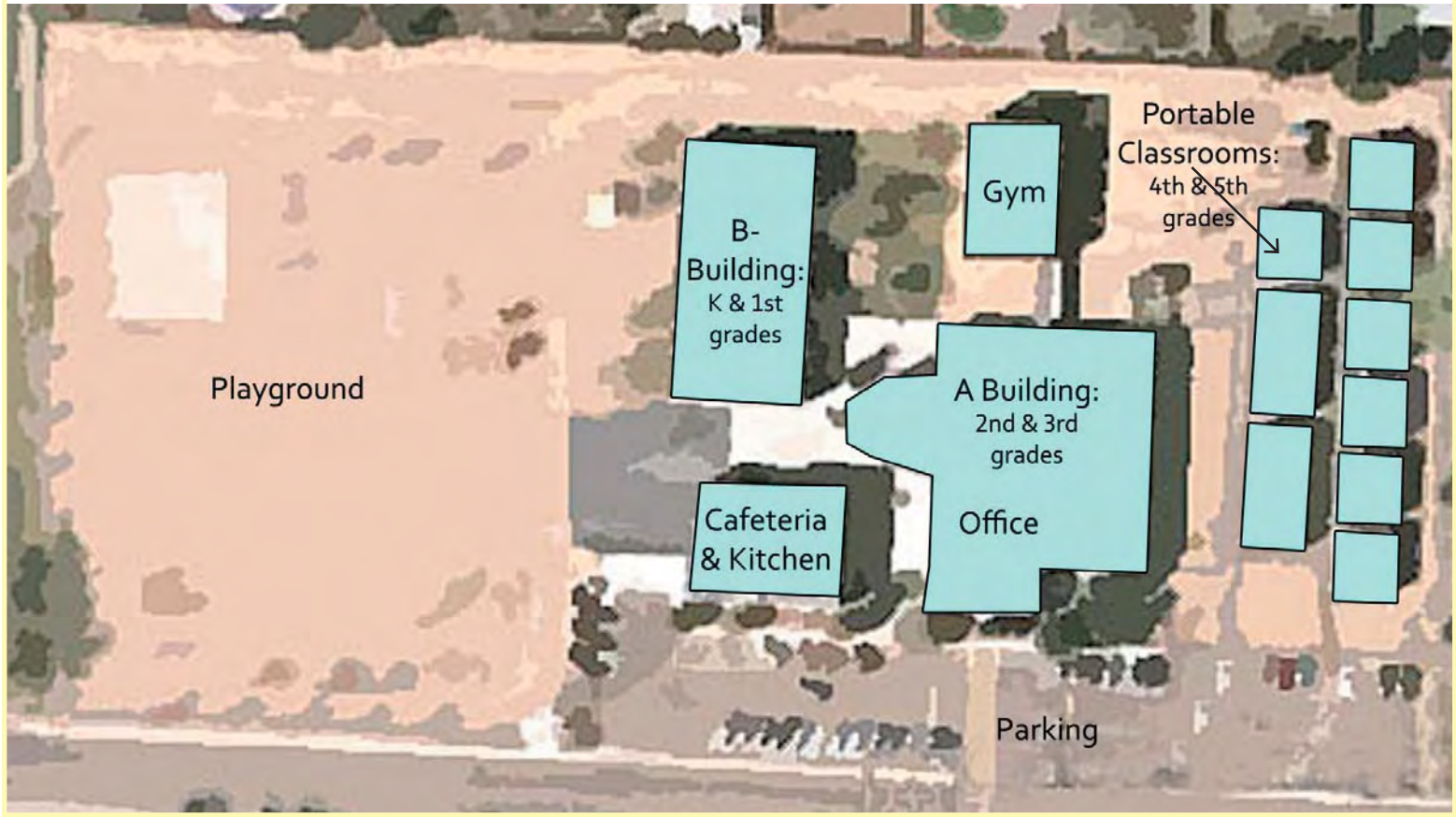
Foothills Arroyo

Oñate Elementary Campus and Surrounds: Key Plan



1. Don Juan de Onate Park
2. Park/School Edge Conditions
3. Site Drainage (2 locations)
4. Play Area
5. Neighborhood/School Edge Conditions
6. Service Area
7. B-Building and Garden Area
8. Preschool Play Area
9. Central Campus
10. Portable Classrooms
11. Parking and Entry Area
12. Surrounding Neighborhood

Oñate Elementary Campus Map



Oñate Elementary and Surrounds: Keyed Notes

1. Don Juan de Oñate Park

This public park is approximately two acres of turf grass spotted with large trees. At the center of the park there are four tennis courts and at the north end there is a play structure area. Concrete pathways connect different areas of the park. The topography varies slightly, mostly following the general downhill slope toward the west, with some berms creating the appearance of smaller hills and valleys. The park is busy on weekends, particularly in the tennis court and playground areas.

Staggered Fencing Provides Illusion of a Continuous Barrier, but Allows Access

Chain link Fence Marking the Border Between Oñate Park and Oñate Elementary

Looking East Toward the Park Play Structure from Chelwood Park Blvd.

2. Park / School Edge Conditions

As shown in the photograph above, there is a stark contrast between the lush lawn and shaded oasis of the park and the sand and concrete of the adjacent Oñate playground. While the illusion of a solid barrier is created by the chain link fence, there are three openings that allow access between the park and the school. The park area is not used for school activities, although it appears that neighbors use the play areas on the school grounds for recreation on weekends. Connections between the park and the school campus could be strengthened to benefit both areas.

Southwest Corner Drain to Street

Combination Drain and Access Point

An Asphalt Ditch Channels Water From East Campus to the Parking Lot and Street

3. Site Drainage and Slope Treatment (2 locations)

These two locations (in the southwest corner and northeast area near the portables) mark the areas where most of the site drainage is directed over to Brentwood Hills Rd. Both areas exhibit standing water after a small amount of precipitation, and, given the large area of the school campus, probably move a significant amount of water into the street. As a good deal of this water is roof drainage, it could be harvested and stored for on-site irrigation purposes. The eastern drainage site also shows a poorly managed slope treatment. The evergreen trees planted on the slope are dying due to the lack of terracing and water percolation. Terracing, boulder stabilization, and revegetation of the slope with native and naturalized plants would decrease erosion and could create a diverse outdoor "learning laboratory" for the adjacent classrooms.

Erosion and Tree Death Due to Poor Slope Management

4. Play Area

The playground covers about an acre of land on the west side of the Oñate school campus. Mostly sand and asphalt, the play area has several metal climbing structures, swings, basketball courts, and a backstop. On the east end of the playground, adjacent to the B-Building garden area, there are three concrete picnic tables and a wooden shade structure. An asphalt path encircles the entire playground and one bike rack is provided in the northeast corner. A few young sycamore trees provide very little shade.

Picnic Tables, Shade Structure, and Ramp on the Western Side of the Garden Area

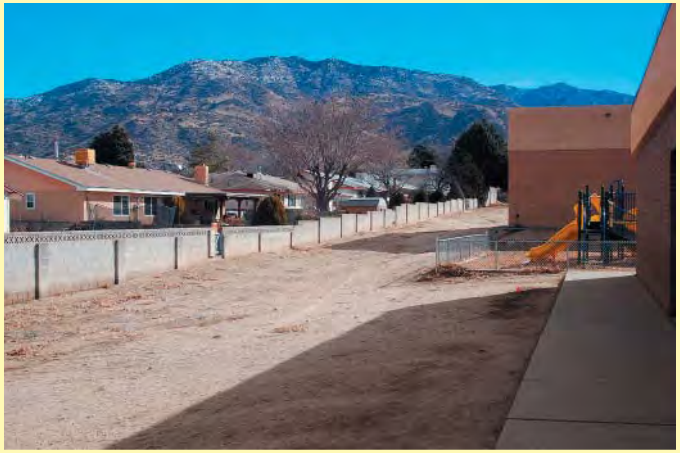
Bike Rack and Asphalt Path

Swings and Backstop

Panoramic View of the Playground, Looking East Toward the Sandia Mountains

5. Neighborhood / School Edge Conditions

The north edge of the school campus is defined by what appears to be a large, sandy drainage channel. This area is said to be used for vehicle access. It also backs up against neighboring residences, some of which have gates to access the school grounds.



Northern Edge of Campus: Looking East

Northern Edge of Campus: Looking West

Gate Access to Neighboring Residence

6. Service Area

This area provides vehicle access to the cafeteria kitchen. Supply and maintenance trucks pass by the two school dumpsters to enter this area, paved with asphalt. This area appears to be the result of recent construction.

Dumpsters and Entrance to Service Area

7. B-Building Garden Area

The garden area, adjacent ramp and retaining wall are the result of construction completed in 2007. Additional site analysis for this area is further described in the Existing Conditions section.

B-Building Garden Area: Looking North

Playground Access Adjacent to Garden Area

8. Preschool Play Area

Originally the kindergarten playground, this area is now dedicated to a preschool playground. Shaded by a few trees, the area is mulched with bark, and has several metal and plastic play structures.

Preschool Playground Area

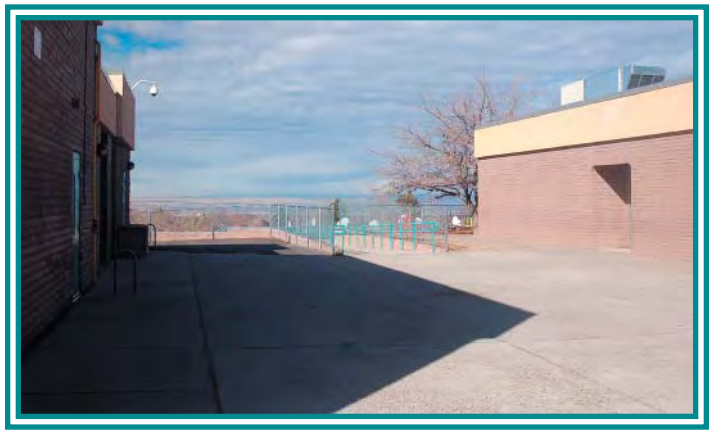
9. Central Campus

While the central area of the Oñate campus is relatively bare (concrete and brick walls), a few interesting features provide useful precedents for the garden design. Roof runoff is collected and channelled into wooden runnels, causing the water to cascade into square concrete planters. The only residents of these planters are large 'Hollywood twister' junipers that appear to be several decades old. Buildings and rooms are either unmarked or labeled with small and/or obscured titles. The lack of signage is surprising, given that developmentally, children of elementary school age learn literacy by reading their environment. It is required that visitors check in with the main office, but a first-time visitor is not given any visual cues as to where the office is located. Dominant colors on campus include a baby blue trim on doors and windows, tan brick walls, and a lighter tan trim. Views of Albuquerque, the West Mesa, and Mt. Taylor are visible from this point.

Main Office

Wooden Roof Drain and Planter Catchment Area

Central Campus: Looking East



Central Campus View to the West

10. Portable Classrooms

Some portable classrooms have miniature gardens set up next to their doorways. These gardens appear to be the work of individual teachers and their classes and include irises, marigolds, and other ornamental flowers. Strange drainage patterns in this area create muddy areas adjacent to the asphalt pathway. The long, thin area behind the portables is lined with the high concrete block walls of residential back yards, and appears to be used only for vehicle access.

Portable Classroom Mini-Garden

View of Portable Classrooms: Looking South

Portable Classrooms: Looking North

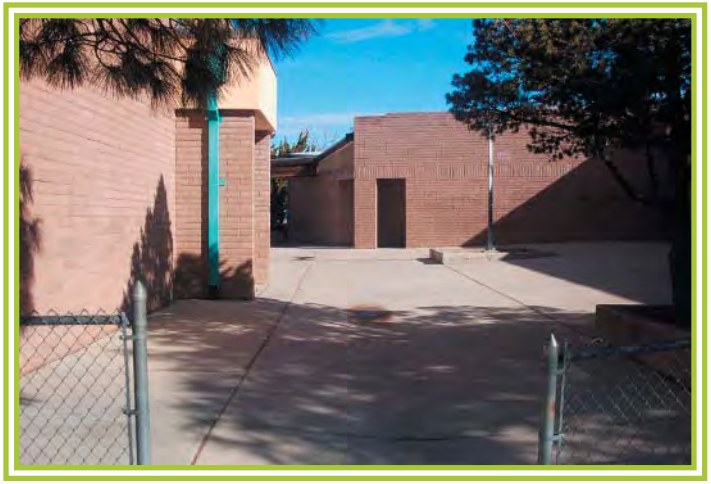
Area Behind Portables: Vehicle Access

11. Parking and Entry Area

The parking lot is oddly sloped in some areas, creating parking spots that are difficult to access. The volume of daily parking is accommodated by the lot, but during special events (like Thanksgiving lunch) extra cars spill out on the street. The school name is no longer visible, due to the growth of a pair of large arborvitae. A new marquee sign was installed by the PTA to remedy this problem. The main entrance to the school is unclear and unmarked.

Front of School: Hidden Name

New Marquee Sign Visible From Street, Marking Playground Entry



Main Entry Area

Parking Area: Looking West

12. Surrounding Neighborhood

Neighborhood homes exhibit a moderate amount of care for their front yard areas. This neighborhood appears to have been built in the sixties or seventies, based on the architecture and overgrowth of prolific junipers in multiple locations. A variety of yard treatments exist, from regional landscape mimicry, to eclectic garden ornaments, artificial flowers, to basic gravel designs or lawn and tree combinations. The neighborhood seems to house families with moderate income. On weekends, many people are out walking and working in their yards, which suggests the possibility of community support and care for an edible school garden program.

Juniper Profusion

Artificial Flower Yard

Eclectic Yard Design

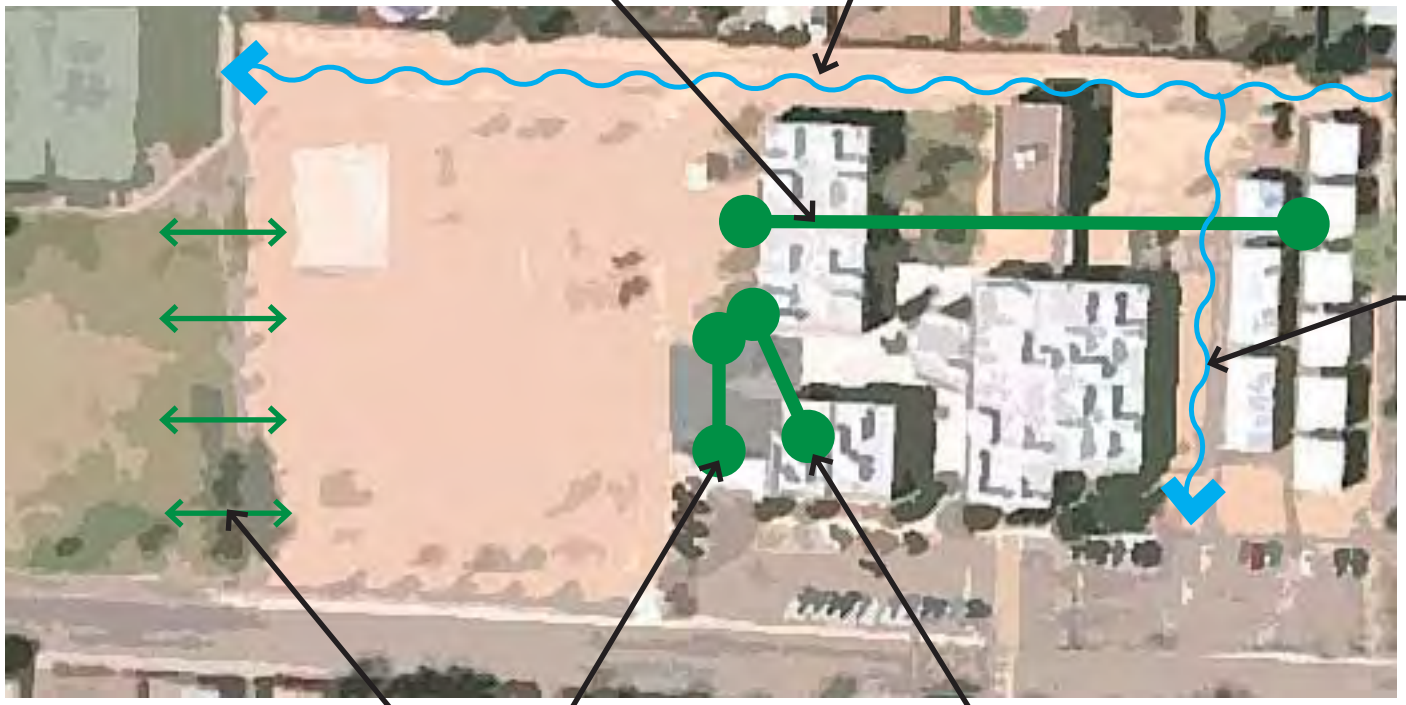
Gravelscape

Campus Connections

Suggestions for schoolyard redesign at Oñate Elementary to strengthen campus interconnections with the B-Building Edible Garden and the surrounding community.

Connect the B-Building edible garden with edible gardens for portable classrooms. These "buddy gardens" could employ traditional agricultural methods such as pocket terraces and waffle gardens, serving as places for older and younger students to interact.

Take advantage of the slope and open space in this area by creating a revegetated arroyo and habitat area that provides an outdoor "learning laboratory" for all Oñate students. This would increase the school's connection to its place by reflecting and enriching the surrounding natural environment.



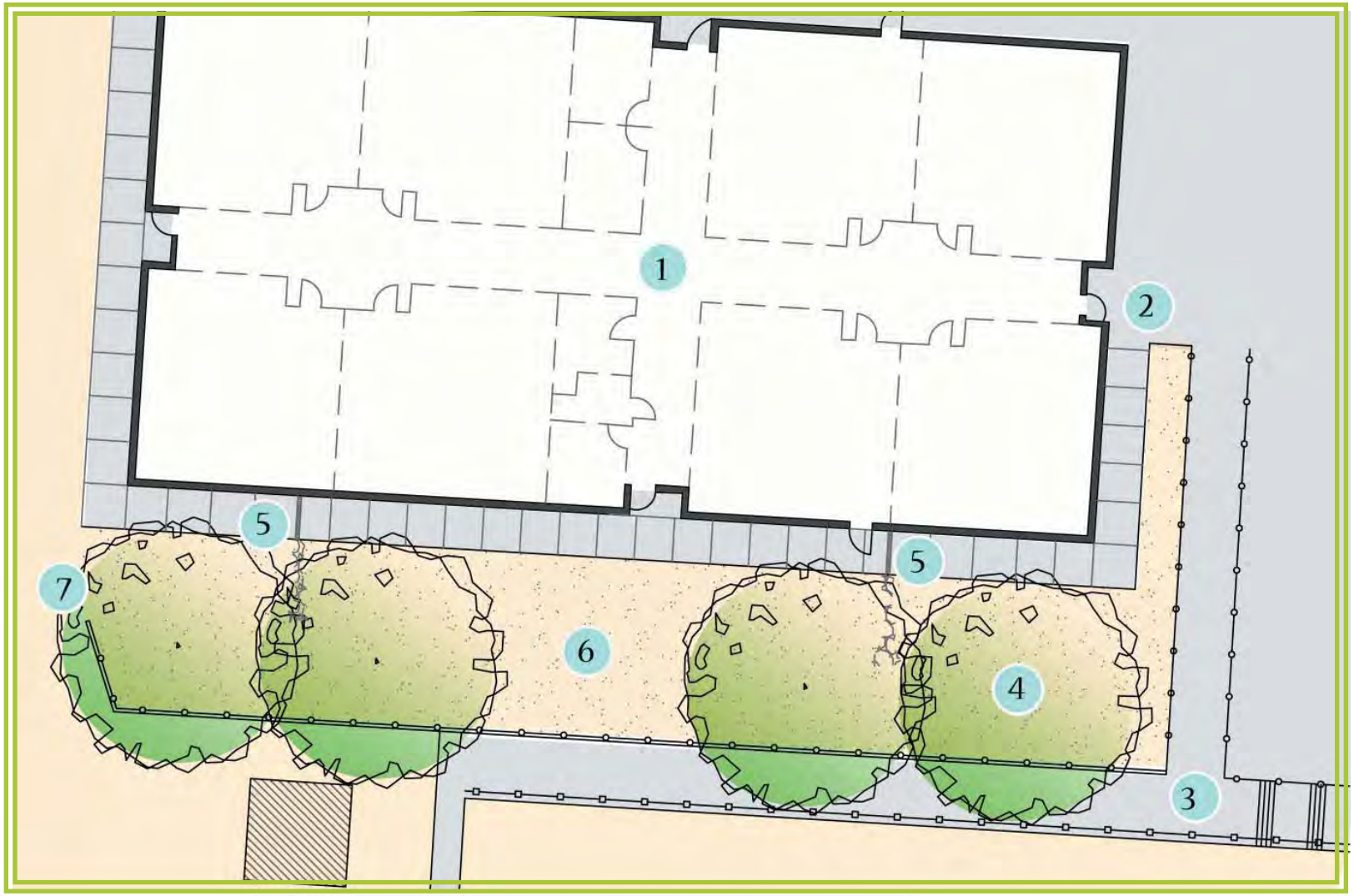
Reconsider existing drainage systems in this area. Create a smaller version of the revegetated arroyo "learning lab" on the north part of campus. The slope could also provide a place for terraced edible gardens.

Increase connections to the park both visually and functionally. Introduce areas of low-water-use turf, such as blue grama and buffalo grass to the playground. Encourage teachers to use the park areas as an outdoor classroom, and increase porosity between the school and park sites.

Connect the composting systems with the established waste / recycling processes on campus

Connect the food systems created in the edible school garden with the existing school food systems in the cafeteria.

Existing Conditions:
B-Building Garden Area Key Map

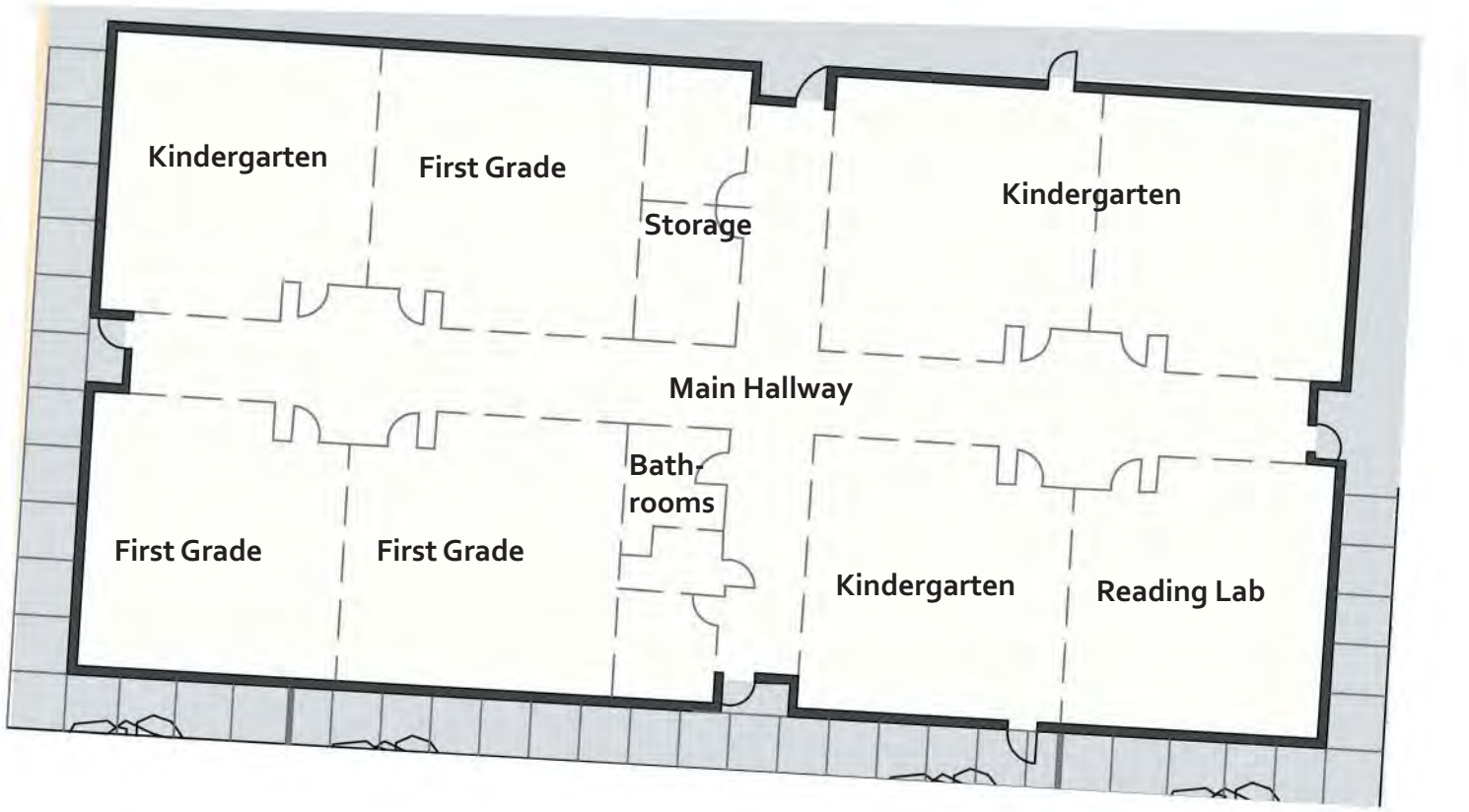


1. B-Building Map
2. B-Building Entrance
3. Playground Access
4. Existing Vegetation
5. Drainage (2 locations)
6. Soil and Slope
7. Edge Conditions

scale: 1" = 20'-0"

1. B-Building Map

Inside B-Building, kindergarten and first grade classes are interspersed. One kindergarten class uses two full classroom areas. Each classroom has one window, and there is only one classroom with direct access to the outside. The main hallway is decorated with student artwork. Room assignments are labeled in the map below.



2. B-Building Entrance

This is the main entrance to B-Building. Other doors shown on the building plan are locked from the outside, allowing traffic to the outside only. This area is also the main access point for the garden area and a place that many children travel through on their way to the playground for recess. Building signage is sparse, and the large concrete pad that leads to the door and to the garden area is flat and uninteresting.

Front Entry and Playground Access

Flat and Narrow Stretch of Soil Between B-Building Front Door and Ramp to Playground

3. Playground Access

Many children pass by the B-Building Garden area on their way to recess. They travel down an 8' wide ramp to the north, or a series of stairs to the south. The retaining wall, ramp, and stairs are the result of 2007 construction. The other major travel route to the playground is on the north side of B-Building. For further details on the north side of the building see #6- Soil and Slope.

Ramp to Playground

Stairs to Playground

4. Existing Vegetation

Four mulberry trees currently provide dense shade for the majority of the garden area. These trees are fairly well-established, getting their irrigation from the B-Building roof drainage and hand-watering from school maintenance crews when needed. The shade provided by these trees is welcome, given the lack of shade on the playground. The shadiness of the site will guide plant choice for areas underneath the trees. The large space in the middle of the garden area provides a sunny spot suitable for raised beds containing edible garden crops.

Mulberry Trees in the Fall

Summer Shade, Looking North

Panoramic View of Garden Area Mulberries in the Winter, Looking North

5. Drainage (2 locations)

B-Building roof drainage is collected in the garden area via two drain pipes that flow across and under the sidewalk in a box culvert. The water channels crossing the sidewalk are covered with a solid metal plate. Gravel placed at the drain openings has not been effective at preventing erosion from the water flow. Water collects at the low point in the center of the garden area. After precipitation, standing water and mud in this middle area is common.

B-Building Roof Drain and Box Culvert, South Side

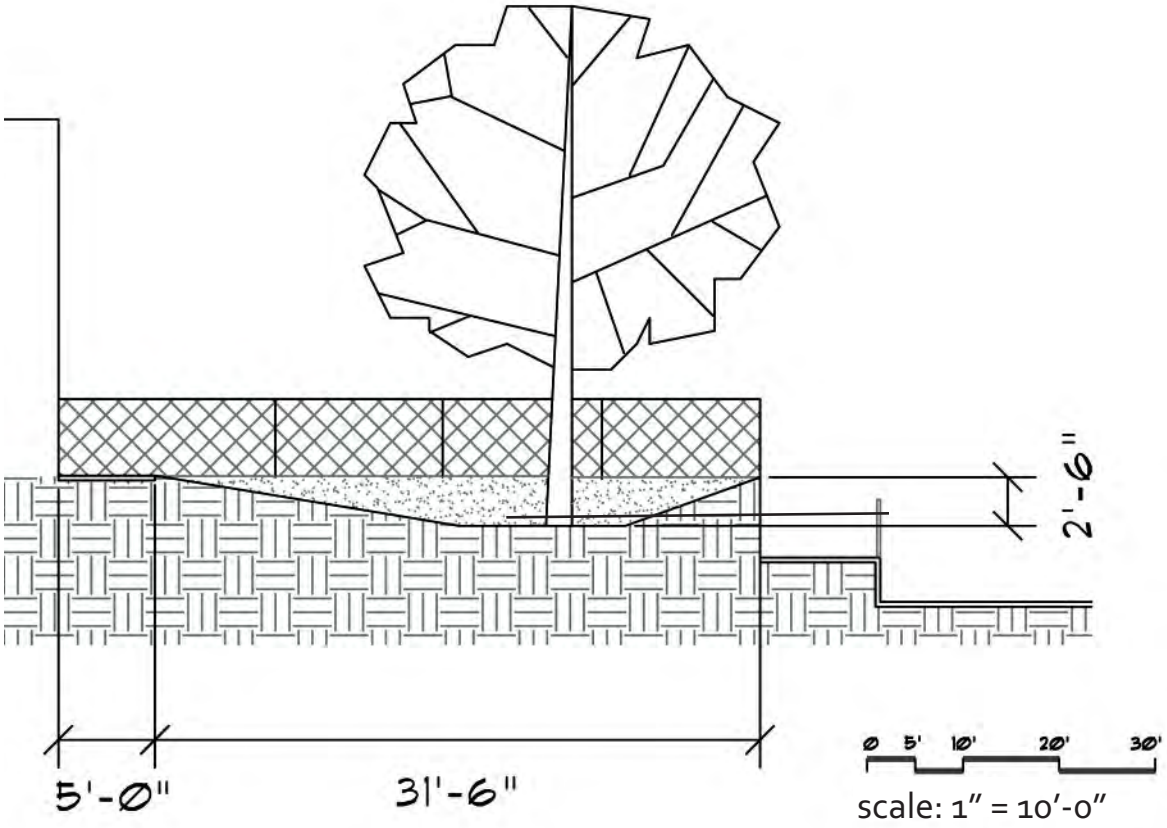
B-Building Roof Drain, North Side

Eroded Drainage Channel

6. Soil and Slope

The garden area has rocky, sandy soil with very little organic content (see Appendix F for detailed soil analysis and treatment recommendations). Except for the area adjacent to the B-Building entrance, the slope of the site sinks into a ditch running north-south for the majority of the garden site. Total change in elevation is approximately 2.5 feet. Dimensions are given in the section drawing below. As shown in the following photographs, runoff from the roof collects in the ditch, creating muddy areas. The retaining wall ends too soon on the north side, causing the drainage to cut into the soil in a way that could eventually compromise the foundation of the wall.

Drainage Collected in the North-South Ditch



Typical Section of Garden Area Slope

Detail of Exposed Wall Foundation

North Side Retaining Wall Termination

7. Edge Conditions

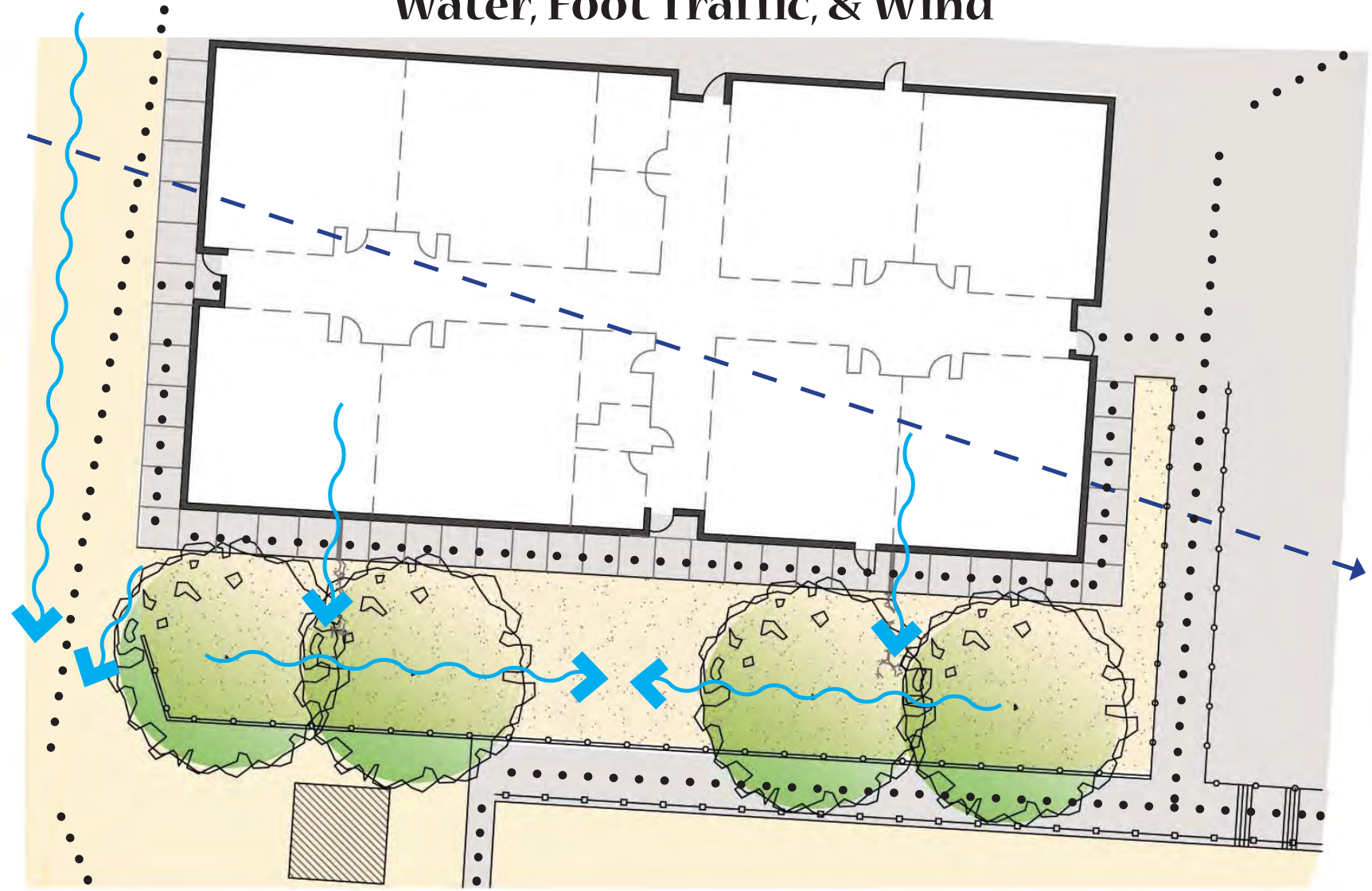
The B-Building garden area is defined on each side by different features. On the east side, it is bordered by a six foot concrete sidewalk and B-Building. On the south side, it is bordered by the sidewalk leading west to the playground. On the west side, a 4 foot high chain link fence provides a barrier to the ramp that descends to the playground. The north side of B-Building and the garden area drop off into the large drainage channel / vehicle access area described in the campus site analysis section. This area looks directly across to neighborhood walls and backyards. There is little existing vegetation. This area is the alternative route for reaching the playground for recess.

Western Edge: Chain Link Fence and Playground

North Side of B-Building: Looking East

North Side of B-Building: Looking West

Garden Area Flows:
Water, Foot Traffic, & Wind



Water Flows

Foot Traffic: In / Out of B-Building, Travel to / from Playground

Prevailing Winds: Southwest

0 10′ 20′ 40′ 60′

scale: 1″ = 20′-0″

Counting Acorns at Monte Vista Elementary School Garden, Goleta, California

The Garden Provides Many Opportunities for Counting and Sorting

Developmental Characteristics of Five Year Olds

Mind

- Learns best through play and own action
- Needs rules and routines, structured games, repetition and patterns
- Senses bind cognitive understanding
- Likes to copy
- Does not yet think logically, cause and effect are still intuitive
- Animistic (inanimate objects have life, movement)
- Literal behavior; often only one way to do things
- Learns to read through interaction with environment
- Counting and sorting, simple addition and subtraction with real materials

Body

- Need for great deal of outdoor physical activity, both structured and "free" play
- Vision focused on objects close at hand
- Gross motor control improving

Spirit

- Important themes include family, self, pets, school, and seasonal themes in nature
- Need many avenues to express themselves
- Fantasy and dramatic play such as dress up, housekeeping, puppets are all still important

(Wood, 1997)

Design Considerations for Five Year Olds

Mind

- Provide opportunities for routine activities such as telling time, describing weather, feeding birds, watering plants, measuring temperature etc.
- Engage all the senses with colors, smells, sounds, textures, and tastes
- Reveal rhythms and patterns in the environment
- Provide for hands-on learning experiences with environmental materials
- Provide plenty of "loose parts," encouraging open ended play and child initiated learning
-Provide opportunities to read from the environment such as signs, letters, numbers, labels, and so on
- Provide manipulatives to count, sort, add and subtract

Body

- Provide open spaces for physical activity and smaller enclosed spaces for focused activity
- Provide opportunities for up-close, hands on activities
- Create flexible spaces that can be used for structured games, focused group time, and individual activities

Spirit

- Showcase natural processes and themes
- Provide a variety of tools and manipulatives to allow for expression
- Environments should be loose and not over-programmed to facilitate creative play and learning.

"Loose Parts" Arts and Crafts from the Garden, Merriewood Children's Center, Lafayette, California

Comfortable and Fun Group Space in the Sunflower House, Monte Vista Elementary School Garden, Goleta, California

Garden Journals Provide Opportunities for Close-Up, Student-Driven Work

Measuring in the Garden

Developmental Characteristics of Six Year Olds

Mind

- Learns best through discovery and games
- Enjoys process more than product
- Attempts to do more than he or she can accomplish
- Concepts begin to be organized in a symbolic manner
-Begins to understand cause and effect, and reasoning
- "Industrious," likes to do "work"
- Spatial and functional relationships are better understood
- Likes to measure things in the environment
- Tracing becomes an important learning tool

Body

- More aware of fingers as tools
- Learns to distinguish left from right
- Easily tires, frequent illness
- Enjoys being outdoors, physical activity
- Continuing need for motor skill development through the use of manipulatives

Spirit

- School replaces home as the child's most important influence
- Enjoys jokes and guessing games
- Experiences an "artistic explosion"
- Dramatic and cooperative play become more elaborate
- Friends and social activity become more important
- Important themes include family, friends, school, workers at school, and themes in nature

(Wood, 1997)

Design Considerations for Six Year Olds

Mind

- Provide opportunities for open-ended activities that can be carried out over several days that may or may not require completion
- Provide tools for "work" such as brooms, rakes, shovels, etc.
- Integrate symbols into the environment
- Provide opportunities for measurement (rain gauge, thermometer, shadow movement, growth)
- Provide flexible spaces for games and social activity
- Reveal interactive processes such as composting, water harvesting, and food preparation

Body

- Engage all the senses with colors, smells, textures, sounds, and tastes
- Provide spaces for physical activity
- Provide comfortable places for rest
- Provide plenty of "loose parts" that encourage motor skills development while allowing for open-ended play

Spirit

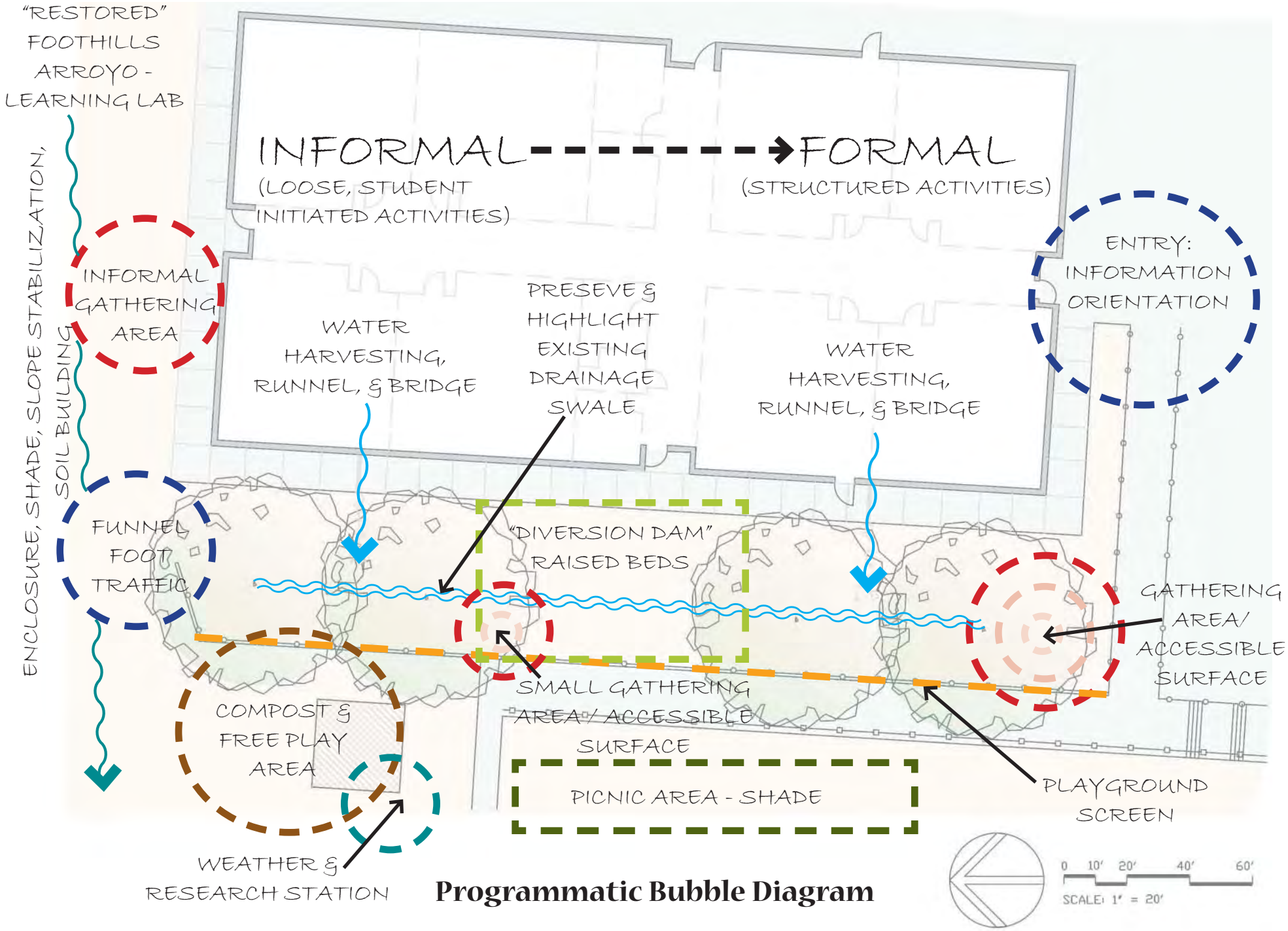
- Allow for student to take part in maintaining and caring for school environment
- Provide spaces that inspire artwork
- Provide a place for students to create and share their artwork
- Showcase natural processes and themes in the environment

Worm Composting

Stimulating all the Senses in the Garden

Edible Garden Design for Ecoliteracy:
B-Building Garden

Garden Entry and Outdoor Classroom



Programmatic Bubble Diagram

B-Building Garden Design: Keyed Plan

SCALE: 1"=20'-0"

Keyed Notes

1. "Restored foothills arroyo" area, with cobble drainage swale, native plants (see plant palette), and climbing/seating boulders.

2. Rammed earth benches, created by students and school community in the shape of their choosing (snakes and worms are popular choices).

3. Stepping stones from recycled concrete pieces or locally available stone (typ.).

4. Lockable storage shed for garden tools and supplies.

5. Stairs to playground, concrete to match sidewalk path.

6. Retaining wall to extend to sidewalk adjacent to B-Building. Concrete blocks to match existing retaining wall.

7. Yard waste compost area, concrete block three-bin composting unit.

8. Supervised digging area (tools stored in shed).

9. Sunflower house (summer and fall).

10. Wooden vermicomposting bin, located close to picnic area to facilitate collection of food scraps.

11. Weather station, including wind vane, outdoor thermometer, and rain gauge (all with large, colorful shapes and print).

12. Rain barrel and drainage runnel to garden area. Top to be secured with fine grate. See Water Systems Section for details.

13. Bridge / accessible pathway to raised bed area. Poured-in-place, recycled rubberized play surface to match colors and concentric circle design shown on plan.

14. Outdoor sink and work tables.

15. Benches (typ.)

16. Cobble drainage swale, 6" deep 3"-6" round gray cobble, located at the low point in the garden area.

17. Raised beds for edible crop production (two for each class in B-Building - twelve total). Reference Raised Bed and Row Cover Construction Detail. Stepping stones surrounding beds to be made as an art project by classrooms (one for each child). Beds to be maintained by the community during the summer as community garden plots.

18. Climbing / seating boulder, 12-15 cubic ft., moss rock or other locally available stone.

19. Native plants and herbs discovery areas (see plant palette). Mulched with 4" deep organic mulch.

20. Outdoor classroom gathering area, poured-in-place recycled rubberized play surface to match colors and design shown on plan.

21. Recycled plastic lumber seating and planter.

22. Welcome sign and garden rules, designed and constructed by B-Building students and teachers.

23. Bulletin board displaying pictures, schedules and events related to the garden.

24. Stand-on sundial embedded in concrete.

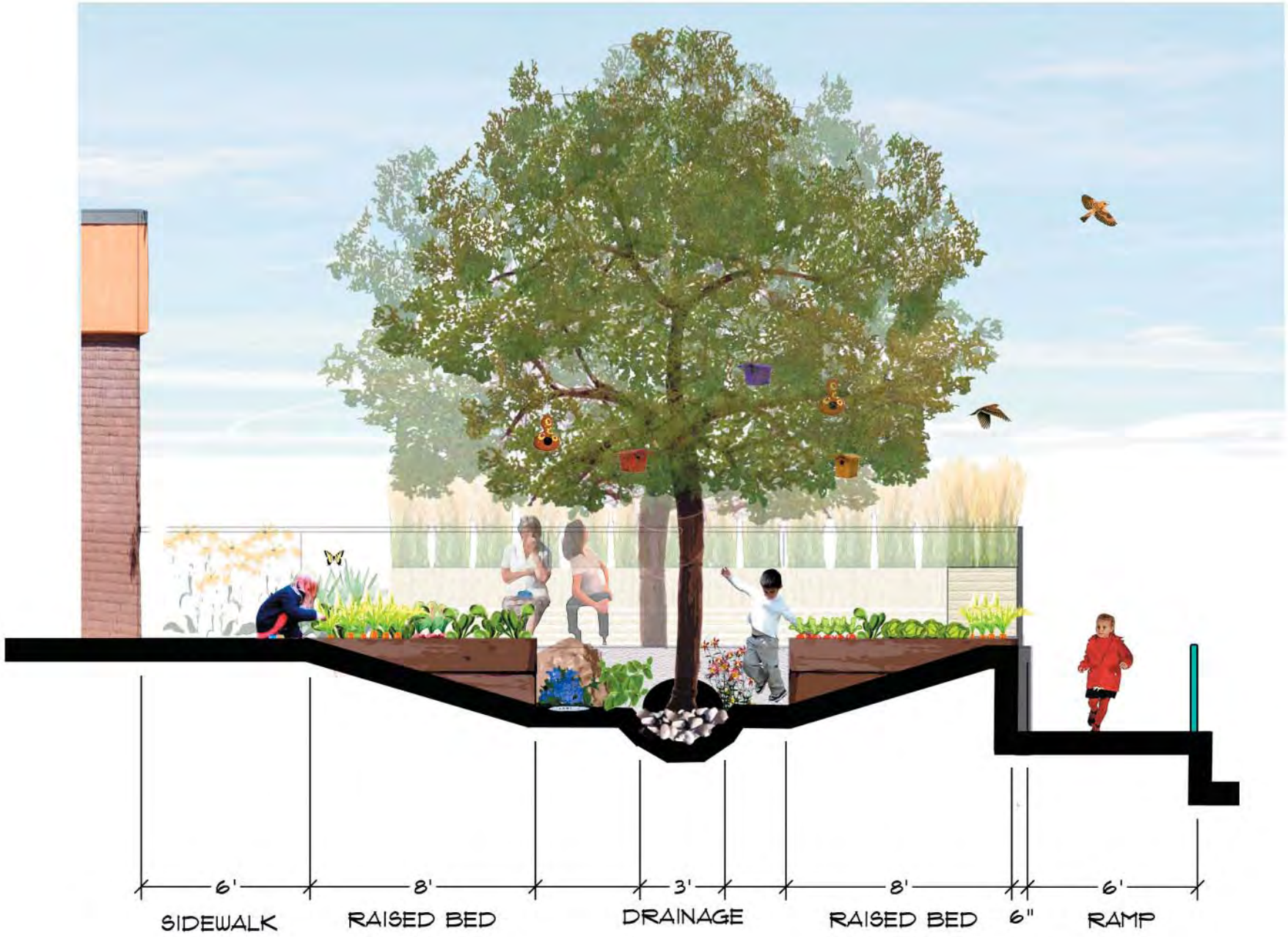
25. Compass rose embedded in concrete.

26. Trellises attached to wall for vines (see plant palette).

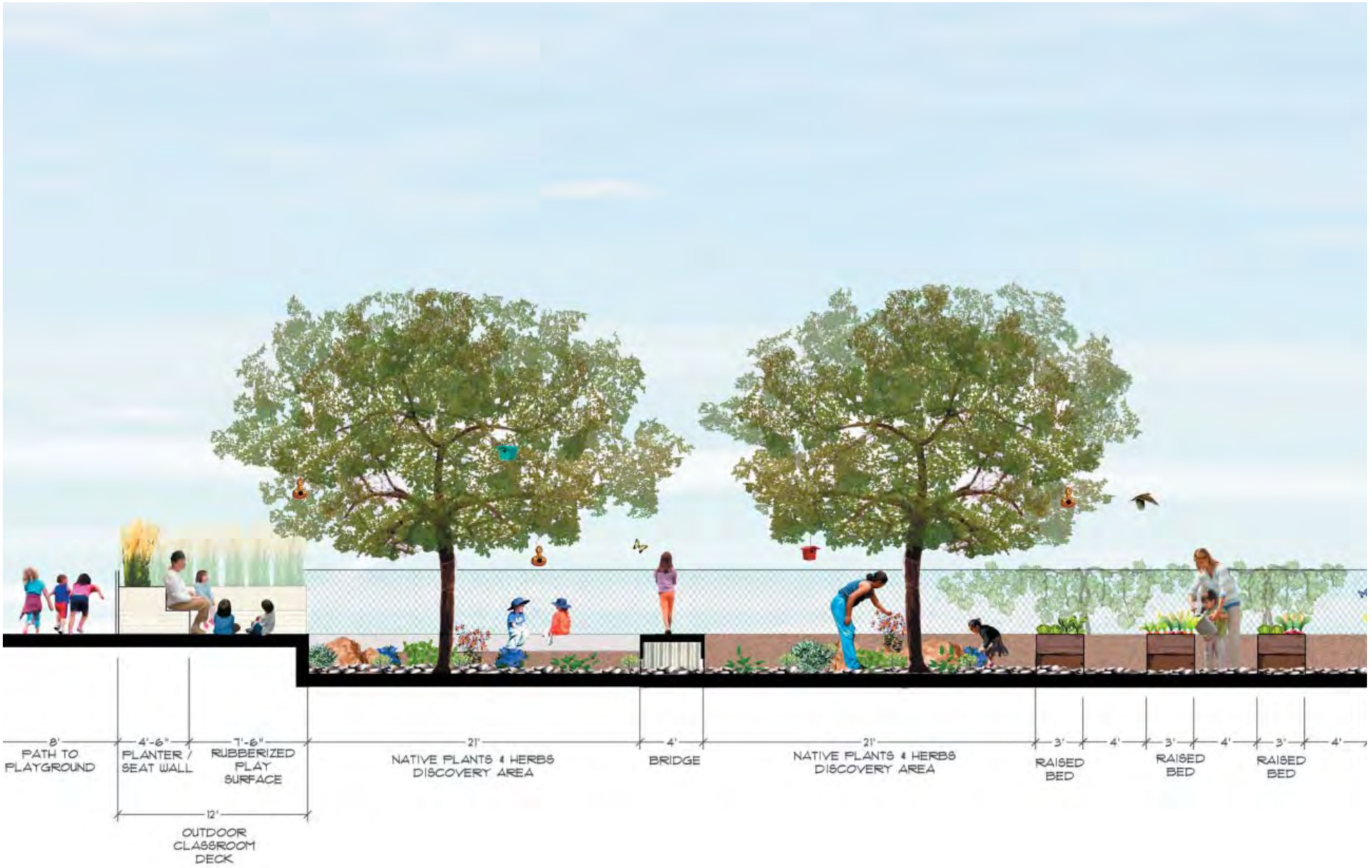
27. Picnic area. Existing concrete picnic tables repositioned with multi-colored umbrellas to provide shade until existing trees mature.

Plant Palette

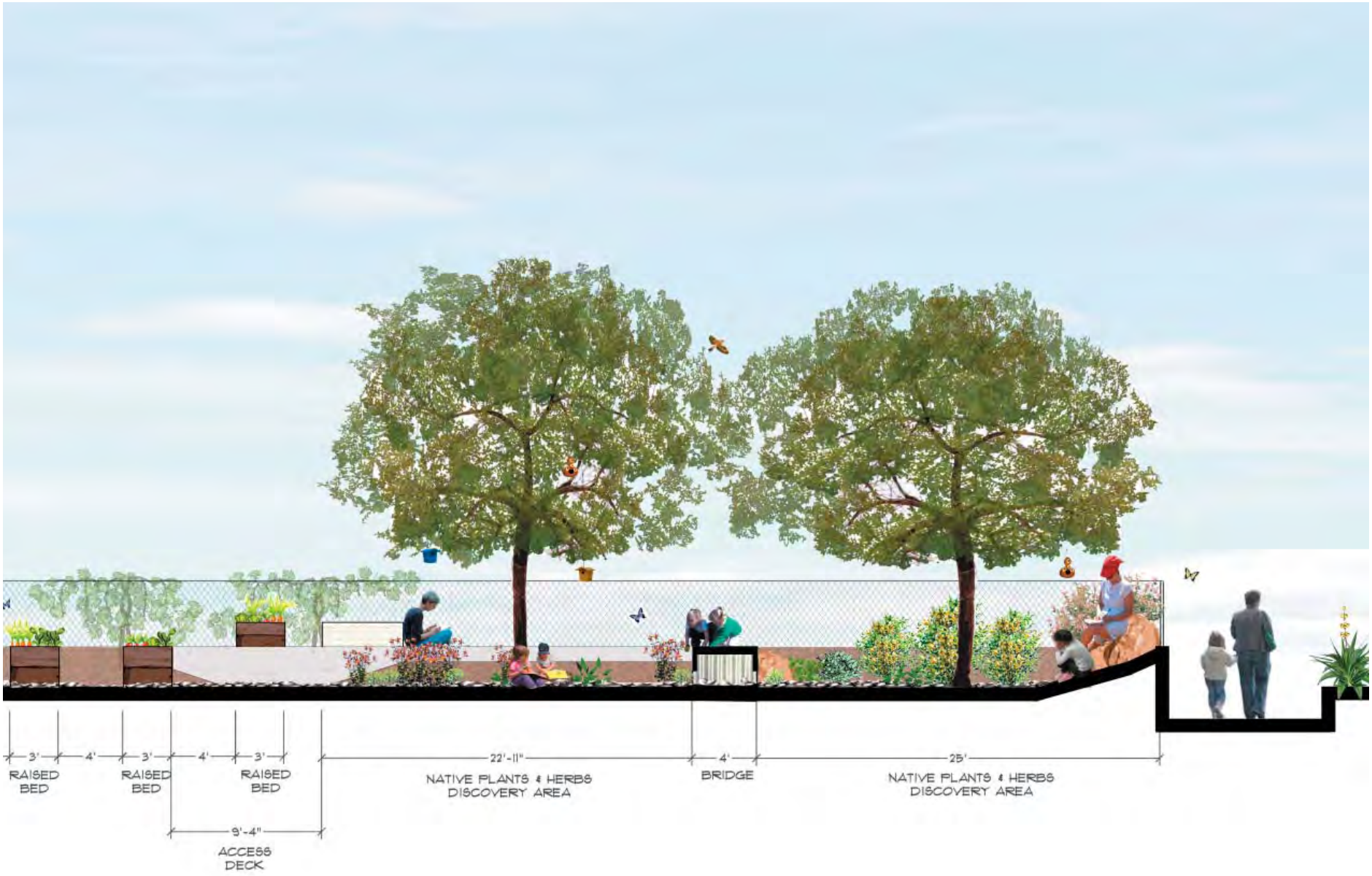
Symbol	Common Name	Botanical Name	Sensory Features	Loose Parts	Other
Restored Foothills Arroyo					
	Desert Willow	*Chilopsis linearis*	pink flowers, wind action	leaves, flowers, seed pods	native
	Pinon Pine	*Pinus edulis*	evergreen	needles, cones	native
	Chamisa	*Ericameria nauseosus*	yellow flowers	leaves, flowers	native
	Softblade yucca	*Yucca recurvifolia*	white flowers, form, evergreen	leaves, flowers, seed pods	native, edible flowers
	Beargrass	*Nolina texana*	white flowers, evergreen	leaves, flowers, seed pods	native
	Indian Paintbrush	*Castilleja integra*	red flowers, texture	flowers	native, attracts hummingbirds
	Sideoats Grama	*Bouteloua curtipendula*	wind action	grass blades, seeds	native
	Needle & Thread Grass	*Stipa comata*	wind action	grass blades, seeds	native
Outer Garden Edges					
	Pomegranate	*Punica granatum*	edible fruits, red flowers	leaves, flowers, fruits	accent
	Foerster's Grass	*Calamagrostis acutiflora 'Karl Foerster'*	color, wind action	grass blades, seeds	screening
	Black-eyed Susans	*Rudbeckia fulgida 'Goldsturn'*	yellow flowers	flowers, seed cones	perennial
	Licorice Mint	*Agastache rupestris*	pink/orange flowers, fragrance	flowers	attracts hummingbirds
	Purple Coneflower	*Echinacea purpurea*	purple flowers	flowers, seed pods	attracts butterflies
	Chocolate Flower	*Berlandiera lyrata*	yellow flowers, chocolate fragrance	flowers, seed pods	native
	Arizona Honeysuckle	*Lonicera arizonica*	pink flowers, fragrance, nectar,	flowers	native
	'Golden Muscat' Grapes	*Vitis labrusca* 'Golden Muscat'	sweet yellow edible fruits	leaves, tendrils, fruits	ripens in fall
	Winter Jasmine	*Jasminum nudiflorum*	sweet fragrance, yellow flowers	flowers	winter bloom
Shaded Garden Swale / Native Plants and Herbs Discovery Areas					
	Golden Currant	*Ribes aureum*	yellow flowers, edible fruit, fragrance	flowers, leaves, fruit	native, shade compatible
	Woods Rose	*Rosa woodsii*	pink flowers, fragrance	flowers, rose hips	native, shade compatible
	Thyme varieties	*Thymus spp.*	fragrance, texture, taste	leaves, flowers	xeric, shade compatible
	Mint varieties	*Mentha spp.*	fragrance, texture, taste	leaves, flowers	shade compatible
	Lamb's Ears	*Stachys byzantium*	soft texture, silver color	leaves, flowers	xeric, shade compatible
	Red/Yellow Spur Columbine	*Aquilegia formosa*	red/yello flowers, leaf shape	leaves, flowers	native, shade compatible
	Soapwort	*Saponaria ocymoides*	purple flowers	flowers	shade compatible
	Yerba Mansa	*Anemopsis californica*	white flowers, textured leaves	leaves, flowers	native, shade compatible
Compost Area and Sunflower House					
	Maximilian Sunflower	*Helianthus maximiliani*	yellow flowers, edible seeds, shade	flowers, seeds	fall bloom, attracts birds
	Hopi Red Dye Amaranth	*Amaranthus cruentus 'Hopi Red Dye'*	purple edible leaves, purple flowers edible seeds	leaves, flowers, seeds	bracts used for food dye



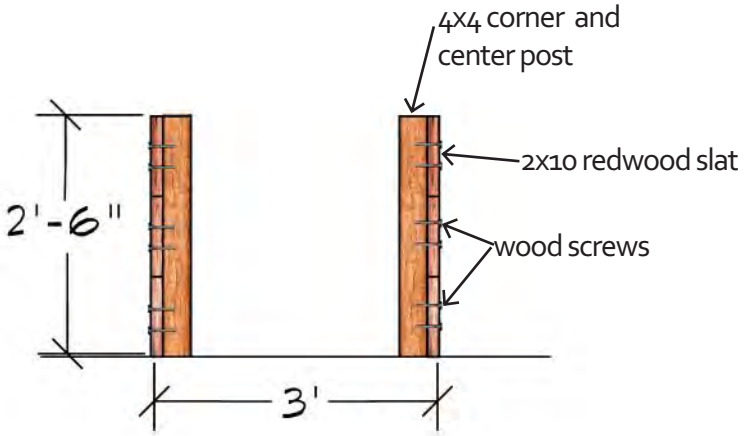
East-West Section, Looking South



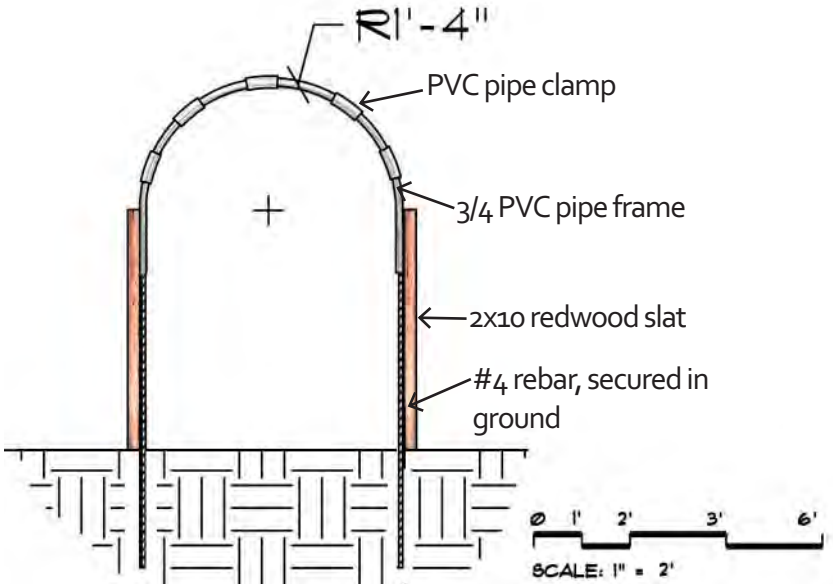
North-South Section, Looking West

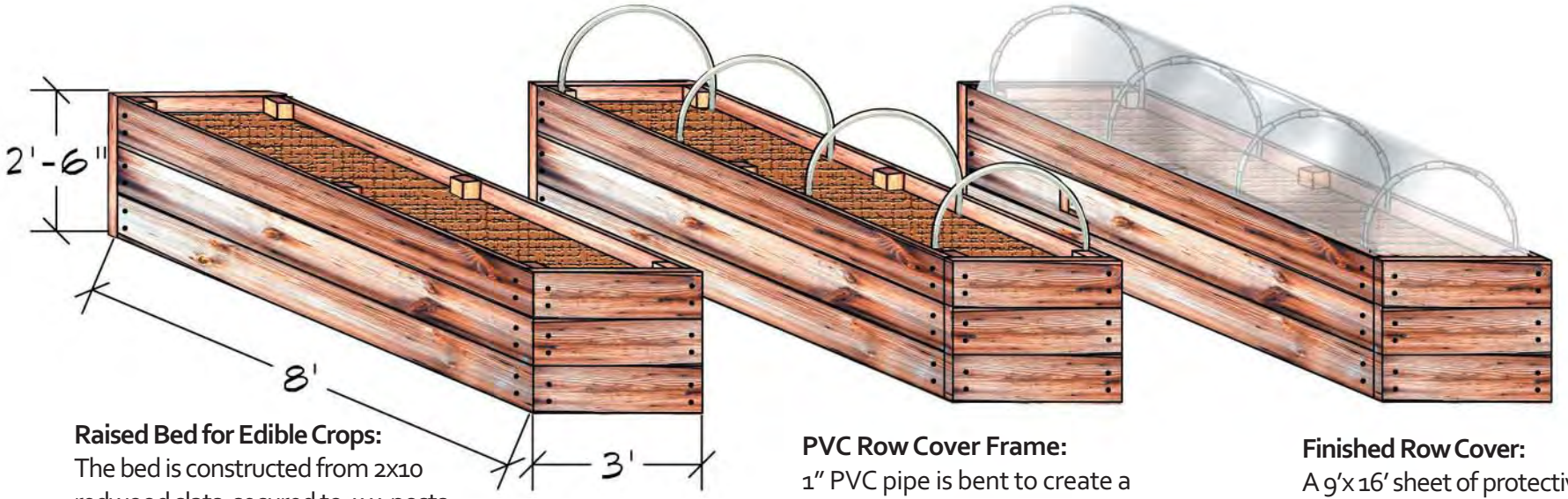


North-South Section, Looking West



Raised Bed End Section

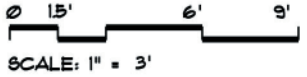




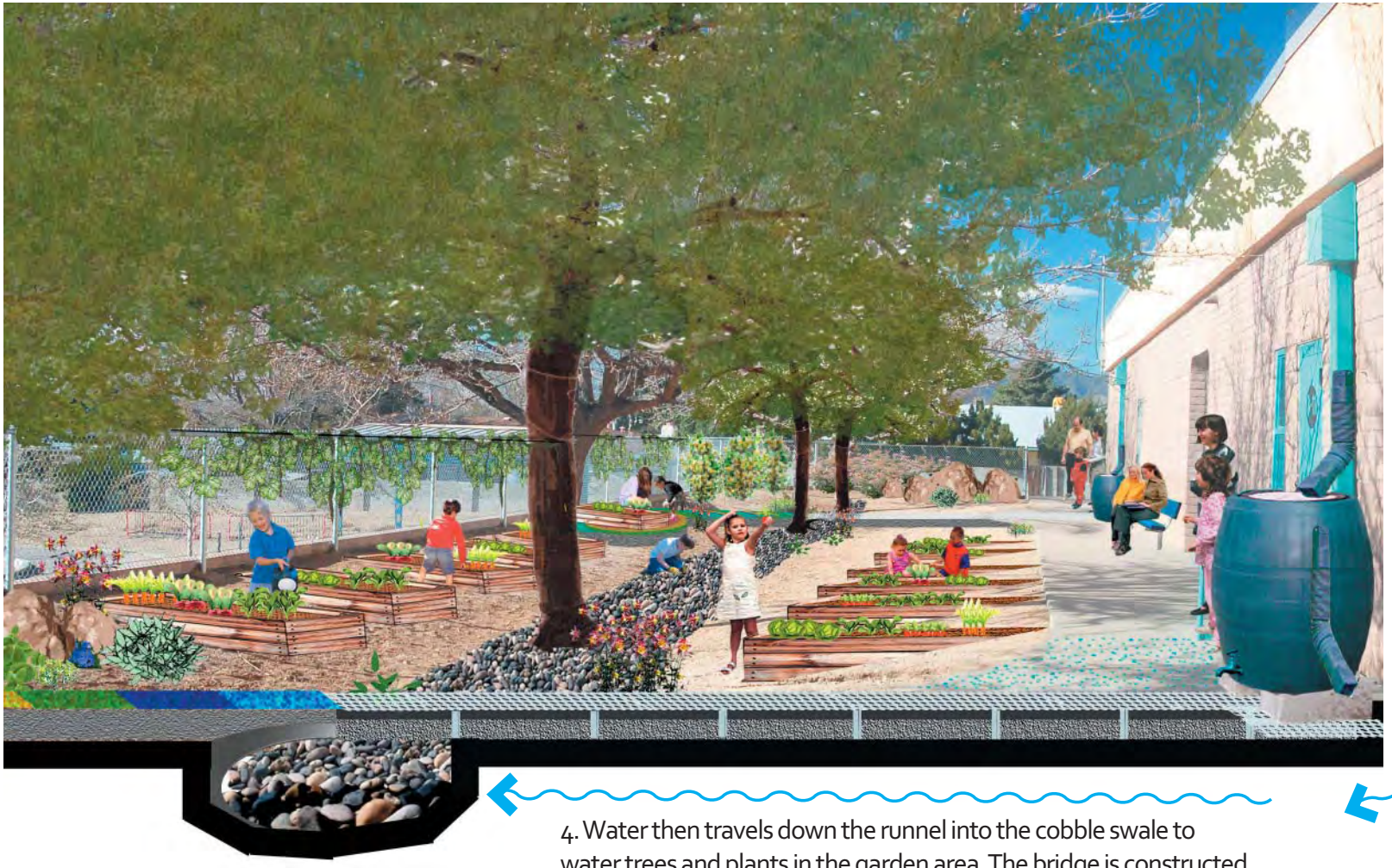
Raised Bed for Edible Crops:
The bed is constructed from 2x10 redwood slats, secured to 4x4 posts at each corner and center with wood screws. The bed is then filled with soil enriched with organic compost.

PVC Row Cover Frame:
1" PVC pipe is bent to create a frame, secured to pieces of #4 rebar embedded in the ground

Finished Row Cover:
A 9'x 16' sheet of protective covering is fastened to the PVC frame with PVC pipe snap clamps.



Raised Bed and Row Cover Construction Details



1. Water is harvested on the B-Building roof and directed into 75 gallon rain barrels.

2. The rain barrels store the water until supervised students turn on the spigot to watch the water run into the swale via a metal-grate covered runnel. The top is secured with a fine metal grate and the spigot is removeable (lockable)

3. An overflow pipe is provided to accommodate large volumes of water typical of the normal Albuquerque rainstorm.

4. Water then travels down the runnel into the cobble swale to water trees and plants in the garden area. The bridge is constructed of concrete embedded with a blue recycled glass (tumbled and child-safe) mosaic and a steel culvert over the drainage area.

5. At the mid-point of the bridge, the metal grate ends and the bridge becomes poured-in-place recycled rubberized play surface, mounted on a concrete slab which leads to the outdoor classroom gathering area.

Water Systems Section

Northern Garden and Restored Arroyo Learning Laboratory

Picnic Area, Weather Station, and Sunflower House

Planting Schedule for Edible Crops (Without Row Covers)

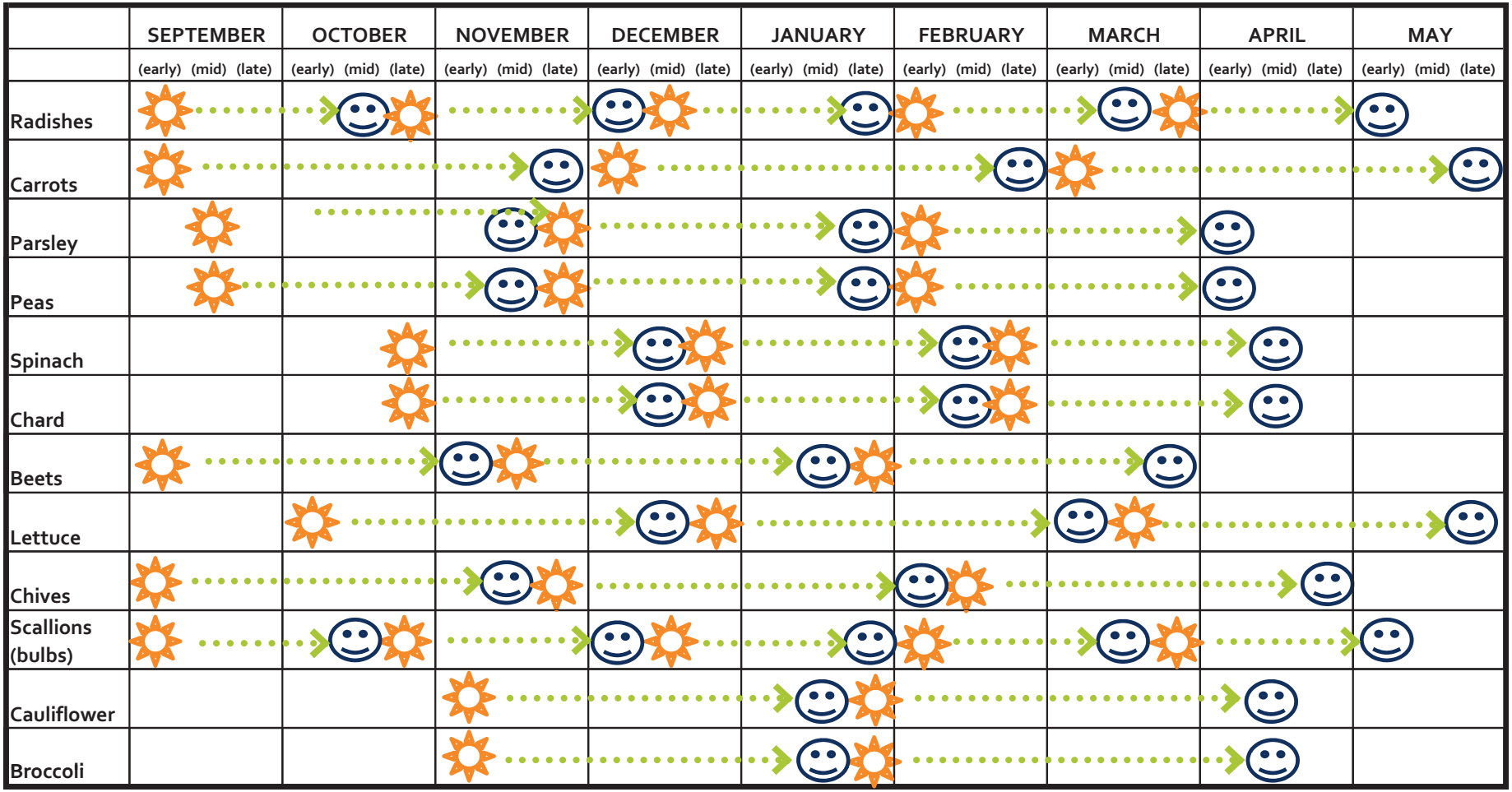
KEY	
SYMBOL	MEANING
	Sow Seeds Inside
	Sow Seeds Outside or Transplant Outside
	Growth Progression (Measuring, Predicting, Recording Observations)
	Harvest Time

This schedule is based on the planting and harvesting information provided in NMSU's Cooperative Extension Service Circular 457-B. For more detailed planting and harvesting information as well as recommended crop varieties, reference Appendix C. No summer maintenance is required.

	SEPTEMBER			OCTOBER			NOVEMBER			DECEMBER			JANUARY			FEBRUARY			MARCH			APRIL			MAY		
	(early)	(mid)	(late)	(early)	(mid)	(late)	(early)	(mid)	(late)	(early)	(mid)	(late)	(early)	(mid)	(late)	(early)	(mid)	(late)	(early)	(mid)	(late)	(early)	(mid)	(late)	(early)	(mid)	(late)
Radishes																											
Carrots																											
Parsley																											
Peas																											
Spinach																											
Chard																											
Beets																											
Lettuce																											
Chives																											
Scallions																											
Cauliflower																											
Broccoli																											

Planting Schedule for Edible Crops
(With row covers from late October to late March)

With cold frames, the planting schedule is much more flexible because they allow the planting of more crops in the fall and grow crops throughout the winter. This chart suggests a staggered planting sequence that will keep students planting and harvesting different crops over the whole school year. Time to harvest may vary slightly depending on temperatures. No summer maintenance is required.



Chapter Five

Summary of Results
Implications for Further Study

Summary of Results

Through a review of literature, exemplary edible school garden programs, and local precedents, this study developed a framework for edible school garden design for kindergarten and first grade in Albuquerque, New Mexico. Landscape designers in Albuquerqe can use this framework to guide edible school garden design as an essential and unifying part of the larger schoolyard ecosystem. While the main objective of the framework is to work with communities to foster ecoliteracy, it is general and adaptable to allow for different school communities to develop a process, program, and design that will best suit their own needs, visions, and place. A more detailed example of a step-by-step guide to working with a community on schoolyard design is provided in Appendix D.

Through a pilot study at Oñate Elementary, a corresponding series of curricular experiences was designed, tested, and developed (reference Appendix A). This series of lesson plans demonstrates how the edible school garden design process can be a part of everyday school activities *and* provide interdisciplinary experience with the major themes of ecoliteracy, state content standards, and learning processes for kindergarten and first grade. These integrated lesson plans are a key part of the edible school garden design process, as outlined by this framework.

This framework was applied and articulated in the design of the B-Building Garden, an edible school garden for kindergarten and first grade at Oñate Elementary. The criteria for edible school garden design for ecoliteracy guided the program, systems design, and materials choice for this design. Combined with continued community and institutional support, integrated curriculum (such as the set developed by this study), collaborative and adaptive design for the whole schoolyard, and a clear, guiding garden pedagogy, this design provides a much-needed model for building community ecoliteracy through edible school garden design in Albuquerque.

Implications for Further Study

Many avenues for further study have been brought to light in this report. To begin with, this study focused on edible school garden design for kindergarten and first grade. However, many (if not all) parts of the framework for edible school garden design developed in this study are also applicable to higher elementary grades, as well as middle school, high school, and university levels. The opportunity exists to develop more specific frameworks for edible school garden design for each of these different age groups and associated communities. As mentioned in the Precedent Study of South Valley Academy, an investigation into service learning for high school and university level students in the areas of edible school garden design and construction would also be particularly beneficial.

The curricular experiences were developed mainly for the purpose of edible school garden *design*. As the design process is meant to be continuous, adaptive, and flexible, any of the lessons could continue to be used once the edible garden is established. However, further study into interdisciplinary and integrated lessons that also teach age-appropriate content standards and learning processes is needed. The edible school garden offers lessons that teach ecoliteracy at many scales, creating abundant possibilities for curriculum development specific to Albuquerque.

Additionally, this study encountered some situations that appear to be barriers to starting and implementing edible school garden programs in Albuquerque public schools (communication between the district and school sites, misconceptions about edible school gardens, etc.). However, the scope of the project did not allow for in-depth research into these barriers. Further study is needed to better understand what causes these situations and the steps needed to best deal with them.

Finally, at the time of this study, no garden has yet been built at Oñate Elementary. Plans and funding exist for the first phase of the design and it is likely to be constructed over the following summer and school year. Much could be gained from a study of how the construction process continues, including how community involvement and institutional support continue to manifest, how integrated lesson plans are implemented, extended, and adapted, and how maintenance, accessibility, and security issues are dealt with in actuality. This presents an ideal opportunity for a landscape architecture student to evaluate the success of this particular garden design. An additional study could record, firsthand, a real edible school garden design construction and maintenance process in Albuquerque. Learning about these processes will be very important for providing models that ensure the design of successful and lasting edible school garden programs in Albuquerque.

Bibliography

Bibliography

A

Alameda County Waste Management Authority. (1997). *Do the Rot Thing: A Teacher's Guide to Compost Activities*. Santa Cruz, Ecology Action.

Albuquerque Public Schools (APS). (2007). *District and School Report Card (2004-2007)*. APS Research, Development and Accountability.

American Society of Landscape Architects (ASLA). (2007). "The 2007 Farm Bill: Supporting Community Gardens for Our Nation's Public Schools." *LANDonline*. Online. Available. www.asla.org.

B

Bachert, R. (1977). *School Gardens in America 1890-1910*. Unpublished Ph.D. dissertation, Indiana University.

Balial, N. (2007). "How Their Gardens Grow." *FW Weekly: Metropolis*. Dec. 5.

Ballantine, J.H. (1997). *The Sociology of Education: A Systematic Analysis.* (4th ed.). New Jersey: Simon and Schuster.

Berger, K.S. (2000). *The Developing Person*. New York: Worth Publishers.

Bishop, E.C. (1912). "School Gardening – Some Cautions." *Nature Study Review*. 8(8):299.

Bloom, B. (1956). *Taxonomy of Cognitive Objectives*. New York: David McKay Co.

Bowers, C.A. (2001). *Educating for Eco-Justice and Community*. Georgia: University of Georgia Press.

Bowers, C.A. (1997). *The Culture of Denial*. Albany: State University of New York Press.

Bowers, C.A. (1995). *Educating for an Ecologically Sustainable Culture*. Albany: State University of New York Press.

Bowers, C. A. (1993). Education, Cultural Myths, and the Ecological Crisis. New York: State University of New York Press.

Brundtland, G.H. (1987). *Our Common Future*. Oxford: World Commission on Environment and Development.

C

California Department of Education. (1991). "The Superintendent's Point of View on Environmental Education." *Science and Education Resource Guide*.

Capra, F. (2007). "Ecology and Community." *Center for Ecoliteracy: Publications*. Online. Available. http://www.ecoliteracy.org

Capra, F. (1999). "Ecoliteracy: The Challenge for Education in the Next Century." *Liverpool Schumacher Lectures*. Berkeley: Center for Ecoliteracy.

Capra, F. (1997). "Creativity and Leadership." Lecture at Mill Valley School District, April 18, 1997. Center for Ecoliteracy.

Center for Ecoliteracy. (1999). *The Edible Schoolyard*. Berkeley, CA, Learning in the Real World.

Center for Ecoliteracy. (1997). *Getting Started: A Guide for Creating School Gardens as Outdoor Classrooms*. Berkeley, CA, Learning in the Real World.

Chesapeake Bay Foundation. (2007) "No Child Left Inside." *Chesapeake Bay Foundation Home*. Online. Available. http://www.eeNCLB.org

Chu, J. (2007). "School Gardens Help Kids Connect with Food Sources." *Inside Bay Area*. Dec. 17.

Clay, R. (2007). "Detoxing the Built Environment." *Monitor on Psychology.* 38 (4): 54-56.

Cornell, J. (1989). *Sharing Nature With Children II.* Nevada City: Dawn Publications.

Corner, J ed.. (1999). *Recovering Landscape: Essays in Contemporary Landscape Architecture*. New York: Princeton Architectural Press.

Crandell, G. (1993). *Nature Pictorialized: "The View" in Landscape History*. Baltimore: the Johns Hopkins University Press.

D

Dennee, J. (2001). *In the Three Sisters Garden*. Vermont: Common Roots Press.

Dennis, S.F. (2008). "Where it's Safe to Get Dirty." *Landscape Architecture.* 98(1): 26-37.

E

Education Development Center (EDC). (2000). *Schoolyard Learning: The Impact of School Grounds*. Online. Available. www.edc.org/GLG/schoolyard.pdf

F

Fenway Victory Gardens. (2008). "Our History." *The Richard D. Parker Memorial Victory Gardens.* Online. Available. http://www fenway victorygardens.com/history.html

G

Garretson, E. (2006). Director, Albuquerque Growers Markets. Interview by Amy Duckert. 20 April. Albuquerque, New Mexico

Glenn, J. L. (2000). *Environment-based Education: Creating High Performance Schools and Students*. Washington, D.C: The National Environmental Education and Training Foundation.

H

Hawken, P., Lovins, A. and H.L. Lovins. (1999). *Natural Capitalism*. New York: Little, Brown, and Company.

Herrington, S. (2001). "Kindergarten: Garden Pedagogy From Romanticism to Reform." *Landscape Journal*. 20, (1), 30-47.

Hexom, D., Taylor, A. and K. Enggass. (2000). *New Explorers Curriculum: Quail Lake Environmental Charter School Philosophical Framework.* Sanger, CA: Sanger Unified School District and School Zone Institute.

Holt, M. (2007). "The Nature and Purpose of Education." *Center for Ecoliteracy: Publications*. Online. Available. http://www.ecoliteracy.org

I

Illich, I. (1970). *Deschooling Society*. London: Marion Boyars.

J

Jackson, J.B. (1994). *A Sense of Place, a Sense of Time*. New Haven: Yale University Press.

Jackson, W. (1994). *Becoming Native to This Place*. Washington, D.C.: Counterpoint.

Johnson, K. and Bjornson, M.R. (2005). *The Chicago School Garden Initiative: A Collaborative Model for Developing School Gardens That Work.* Illinois: The Chicago Botanic Garden.

K

Kats, G. (2006). *Greening America's School: Costs and Benefits. A Capital E Report*. Online. Available. www.cap-e.com

Kawamura, A.G. (2007). "The School in Every Garden." *Center for Ecoliteracy: Publications*. Online. Available. http://www.ecoliteracy.org

Kiefer, J. (2008). "Common Roots: The Food Works Program" *Smart Communities Network*. Online. Available. http://www.smartcommunities.ncat.org/success/Common_Roots.shtml

Koch, P. (2007). "Feeding Our Kids the Right Food… and Inspiring Them to Eat It." *Center for Ecoliteracy: Publications*. Online. Available. http://www.ecoliteracy.org

Korenblat, E. (2002). "Garden Stories." *World Ark*. Spring. 5-8.

L

Lieberman, G.A. and L. Hoody. (1998). *Closing the Achievement Gap: Using the Environment as an Integrating Context for Learning*. San Diego, CA: State Environment and Education Roundtable.

Louv, R. (2005). *Last Child in the Woods: Saving Our Children from Nature Deficit Disorder*. North Carolina: Algonquin Books of Chapel Hill.

Lyle, J.T. (1985). "Design for Human Ecosystems." In Swaffield, S. (2002) *Theory in Landscape Architecture*. Philadelphia: University of Pennsylvania Press.

M

Macy, J. (1997). "World as Lover, World as Self." In J. Smith, *Everyday Mind*. New York: The Berkeley Publishing Group.

Mazria, E. (2005). Santa Fe Green Design Week. Presentation at SITE Santa Fe.

McDonough, W. and M. Braungart. (2002). *Cradle to Cradle*. New York: North Point Press.

McIntyre, L. (2008). "Equal Opportunity Design." *Landscape Architecture*. 98(1): 50-59.

Morrow, B.H. (1995). *Best Plants for New Mexico Gardens and Landscapes*. Albuquerque: University of New Mexico Press.

Murphy, J.M. (2003). *Education for Sustainability: Findings from the Evaluation Study of the Edible Schoolyard*. Prepared for the Center for Ecoliteracy.

N

National 4-H Council. (2008). "History." *4-H Centennial*. Online. Available. http://www.4hcentennial.org/history/main.asp

National Center for Education Statistics. (2000). *Vocational Education in the United States: Toward the Year 2000*. Washington D.C: US Department of Education.

National Gardening Association. (2003). *Growing Ventures: Starting a School Garden Business*. Vermont: National Gardening Association.

National Environmental Education Advisory Council. (2005). *Setting the Standard, Measuring Results, Celebrating Successes: A Report to Congress on the Status of Environmental Education in the United States.* Online. Available. www.epa.gov/enviroed/advisory

O

Ocone, L. and E. Pranis. (1990). *Kids' Gardening.* New York: John Wiley and Sons.

Orr, D.W. (2007). "The Designer's Challenge." Commencement Address to the School of Design, University of Pennsylvania, May 14, 2007. *Center for Ecoliteracy: Publications.* Online. Available. http://www.ecoliteracy.org

Orr, D.W. (2002). *The Nature of Design: Ecology, Culture, and Human Intention*. New York, Oxford University Press.

Orr, D.W. (1994). *Earth in Mind: On Education, Environment and the Human Prospect*. Washington D.C.: Island Press.

Orr, D.W. (1992). *Ecological Literacy: Education and the Transition to a Postmodern World.* Albany: State University of New York Press.

Orr, D.W. (1989). "Ecological Literacy: Education for the Twenty First Century." *Holistic Education Review.* Fall: 48-53.

P

Palmer, J.A. and P. Neal. (1994). *The Handbook of Environmental Education.* New York: Routledge.

Phillips, J. (2001). *New Mexico Gardener's Guide*. Tennessee: Cool Springs Press.

Price, V.B. (2006). "Landscape and Survival." In V.B. Price and B.H. Morrow, *Canyon Gardens: The Ancient Pueblo Gardens of the American Southwest.* Albuquerque: University of New Mexico.

R

Rosner, H., J. Rosner, R. Dannenberg, and B. Jamason. (eds.). (1985). *Albuquerque's Environmental Story.* Albuquerque: Hy and Joan Rosner.

S

Saul, D. (2000). "Expanding Environmental Education: Thinking Critically, Thinking Culturally." *The Journal of Environmental Education.* 31, (3), 5-8.

Snyder, B. (1971). *The Hidden Curriculum*. New York: Alfred A. Knopf.

Sobel, D. (2005). *Place-Based Education: Connecting Classrooms and Communities*. Massachusetts: The Orion Society.

Sobel, D. (1996). *Beyond Ecophobia: Reclaiming the Heart in Nature Educatio*n. Massachusetts: The Orion Society.

Sorvig, K. (2002). "Nature/Culture/Words/Landscapes." *Landscape Journal.* 21(2): 1-14.

Stine, S. (1997). *Landscapes for Learning.* New York: John Wiley and Sons.

Stone, M. (2007). "The Edible Schoolyard." *Center for Ecoliteracy: Publications*. Online. Available. http://www.ecoliteracy.org

Swentzell, R. (2006). "Conflicting Landscape Values." In V.B. Price and B.H. Morrow, *Canyon Gardens: The Ancient Pueblo Landscapes of the American Southwest.* Albuquerque: University of New Mexico Press.

T

Tanner, K. (1999). *A Design Assessment Scale for Elementary Schools. University of Georgia School of Design and Planning Laboratory.* Online. Available. http://www.designshare.com/index.php/print

Taylor, A.P. and G. Vlastos. (1983). *School Zone: Learning Environments for Children*. Corrales, New Mexico: School Zone Inc.

Taylor, A.P., G. Vlastos and A. Marshall. (1991). *Architecture and Children: Teacher's Guide.* Seattle: Architecture and Children Institute.

Taylor, A. P. (2008). *Linking Architecture and Education: Sustainable Design of Learning Environments.* Albuquerque, New Mexico: University of New Mexico Press.

The Sustainable Sites Initiative. (2007). *Standards and Guidelines: Preliminary Report.* American Society of Landscape Architects, Ladybird Johnson Wildflower Center, and the United States Botanic Garden. Online. Available. www.sustainablesites.org

Thayer, R. (1994). "Gray World, Green Heart." In Swaffield, S. (2002). *Theory in Landscape Architecture*. Philadelphia: University of Pennsylvania Press.

Thering, S. (2000). "Theory and Practice in Sustainability: Building a Ladder of Community Focused Education and Outreach." *Landscape Journal.* 19(1): 191-200.

Thiele, L.P. (1999). "Learning the Lesson of Interdependence." *Politics and the Life Sciences*. 18(2): 257-260.

Tikka, P.M., Kuitunen, M., & Tynys, S.M. (2000). "Effects of Educational Background on Students' Attitudes, Activity Levels, and Knowledge Concerning the Environment." *The Journal of Environmental Education*, 31 (3): 12-19.

Titman, W. (1994). "Special Places, Special People, The Hidden Curriculum of School Grounds." *Learning Through Landscapes.* WWF UK.

The Watershed Project. (2004). *Getting Started Garden Design*. Contra Costa County, The Watershed Project.

Thompson, J.W. and K. Sorvig. (2000). *Sustainable Landscape Construction: A Guide to Green Building Outdoors*. Washington D.C.: Island Press.

Trelstad, B. (1997). "Little Machines in Their Gardens: A History of School Gardens in America, 1891-1920." *Landscape Journal.* 16 (2): 161-173.

V

Van der Ryn, S. (2005). *Design for Life: The Architecture of Sim Van der Ryn.* Utah: Gibbs Smith.

Van der Ryn, S. and S. Cowan. (1995). *Ecological Design*. Washington, D.C., Island Press.

Victory Seed Company. (2008). "A History of Victory Gardening." *The Victory Garden.* Online. Available. http://www.victoryseeds.com/TheVictoryGarden/page2.html

W

Waldheim, C., ed. (2006). *The Landscape Urbanism Reader*. New York: Princeton Architectural Press.

Wallbank, D. (2007). "Woodcreek Kids Find Way to Keep Worm 'Pets' Warm." *Lansing State Journal.* Dec. 12.

Wheatley, M. (1992). *Leadership and the New Science: Learning About Organization from an Orderly Universe.* San Francisco: Berrett-Koehler Publishers, Inc.

Wood, C. (1997). *Yardsticks: Children in the Classroom Ages 4-14.* Greenfield, MA: Northeast Foundation for Children.

Z

Zeulner, B. (2003). "Vermicomposting at School Saves $150/Week and Promotes Gardens." *Biocycle*. (44)4: 19.

Baby Lettuce

Appendices

Appendix A

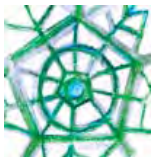
Cultivating Ecoliteracy With Edible School Garden Design: Curricular Experiences

Cultivating Ecoliteracy with Edible School Garden Design

Lesson Plans for K-1 Edible Garden Design

Contents

Lesson Plan
Theme
Symbols



Sample Lesson Plan Format

Age group: K-1
Total lesson time: (in minutes)

Objective: A short description of the content and goals for the lesson.

Context: Location(s) for conducting the lesson

Multiple Intelligences
From Gardner's 8 Intelligences. See the Multiple Intelligences section for further detail.

Content Standards
From the New Mexico State Educational Content Standards and Benchmarks, including Language Arts, Mathematics, Science, Health Education, Social Studies and Arts.

Learning Processes/Skills
From Anne Taylor's "Taxonomy for Learning." A detailed description of the taxonomy and its components is provided in the section of the same name.

Materials

Materials needed for conducting the lesson.

Vocabulary

Important vocabulary words for understanding the process and content of the lesson.

Extensions

Suggestions for additional related and supporting activities.

Activity

A step-by step description of the lesson plan.

Evaluation

Methods for evaluating students' understanding of main concepts in the lesson, including self-evaluation and peer evaluation. Specific areas for evaluation are suggested in the Evaluation Process section.

Lesson Plan Themes

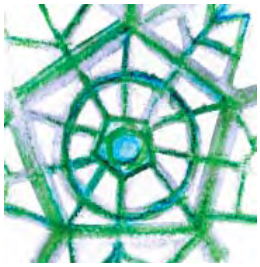
Each lesson familiarizes and/or engages students with the concepts of or more of the themes derived from the Fritjof Capra's organizing principles of ecosystems and communities.

Relationships

An ecosystem is an interdependent community with many relationships. Mapping these relationships leads to patterns. These lessons help students become more aware of their interconnections with the world around them.

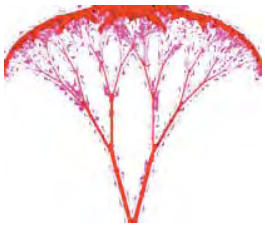
Form and Pattern

Form describes patterns, shifting our understanding of the world from one of objects to relationships. Lessons grounded in this theme help students become more aware of the patterns and forms that make up the web of everyday life.



Networks

Networks describe the pattern of life, which is nonlinear. Through cycles and feedback loops, ecosystems fix mistakes and adapt. These lessons introduce students to the concept of natural cycles and the connections between cycles of individual life forms and their communities.



Self-Organization

Ecosystems organize themselves, producing no waste and relying on partnership for survival. These lessons require teamwork and sharing to carry out a process and/or goal.

Flexibility and Diversity

Ecosystems are flexible, continuously fluctuating, finding balance after disturbance. If a major disturbance eliminates a connection in the web, diversity allows for continuity. Lessons based on this theme engage students in creative problem solving, encouraging the formulation of multiple solutions to the same question.

Lesson Plans

Note: These curricular experiences are designed for children in grades K-1. However, the central ideas behind the lessons can be adapted for higher elementary school grade levels. The order of presentation represents the suggested order in which lessons should occur, as many activities build on concepts learned in previous lessons.

Growing Up!

Age group: K-1
Total lesson time: 5 min.

Objective: Awaken interest and excitement in growing things by helping students make the connection between their own growth and the growth of other living things around them.

Context: Indoor or Outdoor Classroom

Multiple Intelligences

- Bodily-kinesthetic
- Naturalist

Content Standards

Language Arts: IA
Arts: Dance IA, IB, 3B
Life Science: I, II

Learning Processes/Skills

- Valuing
- Stewardship

Materials

Enough space for children to spread out their arms without touching each other.

Vocabulary

seed
stem
leaves
branches
flower
roots
sun / energy
photoynthesize
nutrients
soil

Extensions

Choose the type of seeds based on what you are planting in the garden, or what is seasonally interesting (ie: pumpkins at Halloween time.)

Activity

As a group, pretend you are all tiny seeds. Have children close their eyes as they curl up in a tiny ball. Slowly, guide the students through the process of plant growth, from taking nutrients and water from the soil to gaining energy to make food from the sun, producing, flowers, fruit, and new seeds. Sunflowers are a good seed to start with, as most students are familiar with the seeds and flowers.. This is a good opening activity for any of the following lessons.

Evaluation

Ask students what it felt like to grow into a plant and make new seeds. Discuss the similarities between what plants and children need to grow.

How Does Our Garden Grow?

Age group: K-1
Total lesson time: 30 min.

Objective: Identify kinds of plants and other features that children would like to have in their school garden.

Context: Indoor or Outdoor Classroom

Multiple Intelligences

- Visual-spatial
- Verbal-linguistic
- Intrapersonal
- Interpersonal
- Naturalist

Content Standards

Language Arts: IA, IIA, IIB, IC
Visual Arts: 1A, 1B, 1C, 2B, 4B, 5A, 5B, 5C, 8C
Health Ed: 1:1, 1:4, 3:1, 3:4
Life Science I, Earth Science II

Learning Processes/Skills

- Observation
- Data Collection
- Valuing
- Stewardship

Materials

11x17 or other size (large) white drawing paper
crayons / markers

Vocabulary

seed
stem
leaves
branches
flower
roots
garden
fruits
vegetables
water
soil
nutrients
sunlight

Extensions

Take a field trip to another school garden. Have students observe what is in the garden and discuss what parts they liked or didn't like and why.

Activity

Start this activity with a reading of *The Tiny Seed* by Eric Carle. After reading, introduce students to the idea of growing plants in their own school garden. Discuss the things plants need to grow (food, water, sunlight, soil). Ask students if anyone has eaten any plants today - and what they were. Ask if anyone thinks that they are wearing any plants (cotton). Tell students that they are going to have a chance to share the kinds of plants/features they would like to have in their garden. Give each students a piece of drawing paper and ask them to draw pictures of what they would like to have in their garden.

Evaluation

After students have finished drawing, have them divide into groups based on what they drew (edible/non-edible plants, fruits, vegetables, flowers, animals, non-living features, etc.) Have students hold up their drawings and share what they would like, and why.

Starting Garden Journals

Age group: K-1
Total lesson time: 45 min.

Objective: To experience extended quiet observation time using all the senses, record findings, and discover differences in observation styles.

Context: Indoor Classroom and Garden Area

Multiple Intelligences

- Visual-spatial
- Verbal-linguistic
- Intrapersonal &Interpersonal
- Musical-rhythmic
- Naturalist
- Bodily-kinesthetic

Content Standards

Language Arts: IA, IIA, IIB, IC, IIC
Visual Arts: 1C
Dance: 1B
Social Studies: Geography IIB
Scientific Thinking and Practice I
Life Science III

Learning Processes/Skills

- Observation
- Data Collection
- Valuing
- Stewardship

Materials

-journals: 11X17 white paper, folded in half and bound with yarn (so it is easy to add pages)
-crayons/markers

Vocabulary

five senses
sight
smell
taste
touch
sound
plant
animal
man-made
living
non-living

Extensions

Students can use their journals to record other garden related lessons. To appreciate seasonal changes, students should have observation time at least twice a month.

Activity

As a group, discuss the reasons it might be important to observe a garden area during the design process.. Review ways to observe (the five senses). Discuss some things that students might observe in their garden. Tell students that they will have a chance to record their observations in their own garden journal. This way they can better understand their garden area, including what plants could be grown there, and where they should be planted. Distribute blank journals to each student. As a class, or in smaller groups of five to ten students, travel outside to the garden area. Have each student find a comfortable place to sit, at least two arms lengths away from their neighbor. Ask them to draw or write about what they observe, using the five senses. Kindergarten students may need additional guidance, recording observations from one sense at a time. After about ten minutes, regroup in the classroom. Make a master list of observations and classify each thing as plant, animal, or man-made. For the things that don't fit into these categories (sunlight, rocks, etc.), discuss categories that might describe them.

Evaluation

Have a few students share their journal entries with the rest of the class. Did other students record the same things - and did they record them with the same method, or differently? Discuss what kinds of things might be important to record (shadows, light, colors, sound, water, etc.) and why.

Seasonal Word Walk and Poetry Cubes

Age group: K-1
Total lesson time: 45 min.

Objective: Observe seasonal changes and characteristics in the garden area and brainstorm descriptive words and phrases to create poetry with poetry cubes.

Context: Indoor /Outdoor Classroom and Garden Area

Multiple Intelligences
- Visual-spatial
- Verbal-linguistic
- Interpersonal & Intrapersonal
- Logical-mathematic
- Bodily-kinesthetic
- Naturalist

Content Standards
Math: Number & Operations 1, Geometry 1, Data & Probability 3, 4
Language Arts: IA, IIA, IIB, IC, ID
Science: Scientific Thinking & Practice (ST&P) I, II, Life Science: I, II, Earth Science I, II

Learning Processes/Skills
- Observation
- Data Collection
- Valuing
- Stewardship

Materials
- poetry cube: cardboard cube wrapped with different colored paper on each side.

Vocabulary
seasons
fall
winter
spring
summer
five senses
description
poetry
cube
square
2D & 3D
volume

Extensions
Write poem words on individual pieces of paper that can be tacked up on the wall and rearranged. Allow students to rearrange poems, and create additional poems in their garden journals.

Activity
Read a few short poems to the class. A good one, called "Seasons," with an anonymous author, is as follows, "I'm glad I live where seasons change, I like my world to rearrange." If you use this poem, discuss with students what it means for the world to rearrange and how we can observe these changes. Discuss what poetry is - whether it needs to rhyme or not, and if it has to be about a specific topic. Have students share poems they know. Tell students they are going on a "word walk." During this walk, they will use their five senses to observe the garden area and then they will share their experience with the rest of the class to create a poem. Review the five senses and explain how it will be important to walk quietly in order to really observe what's going on. Walk quietly as a group through the garden area. Upon returning to the classroom, brainstorm descriptive words and phrases from the walk. Write these words and phrases on the poetry cube (2-3 per side). When the cube is full, have students roll it, one at a time, and choose the word/phrase they would like to use next in the poem. Record the poem on chart or chalkboard. When the poem seems to be finished, have one student read the poem out loud. Then read the poem together as a class.

Evaluation
Ask students what they think of their poem. Tell them that if they would like to change it, they can rewrite it in their journals. Share any new poems with the class. Continue to conduct word walks as seasons change and in different parts of the schoolyard and garden area. Re-wrap the poetry cube and create new poems.

Circle Snacks

Age group: K-1
Total lesson time: 30 min.

Objective: Discover circles and spheres in the surrounding world. Find, draw, and eat circles and spheres in fruit and vegetable snacks.

Context: Indoor or Outdoor Classroom

Multiple Intelligences

- Visual-spatial
- Verbal-linguistic
- Interpersonal & Intrapersonal
- Logical-mathematic
- Bodily-kinesthetic
- Naturalist

Content Standards

Math: Geometry 1, Algebra I
Language Arts: IA, IIA, IIB, IC, IIC
Visual Arts: IA, IC, 4B, 5B, 5C, 8C

Learning Processes/Skills

- Observation
- Data Collection
- Creative Problem Solving
- Valuing

Materials

- paper cut into circle
- sphere example
- fruit and veggie circle snacks
- paper towels
- pictures of spheres and circles in nature and daily life
- magnifying lenses
- drawing paper
- markers/crayons

Vocabulary

circle
sphere
2D
3D
fruit
vegetable

Extensions

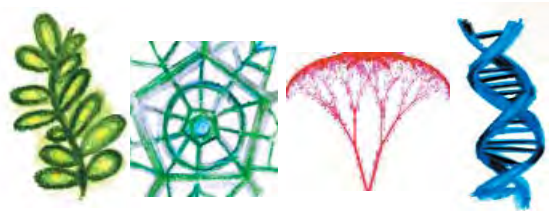
Take 'shape walks,' in which students walk their schoolyard or garden area in search of particular shapes that they record in their garden journals and share with the class.

Activity

Have students sit in a group in a circle. Ask them what they like about the shape they are sitting in. Can everyone see each other? Suggest that there are circles all around us. Hold up circular paper and the sphere example. Discuss the differences and similarities between the two shapes and the meanings of 2D and 3D. Ask students to identify circles and spheres in their classroom. What kinds of circles or spheres do we eat? Tell students they are going to have some circle snacks. However, before they can eat their snack, they need to identify the circles and spheres in it by drawing them on their paper. While they wash hands, distribute the materials. Good snacks include sliced carrots, cucumbers, tomatoes, apples, and whole raspberries, blackberries, and blueberries. Cut enough so that each student can try one kind of each snack. Encourage students to examine their snack with their magnifying lens. If they see additional shapes in their snacks, encourage them to record these shapes on their paper as well.

Evaluation

After students are done drawing and eating, ask them to share their findings with the rest of the class. Did everyone find the same shapes in the same snacks? Why or why not? Allow students to add to their drawings if they wish and add drawings to the garden journals.



Where Seeds Come From

Age group: K-1
Total lesson time: 30 min.

Objective: Discover where seeds come from and introduce concept of the plant life cycle.

Context: Indoor or Outdoor Classroom

Multiple Intelligences	Content Standards	Learning Processes/Skills
- Visual-spatial - Verbal-linguistic - Interpersonal - Bodily-kinesthetic - Logical-mathematic - Naturalist	Language Arts: IA, IIA, IIB, IC, IIC Math: Geometry: 3, 4, Number & Operations 1, 3, Data & Probability 1, 2, 3 Dance: 1B Science: ST&P I, II, III, Life Science I, II	- Observation - Data Collection - Creative Problem Solving

Materials

- variety of fruits (tomatoes, apples, oranges, sweet peppers, kiwis) cut in half
- paper plates
- paper towel
- craft sticks

Vocabulary

predict/prediction
fruit
seeds
promise
life cycle

Extensions

Do an activity in which children participate in the plant life cycle kinesthetically. Draw a circle (with tape or chalk) on the ground and have children move from each stage in the cycle, naming which stage they are representing and the characteristics of that stage.

Activity

Show students each of the fruits and identify them. Discuss how a fruit is a place where seeds are made and protected. Ask the students to predict how many seeds each fruit will have and record these predictions on a chart or the chalkboard. Discuss their reasoning for why they predicted certain numbers of seeds. Tell students that they will get to work in pairs to discover the actual amount of seeds in each fruit. Discuss ways that they can help each other. Distribute cut fruit and craft sticks. Tell students that they can use the craft sticks to find all the seeds. When students have counted all their seeds, they can come up and record their results on the chart or chalkboard. After everyone is finished counting, regroup and discuss results. Which fruit had the most/least seeds? Did any fruits have the same number of seeds? Ask students "Where do seeds come from?" (fruits). Then ask, "Where do fruits come from? (plants). Then ask, "Where do plants come from? (seeds). Explain that they have just described the life cycle of a plant. Draw a circular diagram, with seeds at the top, a plant 1/3 of the way around, and fruit another 1/3 of the way around. Introduce the idea that flowers are also a part of the cycle. Finish the lesson by reading *A Seed is a Promise* by Clair Merrill.

Evaluation

Have students pick a plant of their choice to draw their own plant life cycle. Share drawings with the rest of the class. Discuss different plant life cycles to see if they are the same. Share drawings, compare results, and add drawings to garden journals.

Parts of Seeds and Bulbs

Age group: K-1
Total lesson time: 30 min.

Objective: Explore the parts of a lima bean to find out where new plants come from. Discover and learn the parts of a lima bean and seeds in general. Discover and learn the parts of a bulb.

Context: Indoor or Outdoor Classroom

Multiple Intelligences
- Visual-spatial
- Verbal-linguistic
- Intrapersonal & Interpersonal
- Bodily-kinesthetic
- Naturalist

Content Standards
Language Arts: IA, IIA, IIB, IC, IIC
Math: Geometry 1
Visual Arts: 4B, 5B, 5C, 8C
Science: ST&P I, II, III
Life Science I, II

Learning Processes/Skills
- Observation
- Data Collection
- Creative Problem Solving
- Valuing
- Stewardship

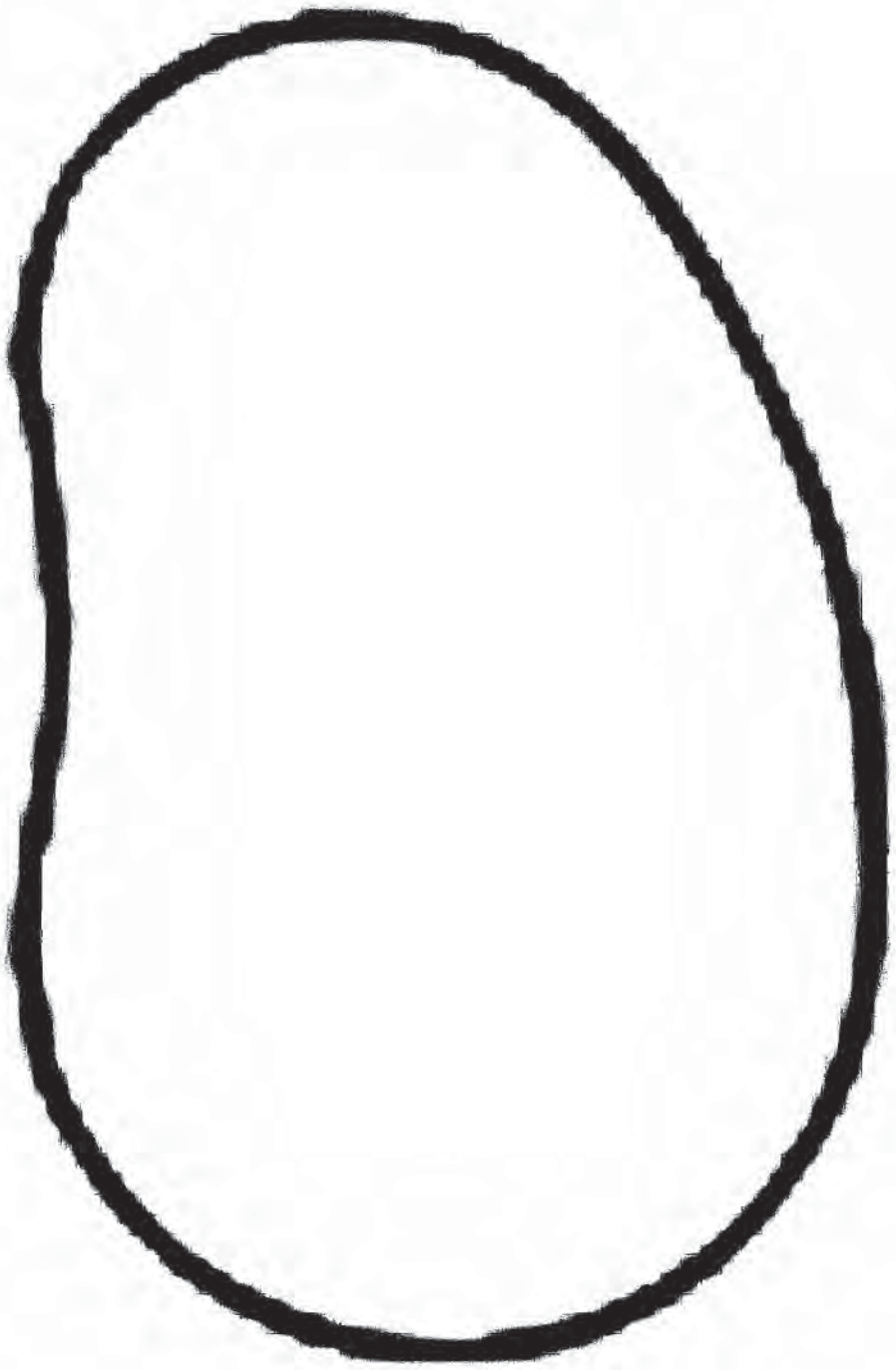
Materials
- 2 lima beans for each student (one soaked overnight, one dry)
- paper towels
- lima bean handout (see next page for example)
- crayons/markers
- magnifying lenses

Vocabulary
seed coat
leaves
roots
storage
embryos
cotelydon
sprout
tunic (dry outer bulb)
scale leaves (interior bulb)
germinate

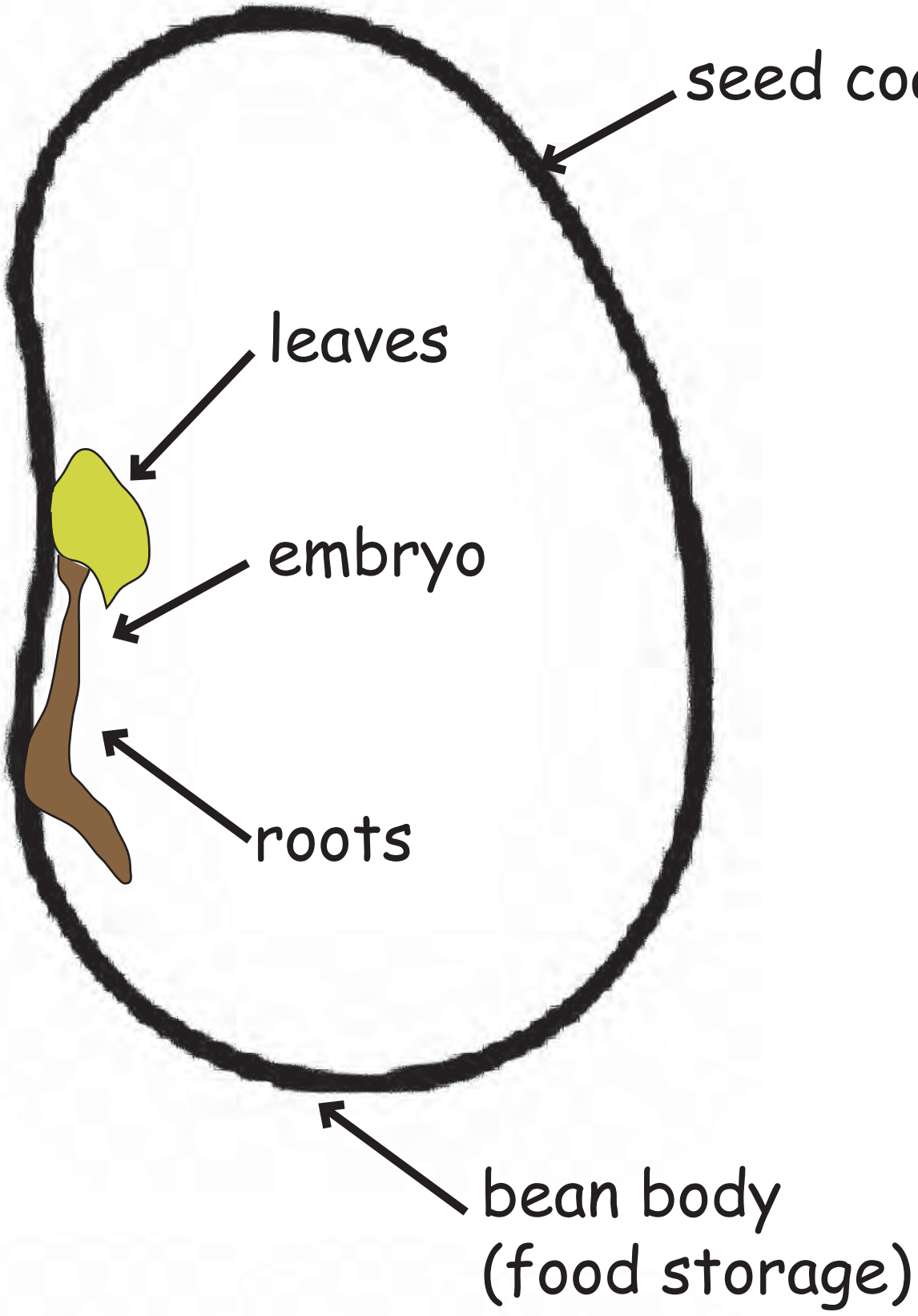
Extensions
Have students do a drawing of a bulb with each part labeled. Plant bulbs in the garden area and around the school grounds as a way to raise awareness and support for the garden program in the spring.

Activity
Give each student an unsoaked lima bean and ask them to describe how it looks, feels, etc. Give each student a soaked lima bean and ask them to explain how it is different. Show students how to gently peel the seed coat off of the soaked bean. Ask what they think the coat is for (to protect seed until growing conditions are right). Show students how to gently open the seed. Explain that inside there is a tiny new plant and encourage students to find this plant and observe it with their magnifying lenses. Explain that to help the seed get started, it has a food storage area. Ask students to guess where this area is (the seed body/cotyledon). On the lima bean handout, have students draw in the tiny plant, including roots and leaves. Provide an example so they can label each part (see following pages for example handout and diagram). On the chalkboard, draw the progression of bean growth. Gather as a group and tell students that other plants, like bulbs, have different ways of storing food and protecting seeds and new growth. Show students a bulb and point out where the roots are and where the leaves will sprout. Open the bulb and pass around the two pieces so that students can observe the different parts. While passing it around, draw a large picture of the bulb section on the board. As a group, label each part of the bulb on the board.

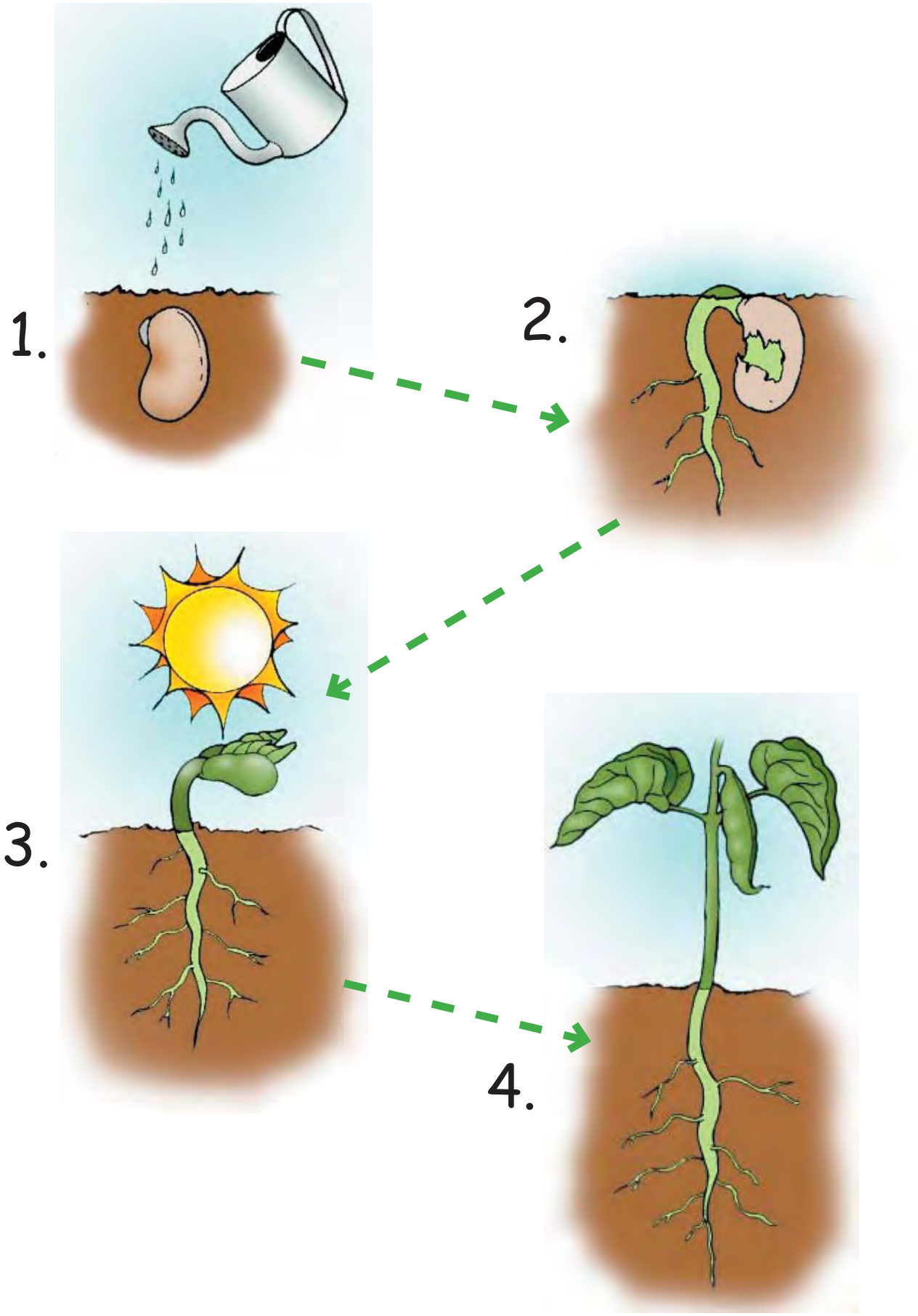
Evaluation
Have students share their bean diagrams and evaluate their work.



lima bean



lima bean



bean growth diagram

Planting Bulbs!

Age group: K-1
Total lesson time: 30 min.

Objective: Review parts of a bulb, develop rules for being in the garden area, and plant bulbs in designated spaces outside.

Context: Indoor Classroom and Garden Area

Multiple Intelligences
- Visual-spatial
- Verbal-linguistic
- Logical- mathematic
- Intrapersonal & Interpersonal
- Bodily-kinesthetic
- Naturalist

Content Standards
Language Arts: IA, IIA, IIB,
Math: Number and Operations I, Measurement 1, 2
Arts: Dance IB, Music IA, IC
Life Science I, II, Earth Science II
Health Ed 3:1, 3:3, 3:4, 3:5

Learning Processes/Skills
- Observation
- Data Collection
- Creative Problem Solving
- Valuing
- Stewardship

Materials
- map of bulb planting areas
- one (or more) bulb for each child
- prepared soil (spaded and loose) for planting
- rulers with masking tape markers at planting depth
- small (child size) shovels

Vocabulary
bulb
soil
planting depth
shovel
trowel
stewardship

Extensions
Have students do drawings of what they think the bulbs will look like. Decorate the classroom or adjacent hallways with pictures to raise excitement for spring. Students can also make signs to designate planting areas and protect bulbs.

Activity
Tell students that today they are going to plant some bulbs. Teach them the "Plant the Bulbs" song (see attached). Review parts of the bulb from the previous lesson. Pay particular attention to which side of the bulb should go down (root side). Then ask students what they think will be important for them to remember when they go outside to plant (garden rules). Write these suggestions on paper or chalkboard for later use. Rules should be simple, like sharing tools and digging space, protecting the plants, practicing safe behavior and looking out for each other. Divide students into groups of four or five for planting. Use a predetermined map for planting bulbs. If other classes are also planting bulbs, discuss with students that the other areas are for other classes. Use rulers marked with masking tape at the appropriate depths to help students determine how deep to plant their bulbs. Mark the area with a combination of lining (lumber or edging) and mulch so that other students know not to tread there. Ask students to predict when the bulbs will bloom. Discuss watering needs and make a plan for caring for the bulbs.

Evaluation
After planting the bulbs, ask students how they thought the garden rules worked. Ask whether or not they think they need to add or change any rules. Ask students to predict when the bulbs will bloom. Discuss any watering needs the bulbs will have.

Planting the Bulbs Song

(To the tune of "Round the Mulberry Bush")

This is the way we plant the bulbs,
Plant the bulbs, plant the bulbs,
This is the way we plant the bulbs,
Before the winter comes.

Other Verses:
This is how deep we dig the hole, dig the hole .....
This is the way we put in the bulbs, put in the bulbs ....
This is the way we cover the bulbs, cover the bulbs ....
This is the way we check the bulbs, check the bulbs ....
This is the way we water the bulbs, water the bulbs ....

Soak and Sprout Snacks

Age group: K-1
Total lesson time: 30 min.

Objective: Review parts of the seed and observe the process of germination. Make connections between seed growth and the food we eat.

Context: Indoor or Outdoor Classroom

Multiple Intelligences
- Visual-spatial
- Verbal-linguistic
- Interpersonal
- Bodily-kinesthetic
- Naturalist

Content Standards
Math: Number and Operations 1
Health Ed: 3:1, 3:2
Life Science: I, II

Learning Processes/Skills
- Observation
- Data Collection
- Valuing
- Stewardship

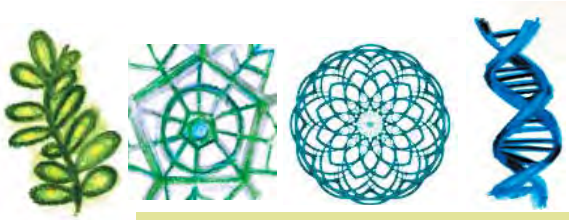
Materials
- seeds for sprouting
- resealable sandwich bags
- masking tape
- paper towels
- water
- glass sprouting jar (optional)

Vocabulary
seed
seed coat
cotyledon
embryo
germination
sprout
estimate

Extensions
Have students record the germination process by drawing pictures of their seed sprouts in their garden journals. Make a flip-book to show the germination process in action.

Activity
Begin this lesson with a review of the parts of a seed and their functions (see Parts of a Seed lesson). Tell students that they will have a chance to grow their own sprouts for a classroom snack. This lesson is a good one to do on Monday or Tuesday so the children can observe the growth process during the week and eat their sprouts on Friday. Show example seed sprout bag - a resealable plastic bag with damp paper towel folded inside, and masking tape for names on the outside. Show students how to sprinkle seeds on half of the damp paper towel, fold the towel in half, and place it inside the plastic bag. Distribute a variety of sprout seeds to each table. Tell students that they can use any combination of the seeds provided, and that they can count out 40 seeds to sprout. Have students dampen their paper towels, count seeds, and prepare sprout bags. Place the bags in a semi-sunny location. Have children make estimates for when their sprouts will be ready to eat. At the same time, start several sprouts in a glass sprouting jar. This way, there will be extra snacks in case someone's seeds don't sprout. Sprouts will probably be ready to eat in 3-4 days. Have students check their seeds every day.

Evaluation
When students eat their sprout snacks, have them share their reactions to the look and taste of the sprouts. Ask if they have eaten the same plants in different stages of the life cycle (which stages?). Have students review the parts of the plant that they are eating as they snack. Record these observations in the garden journals.



Parts of a Plant

Age group: K-1
Total lesson time: 30 min.

Objective: Learn the parts of a plant and what each part does to help the plant. Review the plant life cycle.

Context: Indoor or Outdoor Classroom

Multiple Intelligences
- Visual-spatial
- Verbal-linguistic
- Intrapersonal
- Interpersonal
- Naturalist

Content Standards
Language Arts: IA, IIA, IIB, IC, IIC, ID
Music IA, 3C
Visual Arts; IA, IB, 3B, 4B, 5B, 1C, 5C, 8C
Science: ST&P I, II, III
Life Science I, II,
Earth Science II

Learning Processes/Skills
- Observation
- Data Collection
- Creative Problem Solving
- Valuing
- Stewardship

Materials
- 1 flowering potted plant
- 1 cutting stuck in soil in pot
- 12 x 9 white drawing paper
- 4"x9" strips of brown paper
- paste or glue
- craft sticks
- crayons/markers

Vocabulary

stem	soil
roots	sunlight
leaves	nutrients
flower	pollinator
life cycle	

Extensions

Have students diagram a plant that lives in their schoolyard, with each of its parts labeled. Share diagrams with the rest of the class and make a master list of different kinds of plants in the schoolyard.

Activity

Tell students that today they are going to look at the four parts of a plant. Show students two potted plants: one with a cutting (no roots) and one with roots. Ask one student to gently push on the plants. Discuss why one plant falls over and one stays upright. Pull the rooted plant gently out of its pot to show students the roots. Explain that the roots hold the plant in place and are one of the four important parts of a plant. Ask students to identify the other parts of a plant. Sing the "Parts of a Plant" song (attached). Using the potted plant, identify the stem, leaf, and flower. Ask students what the stems do (carry water and nutrients from roots to leaves and hold leaves up to get energy from the sun.) Ask students what the leaves do (food factory - take water and nutrients from soil and combine it with sunlight to make food). Ask students what the flower is for (making new seeds and attracting pollinators). Tell students that they will make their own diagrams of a plant with all its parts. Show sample picture. Pass out materials. Explain that the brown paper is the soil, the craft stick will be the stem, and that they will draw their own leaves and flowers. They can use the sample as a guide to label each part of the plant. Encourage students to also include the things plants need to survive (soil, sunlight, water, pollinators, etc.).

Evaluation

Have students share their plant diagrams with the rest of the class, identifying each part of the plant on their diagram.

Parts of a Plant Song

(To the tune of "Muffin Man")

Oh, do you know the parts of plants,
The parts of plants, the parts of plants?
Do you know the parts of plants
That make them grow and grow?

The roots, they hold the plant in place,
The plant in place, the plant in place.
The roots they hold the plant in place
Bringing water to the leaves.

The leaves soak up the rays of sun,
The rays of sun, the rays of sun.
The leaves soak up the rays of sun
And help the plant make food.

The stems support the leaves and flowers,
Leaves and flowers, leaves and flowers.
The stems support the leaves and flowers,
carrying nutrients from the soil.

The flower grows into a fruit,
Into a fruit, into a fruit.
The flower grows into a fruit
Which holds the tiny seeds.

And now you know the parts of plants,
The parts of plants, the parts of plants.
Now you know the parts of plants,
That make them grow and grow.

Mapping My Classroom

Age group: K-1
Total lesson time: 30 min.

Objective: Introduce concepts of mapping by identifying major areas of the classroom and create a map using basic shapes.

Context: Indoor classroom

Multiple Intelligences

- Bodily-kinesthetic
- Visual-spatial
- Interpersonal

Content Standards

Math: Geometry 1, 2
Language Arts: I-A, II-A, II-B
Arts: Visual: 1A
Social Studies: Geography II-A

Learning Processes/Skills

- Observation
- Data collection
- Creative problem solving

Materials

- Map examples at many scales (ie: world, U.S., state, neighborhood, classroom, garden)
- Large paper
- Multi-colored markers

Vocabulary

2D & 3D
map
circle
square
rectangle
line

Extensions

Have students draw their own map of the classroom, the schoolyard, or their bedroom at home.

Activity

As a group, discuss what a map is, what it can be used for, why we would make a map. Show students example maps and explain that they are views from above, like a bird flying high. As you get closer, the bird zooms in (children can flap their wings if they want to). For buildings, suggest that they now have x-ray vision and can see through the roof. Tell students you are going to create a map of their classroom as a group. Have everyone sit in a circle and place the large paper in the center where everyone can see. Ask students to identify major parts of the classroom and what shapes they are - the walls, door, windows, tables, bookshelves, etc. Explain that you will show the 3D shapes of the classroom as 2D shapes on the paper (from above). As they identify shapes of different areas have students help you locate the place on the map to draw them. Use a different color for different areas.

Evaluation

After drawing the map, pin it up on the wall. Select a few students to walk to the place you point to on the map. Continue until all of the places drawn on the map have been accurately identified.

Human Rulers

Age group: K-1
Total lesson time: 30 min.

Objective: Discover conventional and non-conventional methods of measurement using measuring tools and the body (hand spans and pacing).

Context: Indoor Classroom and Garden Area

Multiple Intelligences
- Visual-spatial
- Verbal-linguistic
- Intrapersonal &Interpersonal
- Bodily-kinesthetic

Content Standards
Language Arts: IA, IIA, IIB, IC
Math: Number and Operations 1,3
Measurement 1,2, Data Analysis & Probability 1,3
Scientific Thinking and Practice I, II, III

Learning Processes/Skills
- Observation
- Data Collection
- Creative Problem Solving

Materials
12" rulers
meter stick
tape measure
12" long strings for each child

Vocabulary
measure
distance
near
far
length
width
units
inches
feet
estimate
hand span
pace

Extensions
Have students measure different parts of the garden area and their playground. Record measurements in garden journals and share results in class.

Activity
Introduce the concept of measurement by discussing the kinds of things we measure, why we measure them, and how we measure them. Ask students what kinds of things they would want to measure for designing a garden, and why. Share the different kinds of measuring tools (ruler, meter stick, etc.). Ask students what they might do if they had to measure something, but forgot to bring their ruler. Tell them that designers often use their bodies to measure things because they always have their bodies with them. First, demonstrate measurement with a hand span. Have children compare with their neighbor, then find one thing in the classroom that is the same length as their hand span. Share findings as a group. Distribute the 12" long strings and discuss units of measurement. Have students find one thing in the classroom that is 12" long, using their string. Share findings as a group. Ask students how they think they could use their bodies to measure a larger distance. Introduce pacing, or measuring a distance using the length of one's stride. Have students pace inside first, in groups of four or five, counting out loud their number of paces. Take students outside to pace different parts of the garden area. Share findings and record measurements in garden journals

Evaluation
Discuss differences in body-measured distances. Measure paced areas with a measuring tape and compare with paced numbers. Discuss why differences exist and how to address these differences to get accurate measurements.

Shaping the Garden

Age group: K-1
Total lesson time: 30 min.

Objective: Identify how shapes can be used in design to represent existing features and spaces and also create new designs.

Context: Indoor or Outdoor Classroom

Multiple Intelligences

- Visual-spatial
- Verbal-linguistic
- Interpersonal
- Bodily-kinesthetic

Content Standards

Language Arts: IA, IIA, IIB, IC
Math: Geometry: 1, 2, 3, 4
Visual Arts: 4B, 8C, Dance: 1B
Social Studies: Geography IIA
Scientific Thinking and Practice III

Learning Processes/Skills

- Observation
- Data Collection
- Creative Problem Solving

Materials

-2 pre-drawn garden area plans, preferably on a felt board
- felt shapes
- if felt board is not available, use large paper and post-it note shapes

Vocabulary

shape
circle
oval
square
triangle
rectangle
design
plan
map
space
boundary

Extensions

Have students do a garden design plan of their own, using the same shapes and garden area plan. Allow students to use non-conventional shapes to design areas if they choose. Share designs.

Activity

Divide class into two groups. Make sure each group has enough space for everyone to sit comfortably on the ground and see the garden plans. In each group, place pre-drawn garden plans on a flat surface (chalkboard, wall, easel, tabletop, etc.) so everyone can see. Discuss the map on the board and identify shapes that represent existing features (circles for trees, rectangles for buildings, sidewalk, etc.). As a group, pretend to be birds flying over your classroom and garden area and identify different spaces. One at a time, have students choose a shape, explain what they would like it to represent, and place it on the garden plan. Explain that shapes cannot overlap each other or the boundary lines of the garden area. Discuss how this relates to the actual planning of the garden, in terms of shaping plots of growing space, or leaving room for pathways and benches. When all shapes have been placed, discuss how shapes did or did not fit together. In each group, decide what students would like to share with the other group about their design process.

Evaluation

Regroup and place both plans next to each other on a flat surface so everyone can see. Discuss what each group discovered about shapes in designing a garden. How are the designs similar/different? What do students like/dislike about each plan? Discuss how the class can apply this lesson to the real design of their garden.

Gardner's Multiple Intelligences

Howard Gardner's theory of multiple intelligences addresses the different ways in which we learn and solve problems within our cultural settings. His theory has been readily accepted by educational theorists, and is frequently used among educators and educational policy makers to structure school environments and curricular experiences so that all intelligences are stimulated and developed.

The Eight Intelligences

Verbal-linguistic: This intelligence is characterized by sensitivity to spoken and written language, the ability to learn languages, and the capacity to use language to accomplish certain goals.

Logical-mathematic: This intelligence consists of the capacity to analyze problems logically, carry out mathematical operations, detect patterns, and investigate issues scientifically

Visual-spatial: This intelligence exercises the potential to recognize and use spatial patterns and relationships in both large and confined areas.

Musical-rhythmic: This intelligence involves skill in the performance, composition, and appreciation of musical patterns.

Bodily-kinesthetic: This intelligence involves using one's whole body or parts of the body to solve problems.

Interpersonal: This intelligence consists of the capacity to understand the intentions, motivations and desires of other people, working best through social interactions.

Intrapersonal: This intelligence entails the capacity to understand oneself, to appreciate one's feelings, fears and motivations

Naturalist: Added to the list in 1999, this intelligence is characterized by the ability to recognize, categorize and draw upon certain features of the environment

Adapted from:
Smith, M. K. (2002) 'Howard Gardner and multiple intelligences', the encyclopedia of informal education, http://www.infed.org/thinkers/gardner.htm. Last updated: December 28, 2007

Anne Taylor's "Taxonomy for Learning"

This taxonomy for learning describes five stages of learning in the progression to deeper thought, application, and understanding. These five stages represent the development of learning from knowledge retention to higher levels of thinking, including synthesis and evaluation. Educational activities should be designed to engage students in all levels of the taxonomy, described below.

Learning Processes

Observation

This level of learning is multi-sensory, discovering the world through the five senses. It links perceptions to language and literacy and includes visual literacy. It also includes the ability to record observations using a variety of media.

Data Collection

This learning process involves measuring and counting, research, reading, and understanding, sorting, classifying, and comparing.

Creative Problem Solving

This stage of learning requires students to define the problem, form a hypothesis, test the hypothesis, analyze and synthesize data collected and prove/disprove the hypothesis based on findings. It also includes starting over again, based on what was previously learned.

Valuing

At the valuing stage, students make critical aesthetic judgements and decisions, work in groups and understand other points of view, and evaluate work.

Stewardship

At this level, students think beyond themselves, share their findings with each other, and cultivate a mutually beneficial relationship with the surrounding cultural, built, and natural environment. Stewardship involves developing a sense of place and local ethics as well as an understanding of global interconnections and responsibilities.

Source:
Taylor, A. (2008). "Taxonomy of Learning." *Linking Architecture and Education: Sustainable Design of Learning Environments.* Albuquerque, New Mexico: University of New Mexico Press.

Criteria for Evaluation

These criteria, adapted for the target age group (K-1) for these lesson plans, provide a framework for teachers to evaluate student work and the success of the lesson, and for students to evaluate their own work and the work of their peers.

Fluency and Clarity of Communication

Group discussions are a place where students can communicate verbally about what they have learned. Sharing drawings, findings, and diagrams with the rest of the class is a way for students to examine and evaluate different methods of visual communication and adapt their own methods.

Imagination, Innovation, and Creativity

Encourage students to look for different ways to express themselves, through observation of peer work or experimentation. Help students use descriptive words (in addition to like, dislike, nice or bad) to explain their reaction to a project.

Understanding the Process

Review central concepts of the lesson to ensure they were learned. Apply these concepts (in a different way, if possible) in additional activities to increase their relevance and meaning.

Detail and Overall Aesthetics

Encourage students to take pride in their work by fostering an environment of openness, mutual respect, and support. Students should feel comfortable sharing their work and commenting on the work of others. When students share their work, encourage constructive self and peer evaluation, paying particular attention to details like use of color, line weight, accurate lettering (for kindergartners - attempts at lettering), or the use of symbols (like arrows).

Technical Competence

As this age group is just beginning to have experience with symbolic thinking, accurately diagramming and lettering is a challenge. Support attempts to do so, providing many opportunities for practice and examples for guidance when necessary.

Source:

Taylor, A. (2008). *Linking Architecture and Education: Sustainable Design of Learning Environments.* Albuquerque, New Mexico: University of New Mexico Press.

Literature List

GARDENING/GROWING:

The Carrot Seed by Ruth Krauss and Crockett Johnson
Mrs. Spitzer's Garden by Edith Pattou
The Giant Carrot by Jan Peck and Barry Root
Tops and Bottoms by Janet Stevens
This is the Sunflower by Lola M. Shaefer
Sunflower House by Eve Bunting
Sunflower Sal by Janet S. Anderson
Jack's Garden by Henry Cole
Growing Vegetable Soup by Lois Ehlert
Planting a Rainbow by Lois Ehlert
The Tiny Seed by Eric Carle
How a Seed Grows by Helene J. Jordan
One Bean by Anne Rockwell
Raccoons and Ripe Corn by Jim Arnosky
The Empty Lot by Dale H. Fife
A Tree is Nice by Janice May Udry
In a Nutshell by Joseph Anthony
The Dandelion Seed by Joseph Anthony
Camille and the Sunflowers by Laurence Anholt
In My Garden by Ward Shumaker
Ladybug at Orchard Avenue by Kathleen Weidner Zoehfeld
Miss Rumphius by Barbara Cooney
Mysteries in the Garden by Aileen Fisher
Pumpkin Circle by George Levenson
Seeds on the Go by Aileen Fisher
The Chalk Box Kid by Clyde Robert Bulla
The Gardener by Sarah Steweart
The Rose in My Garden by Arnold Loebel
The Snail's Spell by Joanne Ryder

FOOD AND NUTRITION

All the Places to Love by Patricia MacLachlan
Amelia's Road by Linda Jacobs Altman
Bread is for Eating by David and Phyllis Gershator
Harvest by Kris Waldherr
Lunch by Denise Fleming
Fanny at Chez Panisse by Alice Waters
Eating the Alphabet by Lois Ehlert

Literature List
(continued)

Market Day by Eve Bunting
Oliver's Vegetables by Vivian French
The Ugly Vegetables by Grace Lin
Vegetable Friends by Tony Lawlor and Bruce Kociemba
Working Cotton by Sherley Anne Williams

WATER
Alejandro's Gift by Richard Albert
The Poppy Seed by Clyde Robert Bulla
Deer at the Brook by Jim Arnosky
Rabbits and Raindrops by Jim Arnosky
The Water Hole by Graeme Base

CARING FOR OUR WORLD/DIVERSITY/NATURAL RESOURCES
Each Living Thing by Joanne Ryder
Earth Dance by Joanne Ryder
Everybody Needs a Rock by Byrd Baylor
The Way to Start a Day by Byrd Baylor
What Do You See? by Janina Domanska
The Wonderful Happens by Cynthia Rylant

SEASONS/LIFE CYCLES
Butterfly House by Eve Bunting
Fall Leaves Fall by Zoe Hall
Frederick by Leo Lionni
Possum's Harvest Moon by Anne Hunter
Waiting for Wings by Lois Ehlert

Curriculum Resources

Alameda County Waste Management Authority. (1993). ***Do The Rot Thing: A Teacher's Guide to Compost Activities.*** Santa Cruz, CA: Ecology Action.

Dennee, J. (2001). ***In the Three Sisters Garden.*** Vermont: Common Roots Press.

Kiefer, J., and M. Kemple. (1998). ***Digging Deeper: Integrating Youth Gardens Into Schools and Communities.*** Vermont: Common Roots Press.

Potter, M., and C. Howell. (1992). ***Arid Lands, Sacred Waters: Student Activity Packet.*** New Mexico: New Mexico Museum of Natural History.

Rosner, H., J. Rosner, R. Dannenberg, and B. Jamason. (Eds.). (1985). ***Albuquerque's Environmental Story***. Albuquerque: Hy and Joan Rosner.

Taylor, A., G. Vlastos, and A. Marshall. (1991). ***Architecture and Children.*** Seattle, Washington: Architecture and Children Institute.

White, J., K. Barret, J. Kopp, C. Manoux, K. Johnson, and Y. McCullough. (2006). ***Math in the Garden: Hands-On Activities That Bring Math to Life.*** Vermont: National Gardening Association.

Appendix B

New Mexico State Educational Content Standards and Benchmarks

New Mexico Content Standards and Benchmarks

K-1 Mathematics

Strand: Number and Operations

Standard: Students will understand numerical concepts and mathematical operations

Benchmarks:

1. Understand numbers, ways of representing numbers, relationships among numbers, and number systems
2. Understand the meaning of operations and how they relate to one another
3. Compute fluently and make reasonable estimates

Strand: Algebra

Standard: Students will understand algebraic concepts and applications

Benchmarks:

1. Understand patterns, relations, and functions
2. Represent and analyze mathematical situations and structures using algebraic symbols
3. Use mathematical models to represent and understand quantitative relationships
4. Analyze changes in various contexts

Strand: Geometry

Standard: Students will understand geometric concepts and applications

Benchmarks:

1. Analyze characteristics and properties of two and three dimensional shapes and develop mathematical arguments about geometric relationships
2. Specify locations and describe spatial relationships using coordinate geometry and other representational systems
3. Apply transformations and use symmetry to analyze mathematical situations
4. Use visualization, spatial reasoning, and geometric modeling to solve problems

Strand: Measurement

Standard: Students will understand measurement systems and applications

Benchmarks:

1. Understand measurable attributes of objects and the units, systems, and process of measurement
2. Apply appropriate techniques, tools, and formulas to determine measurements

Strand: Data analysis and probability

Standard: Students will understand how to formulate questions, analyze data, and determine probabilities

Benchmarks:

1. Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them
2. Select and use appropriate statistical methods to analyze data
3. Develop and evaluate inferences and predictions that are based on data
4. Understand and apply basic concepts of probability

K-1 Language Arts

Strand: Reading and Listening for Comprehension

Content Standard I: Students will apply strategies and skills to comprehend information that is read, heard, and viewed

Benchmarks:

I-A. Listen to, read, react to, and retell information

I-B. Locate and use a variety of resources to acquire information across the curriculum

I-C. Demonstrate critical thinking skills to comprehend written, spoken, and visual information

I-D. Acquire reading strategies

Strand: Writing and Speaking for Expression

Content Standard II: Students will communicate effectively through speaking and writing

Benchmarks:

II-A. Demonstrate competence in speaking to convey information

II-B. Apply grammatical and language conventions to communicate

II-C. Demonstrate competence in the skills and strategies of the writing process

Strand: Literature and Media

Content Standard III: Students will use literature and media to develop an understanding of people societies, and the self

Benchmarks:

III-A. Use language, literature, and media to gain and demonstrate awareness of cultures around the world
III-B. Identify and use the types of literature according to their purpose and function

K-4 Arts

Content Standard 1: Learn and develop the essential skills and technical demands unique o dance, music, theatre/drama, and visual arts

Benchmarks:

Dance:

A. Accurately demonstrate eight basic locomotor movements (walk, run, hop, jump, leap, gallop, slide, and skip) and non-locomotor movements (bend, twist, stretch, and swing)
B. Show the concepts of personal space and general space, working alone, with a partner, and in a group
C. Distinguish between actions and elements in performing and observing movement
D. Demonstrate kinesthetic (sensory) awareness, focus and concentration, and accuracy in moving various musical rhythms

Music:

A. Sing and speak using appropriate vocal techniques while maintaining a steady beat
B. Explore timbre (tone quality) capabilities and limitations of various classroom instruments
C. Explore through simple movement simple rhythm patterns
D. Identify basic rhythmic symbols including whole, half, quarter, and eighth notes, and the concepts of dotted notes and rests

Theatre:

A. Use body and voice to portray character that contributes to the action of a dramatization
B. Imagine and construct technical elements for classroom dramatizations
C. Select characters, environments, and situations for dramatizations
D. Improvise dialogue to tell stories

Visual Arts:

A. Participate in the process of making art to understand the elements of art: line, shape, form, color, and texture
B. Explore and become familiar with art materials and their related techniques
C. Use art materials and tools in a safe and responsible manner

Content Standard 2: Use dance, music, theatre/drama, and visual arts to express ideas

Benchmarks:

Dance:

A. Explain how dance is different from other forms of human movement such as sports or everyday gestures
B. In groups, actively explore dance as communication and discuss various interpretations and reactions to dance

Music:

A. Recognize music and its notation as a type of language capable of expressing ideas

Theatre:

A. Develop improvised classroom dramatizations that express various moods or emotions
B. Describe the moods or emotional qualities of different kinds of live or videotaped theatrical performances

Visual Arts:

A. Explore and understand works of art based on self, family, community and the world
B. Know and use art to interpret personal ideas, feelings, and experiences through visual form

Content Standard 3: Integrate understanding of visual and performing arts by seeking connections and parallels among arts disciplines as well as other content areas

Benchmarks:

Dance:

A. Explore and identify connections between dance and physical and health education
B. Explore and identify ways in which dance integrates with and enhances the study of other subjects or content areas.
C. Respond to dance through other art forms and explain the connections

Music:

A. Identify terms common to the various art forms
B. Improvise accompaniments to poetry, dramatizations, dance, etc.
C. Identify ways in which music can support and enhance other disciplines

Theatre:

A. Describe how ideas and emotions are expressed in the various art forms
B. Select movement, music, or visual elements to enhance a dramatization
C. Describe visual, aural, and kinetic elements in theatre and dramatic media

Visual Arts:

A. Explore similarities and differences between characteristics of the visual arts and other arts disciplines
B. Identify and apply connections between the visual arts and other disciplines in the local curriculum

Content Standard 4: Demonstrate an understanding of the dynamics of the creative process

Benchmarks:

Dance:

A. Explore, discover, and realize multiple solutions to a given movement problem
B. Create phases through improvisation, working alone, with a partner, and in a group
C. Create dance sequences with a clearly defined beginning, middle, and ending

Music:

A. Improvise completion of a given rhythmic or melodic phrase
B. Investigate a variety of sound sources for improvising short songs and instrumental pieces
C. Understand that there are multiple ways in which a phrase may be completed

Theatre:

A. Collaborate to design, plan, rehearse, and perform dramatizations

Visual Arts:

A. Understand that works of art come from diverse personal and cultural experiences and inspirations
B. Develop appropriate methods of reflection and evaluation of art work

Content Standard 5: Observe, discuss, analyze, and make critical judgments about artistic works

Benchmarks:

Dance:

A. Use action and element vocabulary to discuss dance, and to identify examples from a short dance sequence
B. Present dances to peers and discuss their meanings with competence and confidence

Music:

A. Identify simple music forms when presented aurally
B. Identify the sounds of more familiar instruments as well as treble and bass voices
C. Discuss responses and reactions to particular musical works using appropriate terminology

Theatre:

A. Identify and describe visual, oral, aural, and kinetic elements of dramatic performances
B. Explain how wants and needs of characters are different from their own
C. Explain emotional response, personal preferences and give constructive feedback about dramatic performances

Visual Arts:

A. Understand how personal experiences influence the development of specific artworks
B. Understand that there are different responses to specific artworks and respect those differences
C. Reflect upon and assess the characteristics and merits of one's own artwork

Content Standard 6: Show increased awareness of diverse peoples and cultures through visual and performing arts

Benchmarks:

Dance:

A. Explore folk dances from various local and world cultures and time periods
B. Understand the effects that dance has had on cultures throughout time

Music:

A. Identify and perform a varied repertoire from historical periods and diverse cultures with emphasis on the music and cultures of NM
B. Explore the cultural context of music being studied

Theatre:

A. Communicate information to peers about peoples, events time and places related to dramatizations
B. Identify and compare similar characters and situations in dramas and stories from and about various cultures

Visual Arts:

A. Identify specific works of art as belonging to particular cultures, time, and places

Content Standard 7: Demonstrate knowledge about how technology and invention have historically influenced artists and offered new possibilities for expression

Benchmarks:

Dance:

A. Understand how lighting and costume can affect the meaning of dance

Music:

A. Examine how various instruments have evolved
B. Use appropriate music software

Theatre:

A. Explore the importance of lighting, costumes, set/scenery, properties, sound effects, and make-up to dramatic presentation

Visual Arts:

A. Demonstrate an understanding of specific inventions that have influenced change in artists' ability to create works of art
B. Use various technologies to create works of art

Content Standard 8: Contribute to communities by sharing expertise in dance, music, theatre/drama, and visual arts and by participating in the activities of cultural institutions

Benchmarks:

Dance:

A. Share work with parents, school, and community through informal dance performances
B. Attend local dance performances and cultural festivals and demonstrate appropriate audience behavior

Music:

A. Model appropriate audience behavior at live concert performances
B. Participate in appropriate school programs
C. Share and develop cultural experiences

Theatre:

A. Identify and compare the various settings and reasons for creating dramas and attending various dramatic presentations
B. Perform short informal dramatizations for small invited audiences of peers and/or parents
C. Attend and discuss age-appropriate dramatic presentation in the school and/or community
D. Demonstrate appropriate audience behavior

Visual Arts:

A. Identify and describe visual arts in various artistic settings
B. Access museum, gallery, and public settings to increase awareness of art.
C. Contribute to community culture by exhibiting artwork

K-1 Health Education Standards and Benchmarks

Standard 1: Students will comprehend concepts related to health promotion and disease prevention

Benchmarks:

1. Identify/describe/understand the relationships between personal health behaviors and individual well being
2. Identify examples of mental, emotional, social, and physical health during childhood
3. Describe the basic structure and functions of the human body systems
4. Describe how physical, social, and emotional environments influence personal health
5. Identify common health issues of children
6. Identify health problems that should be detected and treated early and explain how childhood injuries and illnesses can be prevented and/or treated

Standard 2: Students will demonstrate the ability to access valid health information and health-promoting products and services

Benchmarks:

1. Identify characteristics of valid health information and health-promoting products and services
2. Demonstrate the ability to locate resources from home, school, and community that provide valid health information
3. Explain how the media influences the selection of health information, products, and services

Standard 3: Students will demonstrate the ability to practice health-enhancing behaviors and reduce health risks

Benchmarks:

1. Identify responsible health behaviors
2. Identify personal health needs
3. Compare behaviors that are safe to those that are risky or harmful
4. Demonstrate strategies to improve or maintain personal health
5. Develop injury prevention and management strategies for personal health
6. Demonstrate ways to avoid and reduce threatening situations
7. Apply skills to manage stress

Standard 4: Students will analyze the influence of culture, media, technology, and other factors on health

Benchmarks:

1. Describe how cultures within the local community influence personal health behaviors
2. Explain how media influences thoughts, feelings, and health behaviors
3. Describe ways technology can influence personal health
4. Explain how information from school and family influences health

Standard 5: Students will demonstrate the ability to use interpersonal communication skills to enhance health

Benchmarks:

1. Distinguish between verbal and non-verbal communication
2. Describe characteristics needed to be a responsible friend and family member
3. Demonstrate positive ways to express needs, wants, feelings
4. Demonstrate ways to communicate care, consideration, and respect of self and others
5. Demonstrate attentive listening skills to build and maintain health-enhancing relationships
6. Demonstrate refusal skills and why they are important to enhance health
7. Differentiate between negative and positive behaviors used in conflict situations
8. Demonstrate non-violent strategies to resolve conflicts

Standard 6: Students will demonstrate the ability to use goal-setting and decision-making skills to enhance health

Benchmarks:

1. Demonstrate the ability to apply a decision –making process to health issues and problems
2. Explain when to ask for assistance in making health-related decisions and setting health goals
3. Predict outcomes of positive health decisions

4. Set a personal health goal and track progress toward achievement

Standard 7: Students will demonstrate the ability to advocate for personal, family, peer, and community health

Benchmarks:

1. Describe a variety of methods to convey accurate health information and ideas
2. Express information and opinions about health issues
3. Identify community agencies/resources that advocate for health individuals, families, peers, and communities

K-4 Social Studies Standards and Benchmarks

Strand: History

Content Standard I: Students are able to identify important people and events in order to analyze significant patterns, relationships, themes, ideas, beliefs, and turning points in New Mexico, United Stated, and world history in order to understand the complexity of the human experience

Benchmarks:

I-A – New Mexico. Describe how contemporary and historical people and events have influences New Mexico communities and regions

I-B-United States. Understand connections among historical events, people, and symbols significant to United States history and cultures

I-C – World. Students will identify and describe similar historical characteristics of the United States and its neighboring countries

I-D-Skills. Understand time passage and chronology

Strand: Geography

Content Standard II: Students understand how physical, natural, and cultural processes influence where people live, the ways in which people live, and how societies interact with one another and their environments.

Benchmarks:

II-A. Understand the concept of location by using and constructing maps, globes, and other geographic tools to identify and derive information about people, places, and environments

II-B. Distinguish between natural and human characteristics of places and use this knowledge to define regions, their relationships with other regions, and patterns of change.

II-C. Be familiar with aspects of human behavior and man-made and natural environments in order to recognize their impact on the past and present

II-D. Understand how physical processes shape the Earth's surface patterns and biosystems

II-E. Describe how economic, political, cultural, and social processes interact to shape patterns of human populations, and their

interdependence, cooperation, and conflict

II-F. Describe how natural and man-made changes affect the meaning, use, distribution, and value of resources

Strand: Civics and Government

Content Standard III: Students understand the ideals, rights, and responsibilities of citizenship and understand the content and history of the founding documents of the United States with particular emphasis on the United Stated and New Mexico constitutions and how governments function at local, state, tribal, and national levels

Benchmarks:

III-A. Know the fundamental purposes, concepts, structures, and functions of local, state, tribal, and national governments

III-B. Identify and describe the symbols, icons, songs, traditions, and leaders of local, state, tribal, and national levels that exemplify ideals and provide continuity and a sense of community across time.

III-C. Become familiar with the basic purposes of government in New Mexico and the United States

III-D. Understand rights and responsibilities of "good citizenship" as members of a family, school, and community

Strand: Economics

Content Standard IV: Students understand basic economic principles and use economic reasoning skills to analyze the impact of economic systems (including the market economy) on individuals, families, businesses, communities, and governments.

Benchmarks:

IV-A. Understand that individuals, households, businesses, governments, and societies make decisions that affect the distribution of resources and that these decisions are influenced by incentives (both economic and intrinsic)

IV-B. Understand that economic systems impact the way individuals, households, businesses, governments and societies make decisions about goods and services

IV-C. Understand the patterns and results of trade and exchange among individuals, households, businesses, governments, and societies, and their interdependent qualities

K-4 Science Content Standards and Benchmarks

Strand I: Scientific Thinking and Practice

Standard I: Understand the processes of scientific investigations and use inquiry and scientific ways of observing, experimenting, predicting , and validating to think critically

Benchmarks:

I. Use scientific methods to observe, collect, record, analyze, predict, interpret, and determine reasonableness of data
II. Use scientific thinking and knowledge and communicate findings
III. Use mathematical skills and vocabulary to analyze data, understand patterns and relationships, and communicate findings

Strand II: Content of Science

Standard I (Physical Science): Understand the structure and properties of matter, the characteristics of energy, and the interactions between matter and energy.

Benchmarks:

I. Recognize that matter has different forms and properties
II. Know that energy is needed to get things done and that energy has different forms
III. Identify forces and describe the motion of objects

Standard II (Life Science): Understand the properties, structures, and processes of living things and the interdependence of living things and their environments

Benchmarks:

I. Know that living things have diverse forms, structures, functions, and habitats
II. Know that living things have similarities and differences and that living things change over time
III. Know the parts of the human body and their functions

Standard III (Earth Science): Understand the structure of Earth, the solar system, and the universe, the interconnections among them, and the processes and interactions of Earth's systems

Benchmarks:

I. Know the structure of the solar system and the objects of the universe
II. Know the structure of the Earth and its atmosphere and the processes that shape them

Strand III: Science and Society

Standard I: Understand how scientific discoveries, inventions, practices, and knowledge influence, and are influenced by, individuals and societies

Benchmarks:

I. Describe how science influences decisions made by individuals and societies

Appendix C

Recommended Crop Varieties and Planting and Harvesting Information for New Mexico Vegetable Gardens

(Reprinted with permission from the New Mexico State University Extension Department)

Circular 457-B

Growing Zones, Recommended Crop Varieties, and Planting and Harvesting Information for Home Vegetable Gardens in New Mexico

Cooperative Extension Service
College of Agriculture and Home Economics

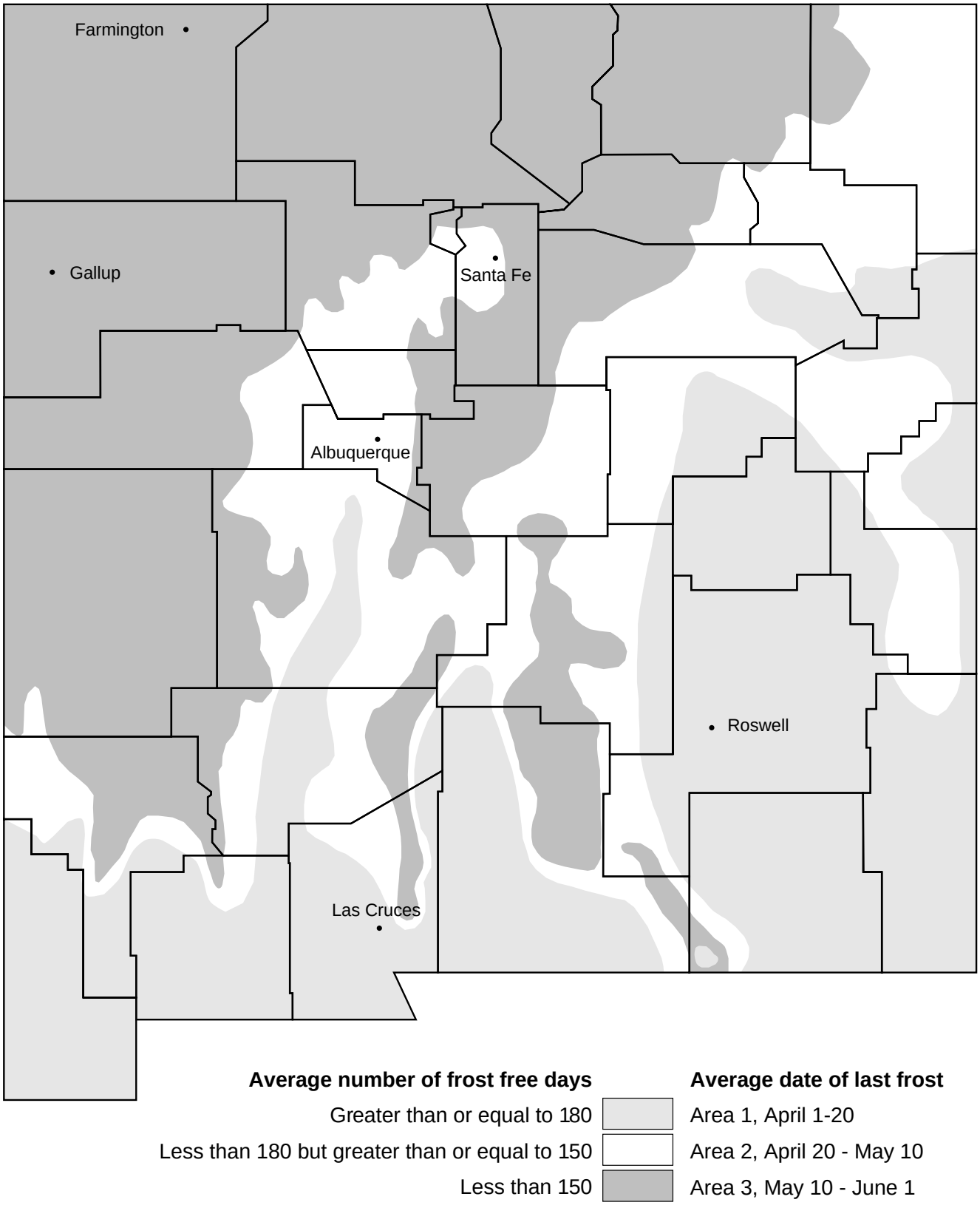


Fig. 1. **Average number of frost-free days and average date of last frost in three growing zones. From *Climatological Data, Annual Summary—New Mexico 1982*, National Weather Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce.**

Growing Zones, Recommended Crop Varieties, and Planting and Harvesting Information for Home Vegetable Gardens in New Mexico

George W. Dickerson
Extension Horticulture Specialist

New Mexico can be divided into three growing zones, which are based on the average number of frost-free days and the average date for the last frost in the spring (fig. 1). Growing periods for individual gardens can vary as much as 20 days from the average for the zone. This variance may be due to elevation, site exposure, or air drainage. For example, gardens with northern slope exposures are cooler than those with southern slope exposures. Also, cooler air is heavier than warmer air, so valley cropping sites are more prone to frost than sites overlooking the valley. Therefore, consider your garden's unique needs as you determine planting dates.

Crop variety recommendations within this guide are based on variety trials conducted by the New Mexico Cooperative Extension Service and experienced Master Gardeners. Home gardeners may seek advice from these or other experienced gardeners in the area.

The number of days to harvest are seed catalogue estimates and may vary depending on weather conditions. Planting depth will depend on your soil: seed may be planted slightly deeper in sandy soils and slightly shallower in clay soils. The distance between rows depends on your watering technique (furrow, sprinkler, or drip) and the paths you leave between rows for picking.

Refer to Circular 457, "Home Vegetable Gardening in New Mexico" for more information on gardening in New Mexico.

Vegetable varieties, days to harvest, planting date, planting instructions, and approximate yield for home gardens.

Crop	Recommended Varieties	Days to Harvest	Planting Dates		
			Area 1	Area 2	Area 3
Asparagus	Jersey Giant	2 (yrs.)	Feb 1-Mar 1	Mar 1-Apr 30	Apr 1-30
	Mary Washington	2 (yrs.)			
	U.C. 157	2 (yrs.)			
	Jersey Knight	2 (yrs.)			
Beans, Bush	Blue Lake Bush	58	April 15-May 1; July 15-Aug 15	May 1-31; July 1-31	May 1-July 15
	Contender	49			
	Blue Lake 274	58			
	Greensleeves	56			
	Kentucky Wonder 125	58			
	Tendercrop	53			
	Topcrop	49			
Beans, Bush (Wax)	Goldcrop Wax	54	April 15-May 1; July 15-Aug 15	May 1-31; July 1-31	May 1-July 15
	Cherokee	50			
	Imp. Golden Wax	52			
	Sunrae	55			
Beans, Pole	Blue Lake	60	April 15-May 1	May 1-31	May 1-June 30
	Kentucky Blue	65			
	Kentucky Wonder	65			
Beans, Lima	Fordhook 242	75	April 15-Aug 1	May 1-July 15	May 15-June 15
	Baby Fordhook	70			
	Henderson Bush	65			
	Jackson Wonder	65			
Beans, Lima, Pole	Large Speckled Christmas	88	April 15-May 1	May 1-31	May 1-15
	King of Garden	88			
Beans, Other	Fava or Broadbeans	85	Jan 15-Feb 15	Feb 15-March 15	March 15-May 15
	Garbanzo or Chickpea	100	Jan 15-Feb 15	Feb 15-April 15	May 15-June 15
	Pinto, Luna	85	April 15-May 1; July 15-Aug 15	May 1-31;	May 1-July 15
	Pinto, Navajo	85			

How to Plant			Feet of Row per Person	Seed or Plants per 100 Feet of Row	Approximate Yield per 100 Feet of Row	
Distance Between--						
Depth (inches)	Plants (inches)	Rows (inches)			Canned (pints)	Fresh (pounds)
6-8	12-15	36-60	30	80-100 plants	60	25
1-2	2-6	18-36	80	1/2 pound	90	65
1-2	2-6	18-36	80	1/2 pound	90	65
1-2	4-8	36-48	10	1/2 pound	90	80
1-2	3-6	18-36	20	1 pound	30	40
1-2	8-12	36-48	20	1/2 pound	30	40
1-2	3-6	24-48	20	1 pound	30	40
1-2	3-4	24-30	--	1/2 pound	--	--
1-2	3-4	24-30	--	1/2 pound	--	--

Vegetable varieties, days to harvest, planting date, planting instructions, and approximate yield for home gardens (Continued)

Crop	Recommended Varieties	Days to Harvest	Planting Dates		
			Area 1	Area 2	Area 3
Beets	Detroit Dark Red	60	Feb 1-March 15; July 15-August 15	March 1-April 15; July 15-August 1	April 1-June 30
	Early Wonder	54			
	Golden Beet	55			
	Cylindra	60			
	Ruby Queen	53			
	Perfected Detroit	58			
Broccoli	Bonanza Hybrid	55	Feb 15-March 1; July 15-August 1	March 15-April 1; July 1-15	April 15-June 1
	Green Goliath	55			
	Green Comet Hybrid	55			
	Emperior	58			
	Green Valient	66			
	Premium Crop	58			
	Hybrid Packman	60			
Brussels Sprouts	Prince Marvel Hybrid	90	March 15-May 15	April 1-May 15	April 15-30
	Hybrid Jade Cross	82			
Cabbage	Golden Acre	64	Feb 15-March 1; July 15-August 1	March 15-31; July 1-15	April 15-June 30
	Red Acre	76			
	Early Jersey Wakefield	63			
Cabbage, Chinese	Michihli	70	March 1-31; July 1-20	June 15-30	May 15-June 15
	Two Seasons Hybrid	62			
	Pak Choi Joi Choi Hybrid	45			
Cantaloupe (Muskmelon)	Delicious 51	84	April 1-15	April 15-30	May 1-15
	Hales Best	88			
	Ambrosia Hybrid	86			
	Luscious Plus Hybrid	75			
Carrots	Imperator	75	Jan 15-March 1; Aug 1-15	Feb 15-April 1; July 1-August 1	May 1-June 30
	Red Core Chantenay	70			
	Danvers Half Long	75			
	Nantes Coreless	68			

How to Plant			Feet of Row per Person	Seed or Plants per 100 Feet of Row	Approximate Yield per 100 Feet of Row	
	Distance Between--					
Depth (inches)	Plants (inches)	Rows (inches)			Fresh (pounds)	Canned (pints)
1/2	2-4	12-30	10	1 ounce	80	70
1/2	8-12	24-36	25	1/2 ounce or 100-150 plants	75	--
1/2	18-24	24-40	10	1/2 ounce or 50-65 plants	60	--
1/2	12-24	24-36	6	1/2 ounce or 50 to 100 plants	150	--
1/2	12-24	24-36	10	1/2 ounce or 50-100 plants	30	--
1/2-3/4	12	60-84	15	1 ounce	90 melons	--
1/4	1-3	16-36	30	1/2 ounce	75	--

Vegetable varieties, days to harvest, planting date, planting instructions, and approximate yield for home gardens.(Continued)

Crop	Recommended Varieties	Days to Harvest	Planting Dates		
			Area 1	Area 2	Area 3
Cauliflower	Snowball (types)	65	Feb 15-March 1; June 25-July 5	March 15-31; July 1-August 1	May 1-30
	Snow King	50			
	Snow Crown Hybrid	53			
	Snowball Self-Blanching	70			
Chard, Swiss	Fordhook Giant	60	Feb 1-March 15; July 15-August 15	March 1-April 15; July 1-August 1	April 1-June 30
	Rhubarb	60			
	Lucullus Light Green	60			
Collards	Georgia	80	Feb 1-March 15; July 15-August 15	March 1-April 15; July 15-August 1	April 1-June 30
	Vates	80			
Corn, Sweet (regular, SU)	Merit	75	March 21-July 30	April 20-July 1	May 1-July 1
	Early Sunglow	63			
	Golden Jubilee	84			
	Iochief	89			
	Silver Queen (white)	94			
	Golden Cross Bantam	85			
Corn, Sweet (Sugary Enhancer, SE)	Kandy Korn EH	89	March 21-July 30	April 20-July 1	May 1-July 1
	Hybrid Double Delicious	83			
	Hybrid Bodacious	72			
	Miracle	82			
Corn, Sweet (Super Sweet, SH2)	Early Xtra-Sweet	71	April 1-July 30	May 1-July 1	May 15-July 1
	Illini Xtra-Sweet	85			
	How Sweet It Is	87			
	Honey-'N Pearl	78			
Cucumber, Slicing	Armenian (long, ribbed)	70	April 1-15	April 15-May 15	May 15-June 1
	Bush Champion	55			
	Hybrid Slicemaster	58			
	Hybrid Burpless	60			
	Spacemaster (bush)	54			
	Straight Eight	58			
	Streamliner	58			

How to Plant			Feet of Row per Person	Seed or Plants per 100 Feet of Row	Approximate Yield per 100 Feet of Row	
	Distance Between --					
Depth (inches)	Plants (inches)	Rows (inches)			Fresh (pounds)	Canned (pints)
1/2	18-24	24-36	20	1/2 ounce or 50-65 plants	50 heads	--
1/2-3/4	4-15	24-36	10	1 ounce	100	--
1/2	10-24	24-36		1/2 ounce		
1-2	8-12	30-40	120	1/2 pound	75 ears	20
1-2	8-12	30-40	120	1/2 pound	75 ears	20
1/2-1	8-12	30-40	120	1/2 pound	75 ears	20
1/2-3/4	8-12	36-72	5	1/2 ounce	180	--

Vegetable varieties, days to harvest, planting date, planting instructions, and approximate yield for home gardens.(Continued)

Crop	Recommended Varieties	Days to Harvest	Planting Dates		
			Area 1	Area 2	Area 3
Cucumber, Slicing (cont'd)	Sweet Success Hybrid	58			
	Sweet Slice Hybrid	62			
Cucumber, Pickling	National Pickling	55	April 1-15	April 15-May 15	May 15-June 1
	West India Gherkin	60			
Eggplant	Black Beauty	73	April 1-30	April 15-May 15	May 1-30
	Dusky	63			
	Easter Egg	69			
	Orient Express	58			
	Ichiban Hybrid	65			
Garlic	Spanish Roja	8-10 months	Oct 1-Nov 30	Sept 15-Nov 15	Sept 1-Oct 31
	Carpathian	8-10 months			
	Inchelium Red	8-10 months			
	California Early	8-10 months			
	Silverskin (S & H)	8-10 months			
Kohlrabi	Early Purple Vienna	60	Feb 1-March 15; July 15-August 15	March 1-April 15; July 1-August 15	April 1-June 30
	Early White Vienna	55			
	Grand Duke	45			
Leek	American Flag	130	Jan 15-Feb 15	Feb 15-March 15	March 15-April 1
	Titan	110			
Lettuce, Head	Great Lakes Strains	90	Nov 20-Jan 20	March 1-15	April 1-June 15
	Iceberg	82			
Lettuce, Leaf	Black Seeded Simpson	45	Dec 1-March 15; August 1-30	March 1-31; July 15-August 15	April 1-July 1
	Oak Leaf	50			
	Ruby	45			
	Salad Bowl	45			
	Red Sails	50			
	Prizehead	45			
Lettuce, Romaine	Paris Island Cos	75	Dec 1-March 15; August 1-30	March 1-31; July 15-August 15	April 1-July 15
	Rosalita	65			
	Valmaine Cos	70			

How to Plant			Feet of Row per Person	Seed or Plants per 100 Feet of Row	Approximate Yield per 100 Feet of Row	
Depth (inches)	Distance Between -- Plants (inches)	Rows (inches)			Fresh (pounds)	Canned (pints)
1/2-3/4	8-12	36-72	5	1/2 ounce	90	25
1/4-1/2	18-30	24-48	5	1/2 ounce	200	--
1-3	3-6	12-36	3	1-12 pounds	--	--
1/2	3-6	12-36	12	1/2 ounce	100	--
1/2	3-6	12-36	10	1/2 ounce	--	--
1/4-1/2	10-15	20-36	12	1/2 ounce	50 heads	--
1/4-1/2	8-12	20-36	6	1/2 ounce	100	--
1/4-1/2	10-14	20-36		1/2 ounce	100	--

Vegetable varieties, days to harvest, planting date, planting instructions, and approximate yield for home gardens.(Continued)

Crop	Recommended Varieties	Days to Harvest	Planting Dates		
			Area 1	Area 2	Area 3
Lettuce, Butterhead	Bibb	75	Dec 1-March 15; August 1-30	March 1-31; July 15-August 15	April 1-July 1
	Buttercrunch	75			
Mustard	Tendergreen	35	Feb 1- March 31; August 1-30	March 1-April 15; August 1-31	April 1-July 15
Okra	Clemson Spineless	56	April 1-15	April 15-30	May 1-15
	Annie Oakley Hybrid	52			
Onions, Fall Planted	Early New Mexico Grano	9-10 months	Oct 1-15		
	Temprano Grano 502	9-10 months			
	Hybrid White Bermuda	92			
	Texas Grano 1015Y	175			
	Red Hamburger	95			
	Granex Hybrid	80			
Onions, Spring Planted	White, Yellow & Red Globe	110	Jan 15-Feb 15	Feb 15-March 15	March 15-April 3
	White & Yellow Sweet Spanish	80-100			
	Walla Walla Sweet	115			
Parsnips	All American	100	Jan 15-March 1	Feb 15-April 15	April 1-May 15
	Hollow Crown	110			
Parsley	Italian Dark Green Plain Leaf	72	Jan 15-March 1	Feb 15-April 15	April 1-May 15
	Forest Green	75			
	Paramont	70			
Peas, Snap Pea	Sugar Daddy	62	Jan 15-Feb 15	Feb 15-April 15	March 15-June 15
	Sugar Ann	56			
	Sugar Bon	56			
	Sugar Snap	70			
	Super Snappy	65			
Peas, Snow	Oregon Sugar Pod II	68	Jan 15-Feb 15	Feb 15-April 15	March 15-June 15
	Dwarf Gray Sugar	57			
Peas, English	Alaska	55	Jan 15-Feb 15	Feb 15-April 15	March 15-June 15
	Green Arrow	70			
	Little Marvel	63			
	Wando	68			
	Lincoln	67			

How to Plant			Feet of Row per Person	Seed or Plants per 100 Feet of Row	Approximate Yield per 100 Feet of Row	
	Distance Between--					
Depth (inches)	Plants (inches)	Rows (inches)			Fresh (pounds)	Canned (pints)
1/4-1/2	10-15	20-36		1/2 ounce	--	--
1/2	5-10	20-36	6	1-2 ounces	50	60
1	8-24	42-60	10	2 ounces	30	12-24
1/2	2-4	20-36	20	1 ounce	70	--
1/2	2-4	20-36	40	1 ounce	75	--
1/2	2-4	20-36	10	1 ounce	100	--
1/4-1/2	4-12	12-36		3/4 ounce	--	--
1	1-3	24-36	5	2 pounds	40	25
1	1-3	24-36	5	2 pounds	40	25
1	1-3	24-36	5	2 pounds	40	25

Vegetable varieties, days to harvest, planting date, planting instructions, and approximate yield for home gardens.(Continued)

Crop	Recommended Varieties	Days to Harvest	Planting Dates		
			Area 1	Area 2	Area 3
Peas, Cowpeas	California Black-eye	75	April 14-May 1	May 1-31	May 1-July 15
	Purple Hull	78			
Peppers, Bell	Bell Boy	72	April 1-30	April 15-May 15	May 15-June 15
	Gypsy Hybrid	65			
	California Wonder	75			
Peppers, Chile	Española Improved (hot)	70	April 1-30	April 15-May 15	May 15-June 15
	Hungarian Wax (hot)	65			
	Jalapeño (hot)	80			
	Nu Mex R Naky (mild)	80			
	New Mexico 6-4 (mild)	80			
	NuMex Big Jim (mild to medium)	80			
	Sandia (hot)	80			
Potato, Irish	Irish Cobbler (white)	100	Feb 1-28	April 1-May 15	May 1-31
	Kennebec (white)	105			
	La Rouge (red)	110			
	Norgold (russett)	105			
	Pontiac (red)	105			
	Viking (red)	105			
Potato, Sweet	Caromex	130	May 1-15	May 15-31	June 1
	Jewel	130			
	Oklamex Red	130			
Pumpkin	Big Max	120	April 1-30	May 1-15	May 15-31
	Jack-O-Lantern	110			
	New England Pie	105			
	Small Sugar	100			
	Spirit	100			
	Hybrid Autumn Gold	90			
	Jack-Be-Little	100			
	Ghost Rider	115			
Radish	Cherry Belle	22	Feb 1-March 31	March 1-April 30	April 1-July 15
	Easter Egg	25			
	French Breakfast	23			
	Sparkler	25			

How to Plant			Feet of Row per Person	Seed or Plants per 100 Feet of Row	Approximate Yield per 100 Feet of Row	
	Distance Between --					
Depth (inches)	Plants (inches)	Rows (inches)			Fresh (pounds)	Canned (pints)
1/2-1	5-8	24-36	--	--	--	--
1/4	12-24	24-36	5	1/2 ounce	40	--
1/4	12-24	24-36	15	1/2 ounce	75	--
4	12	30-36	60	10 pounds	75	--
(transplants)	10-18	36-48	5	65-120 plants	--	--
1-11/2	36-60	72-96	5	1 ounce	150	--
1/2	1-2	12-18	6	1 ounce	100 bunches	--

Vegetable varieties, days to harvest, planting date, planting instructions, and approximate yield for home gardens.(Continued)

Crop	Recommended Varieties	Days to Harvest	Planting Dates		
			Area 1	Area 2	Area 3
Radish (cont'd)	White Icicle	28			
	Champion	28			
	German Giant	29			
Spinach	America	50	Jan 15-Feb 15; Sept 1-30	Feb 15-March 15; August 1-30	March 15-July 15
	Longstanding (Bloomsdale)	43			
	Melody	42			
	Winter Bloomsdale	45			
	Hybrid Tyee	37			
	Hybrid Avon	44			
	Giant Nobel	43			
Spinach, Summer	New Zealand	70	March 15-April 15	April 15-May 15	May 15-June 15
Squash, Summer	Dixie (crookneck, yellow)	55	April 1-August 1	April 15-July 1	May 15-June 15
	Early Prolific (straightneck, yellow)	53			
	Gold Rush (zucchini, yellow)	45			
	Hybrid Jackpot (zucchini, green)	44			
	Black Magic (zucchini, green)	50			
	Grey Zucchini	42			
	Peter Pan (scallop)	50			
	Sunburst Hybrid (scallop)	50			
Squash, Winter	Blue Hubbard	115	April 1-June 1	April 15-May 15	May 1-15
	Buttercup	105			
	Jersey Golden	90			
	Acorn	115			
	Sweet Mama Hybrid	85			
	Table King Acorn	75			
	Table Queen Acorn	80			
	Vegetable Spaghetti	100			
	Waltham Butternut	97			
	Delicata	100			
	Ponca	90			
	Table Ace	70			

How to Plant			Feet of Row per Person	Seed or Plants per 100 Feet of Row	Approximate Yield per 100 Feet of Row	
	Distance Between--					
Depth (inches)	Plants (inches)	Rows (inches)			Fresh (pounds)	Canned (pints)
1/2	2-6	12-36	15	1 ounce	50	60
1	12-18	36	10	1 ounce	60	75
1	24-48	36-60	5	2 ounces	100	--
1	36-96	72-96	10	1 ounce	40 fruits	--

Vegetable varieties, days to harvest, planting date, planting instructions, and approximate yield for home gardens.(Continued)

Crop	Recommended Varieties	Days to Harvest	Planting Dates		
			Area 1	Area 2	Area 3
Tomatoes, Plum, small types	Red Cherry	72	Feb 15-March 15	April 15-30	May 1-15
	Sweet 100	70			
	Tiny Tim	55			
	Yellow Pear	70			
Tomatoes, Regular	Beefmaster VFN	80	Feb 15-March 15	April 15-30	May 1-15
	Better Boy VFN	72			
	Early Girl	54			
	Early Pick VF	68			
	Extra Early VFNT	55			
	Fantastic	65			
	Homestead 24	76			
	Delicious	77			
	Celebrity VFFNT Hybrid	70			
	Super Beefsteak VFN	80			
Tomatoes, Paste	Roma VF	75	Feb 15-March 15	April 15-30	May 1-15
	Viva Italia Hybrid	80			
Turnips	Purple Top White Globe	55	Feb 1-March 15; July 20-August 20	March 1-April 15; July 1-August 15	April 1-June 30
	Hybrid Tokyo Cross	35			
Watermelon	Black Diamond	90	April 1-15	April 20-May 20	May 1-15
	Charleston Gray	85			
	Crimson Sweet	80			
	Bush Sugar Baby	75			
	Sweet Favorite	80			
Melons, other	Casaba, Golden Beauty	120	April 1-15	April 20-May 20	May 1-15
	Crenshaw, Early Hybrid	90			
	Honey Dew Type, Hybrid Earli-dew	80			
	Honey Dew Type, Venus	88			

How to Plant			Feet of	Seed or Plants	Approximate Yield per 100 Feet of Row	
	Distance Between --		Row per Person	per 100 Feet		
Depth (inches)	Plants (inches)	Rows (inches)		of Row	Fresh (pounds)	Canned (pints)
1/2	18-48	36-60	60	1/2 ounce or 25-65 plants	150	110
1/2	18-48	36-60	60	1/2 ounce or 25-65 plants	150	110
1/2	18-48	36-60	60	1/2 ounce or 25-65 plants	150	110
1/2	2-6	12-36	30	3/4 ounce	100	--
1	24-36	72-96	10	1 ounce	20 fruits	--
1	24-36	72-96		1 ounce	90 melons	

To find more resources for your business, home, or family, visit the College of Agriculture and Home Economics on the World Wide Web at www.cahe.nmsu.edu

Reprinted May 2003 **Las Cruces, NM**
5C

Appendix D

Example Step-by-Step Guide to Designing Outdoor Learning Environments

(Reprinted with permisison from Taylor and Vlastos, 1983)

Community Playground Planning

When a school decides to create an innovative playground, the people responsible for the new design must evaluate how the space is to be used. Parents as well as teachers should be consulted; they need to analyze the children's play and, of course, the child himself needs to show us how he plays. Parents have traditionally been excluded from schools except in token ways such as the PTA and such social festivities as school carnivals or field trips.

In several workshops with a variety of parents and teachers, discussions revealed that parents *do* want to be a part of their children's education. They want to help decide what is to be taught and to actively participate in the learning process with their own children. The problem is that there is no vehicle for this parent participation in many of our schools; moreover, teachers and principals are threatened by their presence. One very useful and pleasant vehicle for parent involvement is playground planning and construction. The process outlined here applies to all kinds of playground development, whether a contractor does the work or not, since it is in the low-budget category and is within the financial reach of everyone.

People can get involved in several different ways:

1. Raising money.
2. Donating materials.
3. Volunteering labor and skill.
4. Using influence and contacts in the community for supplies and expertise.

Playground Planning Meetings

An assumption is made that the combined energies of many people collaborating on a problem-solving project (sometimes called "synergism") brings a more dynamic solution than if only one or two people work at it. A sample meeting schedule is described here to demonstrate the playground planning process.

Meeting One: Organization—People interested in doing something about their school playground should get together. Find an interested architect, one or more architectural students, or a parent with design expertise who might give you more planning advice, and organize yourself into a committee. (Also, many universities have community design centers.) Involve the principal and other school district administrators. Decide generally what it is you want to do.

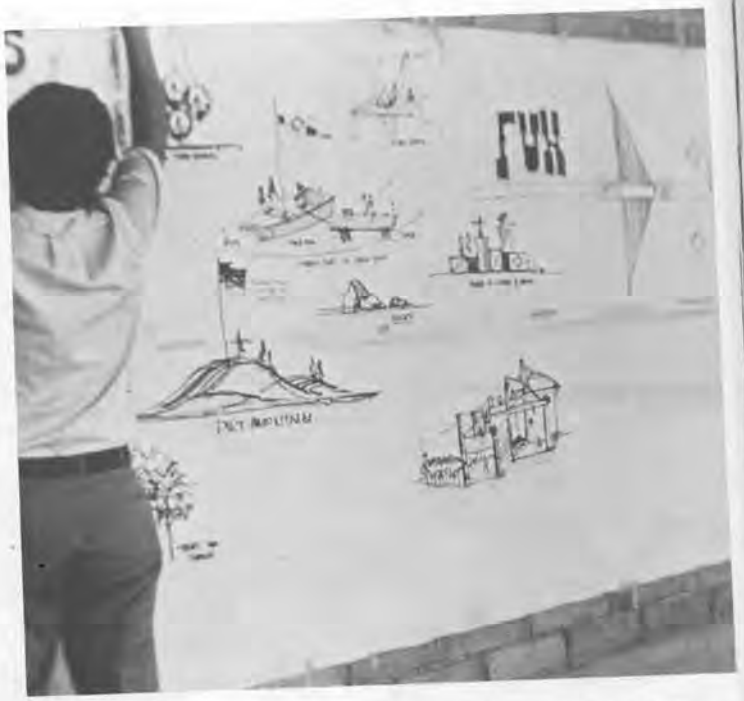
Children can help to plan playgrounds. They can give adults a lot of information about their needs and what they would like. Adults need to observe children in play before they design for them.

Meetings Two, Three, and Four: Examination of How Children Play and the Area to be Used—Begin to examine what constitutes play; is play educational or is it recreational? What kinds of activities do children engage in on any playground? Brainstorm and write down the kinds of behavior that are named. Children run, jump, skip, bounce, swing, splash, roll, climb, push, pull, slide, sit, play with sand, etc. The range of activity will vary from very active to quiet and passive play.

On a continuum from active to passive play, there needs to be a balance of design for a convenient outdoor gathering place, for loitering, for wandering, and for passive watching without participation. Yet within this diversity, immediate and spontaneous conversation across all activities should be possible.

Ask for the school blueprints and look carefully at the playground's assets and liabilities. Analyze it in terms of the following considerations:

1. What is this playground to the school? Is it used only during school hours, and locked up after hours?
2. Does it have potential as a community playground or park to be used after school hours or at night during the summer?
3. Observe natural phenomena on the playground. What is the prevailing wind? Are there dust problems? Are there mud problems? Is there a sun problem? Are there any trees for shade? Are there any hills or multilevel areas for active running, or is your playground on a flat plane? Are there areas for gardens? Where is the water supply?
4. Consult with a physical-education person. What design criteria for the playground landscape can be extrapolated from the curriculum of "movement education," a new concept in body awareness and physical development?



In planning your playground, begin by sketching some ideas on paper so that discussion and design are taking place simultaneously.

Make a list of the things you would like to see on your playground. (Photo by Dan Aiello)

Meeting Five: Interview Children

1. What do they like best about school?
2. What do they do on the playground?
3. Where do the girls play?
4. Where do the boys play?
5. Do they ever play together?
6. What would they like to see on their playground that isn't there now?
7. Would they like to help take care of an animal pen, a garden, or a greenhouse?
8. What do they do after school between the hours of 3:30 PM and 8:30 the next morning?

Younger children have different environmental needs from older children because of the differences in motor skills, mental development, and physical size. These different scale and skill determinants act as subtle barriers between younger and older children. There can also be common areas such as amphitheaters, animal pens, and large playing fields where the varying age groups can come together and socialize.

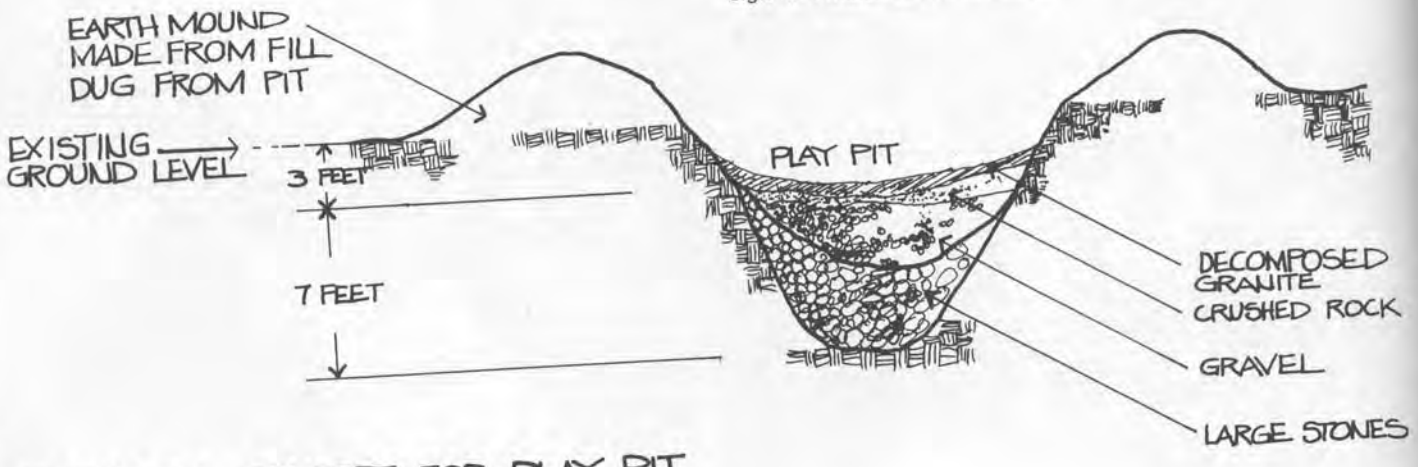
Children should take part in the design and construction of the playground. During the construction process they can give useful criticism and help.

Meetings Six through Ten: Finalize Plans

1. Put a diagram of your playground on a wall surface and begin to think aloud, using graphic symbols.
2. Parents, teachers, and other community people should get up and draw suggestions on the diagrams. Brainstorm *what* should be on the playground and *where*, based on the information gathered in previous meetings. Each person should be able to give specific information on facts with which he has become intimately familiar. Ask parents to remember what was their favorite place to play as a child.
3. Finalize plans. How should the earth be shaped? Will there be play pits or mounds? What kind of level changes will there be? How will they be constructed? Is there to be grass? What kind of fencing or wall is going to be built? Where do the play structures go? Where are they? Will there be large playing fields or basketball courts?
4. Decide which items have priority. Make a sequential plan from large to smaller tasks, and organize them on a calendar. Decide which part of the playground will be developed first. It is a good idea to begin with spaces near the building and then gradually move out to the larger areas.
5. Build a model.

During the construction of a playgound, the children's behavior immediately changes once there is a hole with a hill to climb. It is more challenging than level ground.

Earth mounds and play pits are fine play structures. They offer an easy way to create level changes on a playground. Be sure to design for efficient water drainage.



DRY WELL CONCEPT FOR PLAY PIT

6. A committee should be formed throughout the designing and building process to collect materials from the community. Materials should include a backhoe, tools, railroad ties, telephone poles, large rocks, old lumber, tree stumps, gravel, sand, grass seed, plants, trees, tires, cable spools, and cement culverts.

7. Identify resources in the community that can be tapped to help on this project.

8. A nearby military installation or industrial plant with a community service branch can help to survey; run a backhoe for earth digging and mounding; haul railroad ties on flatbed trucks (in the West, ties are lying by the tracks waiting to be picked up); provide labor.

There is a direct correlation between community and parent energy, and the amount of materials gathered for playground construction.

9. Assess the community and parent energy (we call it "sweat equity"). Is there a nursery nearby? Is there a parent with a construction firm? Are there parents who are bricklayers, plumbers, or electricians? Are there older children at the school or high school students who could get credit for work experience in building the playground?

10. Make detailed plans of weekend workshops and construction schedules. Have some parents arrange to provide food for the workers. (We've found that food is a great relaxant and that a lot of communication takes place when people are eating.)

Food is a come-on for community inspired playgrounds, and a necessary element in all-day work sessions.

Work Schedule and Tools

Here's a schedule you might follow in planning and working on your playground:

1. Stake out the playground area to be improved.
2. Take a core sample of earth, if necessary, to determine the kind of ground you are digging, or where the water table is.

The district maintenance and operations crew take a core sample to determine the water table level.

The school chalk marker is used to make a giant blueprint of the playground design so that it is understandable to both the layman and the professional.

8. Begin play structures and banking of the earth with railroad ties, telephone poles, wooden spools, steel barrels, rocks, or whatever can be found.

9. Continue shaping the earth by hand. This is a long and tedious job.

10. Begin the structure (deck or walkways) that forms the transition area from inside the school building to the outside.

11. Install lights, drinking fountains, or other needed electrical outlets.

Try to seek out new and aesthetically pleasing ways to use found materials.

Construction of the amphitheater.

12. Begin and complete such structures as play towers, amphitheaters, sand pits, slides, playhouses, water play area, seesaws, caves, jumping pit, picnic tables, benches, basketball courts, shade ramadas, swings (can be made from tires), tire bounce, suspension bridge.

(Photo by Larry Licht)

(Photo by Larry Licht)

13. Bring in top soil and tamp it down.
14. Plant grass and trees.
15. Watch your energies come alive through the children who use your well-designed playground.

Following is a list of tools you may have to rent or borrow: post-hole digger, bolt cutter, pipe bender, chain saw, earth tamper, shovels, wheelbarrows, backhoe, trench digger, welding equipment, table saw, heavy drill, hand tools, wire or cable stretcher, rebar cutter, a two-ton truck and a flatbed truck for heavy hauling.

The same planning steps can be used where there is a higher budget project and the work load is assumed by a contractor rather than volunteer help.

Play sculpture and private spaces. Courtesy Nueva Day School, Hillsborough, California.

A play labyrinth among the trees. Courtesy Nueva Day School, Hillsborough, California.

Appendix E

News Articles about Oñate Elementary B-Building Garden Design Process

November 05, 2007

UNM Service Learning Course Uses Architecture Studio as Education Model

The University of New Mexico course Architecture and Children, taught by Anne Taylor, UNM Regents Professor in the UNM School of Architecture and Planning, is a service learning course where architecture students take visual and interdisciplinary processes they know well and go into schools and museums to teach architecture and design to children.

Photo: UNM Regents Professor Anne Taylor

Two UNM students, Amy Dukert and Beate Ortley, are teaching Thursday, Nov. 15, at 12:30 p.m. at Oñate Elementary School under the supervision of teacher David Dallas. The students are working with children to design a garden. Dukert is a landscape architecture graduate student.

Another UNM student, Noe Quiñonez, is teaching Architecture and Design in Spanish on Tuesday, Dec. 4, at 8 a.m. at Rio Grande High School.

"These university students are like visual pied pipers. They can draw concepts from physics, math and social studies to explain concepts to children. They also provide an applied, hands on way of learning not offered in many schools," Taylor said.

"UNM architecture students are a welcome sight to young students who stand up and cheer when they walk into the classroom," Taylor added.

Taylor's program is a form of environmental education using built, natural and cultural environments to give young students visual tools in two and three dimensions to solve real life problems creatively using math, science, technology and other subjects.

The design studio is a form of professional education, traditional in schools of architecture where students take on a design project under the supervision of a master designer. Its setting is the loft-like studio space where 12 to 20 students arrange their drawing tables, papers, books, pictures, drawings and models.

The design studio format is successful because:
• the studio population is small and workable
• students are responsible for their own learning The studio model revolutionizes learning, giving the power to student and prizing individuality.
• learning is based on creative problem solving
• learning is hands on and a real life education
• architecture and design integrate thinking from math, science, history and art

For more information, contact Anne Taylor at 277-1199.

Media Contact: Carolyn Gonzales, (505) 277-5920; e-mail: cgonzal@unm.edu

Posted by scarr at November 5, 2007 04:43 PM

Bulbs Help Oñate Students Plant Seeds of Creativity

2007/11/30

Kindergarteners and first graders at Albuquerque Public Schools Oñate Elementary School braved the elements Thursday (Nov. 29) to plant the first bulbs for what will become an expansive garden around one of the school's buildings.

Students from the UNM School of Architecture and Planning, one each from the architecture and landscape architecture programs, worked with the elementary classes to create a design on paper. They finished just in time to start planting the 150-feet-by-10-feet garden before winter weather arrives, though Thursday turned out to be a cold, rainy afternoon. The garden is designed with swales to capture rainwater that drains from the school's roof.

"In addition to math, science and map-reading skills, the students get to be outside, which is good for them," first grade teacher Carol Price said. "They're creating something that's alive."

UNM students Amy Duckert and Beate Ortley first taught the students indoors about what the bulbs will be doing all winter and how to dig small holes before they went out to the site. Ortley completes her master's degree in December, but Duckert will visit the classes weekly through the end of the school year.

Bulbs are only the beginning. Plans for the garden include a wide variety of herbs and flowers, including different species of thyme and mint, as well as sunflowers and echinacea. The young students also will plant winter/spring vegetables that can be grown and harvested before the school year is over.

Price said they will use the garden for lessons in art classes. She added that the teachers have been discussing ways to turn the garden into a fundraiser for the school, such as harvesting and selling lavender.

"We're in the process of working on getting grants for the rest (of the planting)," first grade teacher David Dallas said. Dallas is also a graduate of the UNM School of Architecture and Planning.

The project is part of the Architecture and Children graduate-level course, led by UNM professor Anne Taylor. Taylor's students visit APS schools frequently.

"Projects like this really help our students learn to think creatively," Superintendent Elizabeth Everitt said. "We really value our partnerships with UNM in all fields."

ABQ journal

On the Web

Get more information about your child's school on the greatschools Web site, which can be accessed through the **Journal** site: abqjournal.greatschools.net. Enter the school's name, and you'll find test scores, rankings, enrollment and parent comments.

IN BRIEF

APS food drive ends Dec. 19

Albuquerque school administrators are having a "Food for Kids Drive" to help more than 3,200 homeless students in the district.

The foyer of the APS headquarters building, 6400 Uptown NE, is donation central. Nonperishable food items can be dropped off there until Dec. 19.

APS will deliver the food to Roadrunner Food Bank, which will distribute it to the families of the homeless students.

Students help landscape Oñate

Kindergartners and first-graders at Oñate Elementary School have planted the first bulbs for what will become an expansive garden around one of the school's buildings.

Students from the UNM School of Architecture and Planning — one each from the architecture and landscape architecture programs — worked with the elementary classes to create a design on paper.

The 150-by-10-foot garden is designed with swales to capture rainwater that drains from the school's roof. Oñate is near Menaul and Chelwood NE.

Plans for the garden include a wide variety of herbs and flowers, including different species of thyme and mint, as well as sunflowers and echinacea. Students also will plant vegetables that can be grown and harvested before the school year is over.

The project is part of the Architecture and Children graduate-level course, led by UNM professor Anne Taylor.

Dec. 11, 2007
"In Brief" Section B, Schools

Appendix F

Soil Analysis Data Sheet for Oñate Elementary B-Building Garden Area

IAS Laboratories

2515 East University Drive
Phoenix, Arizona 85034
(602) 273-7248

SOIL ANALYSIS REPORT

Today's Date: 11/28/2007
Grower: Onate Elementary
Submitted By: Amy Duckert
Send Report To: Morrow Reardon Wilkinson, LTD
Report Number: 6631782
Crop: Native Plants
Date Received: 11/26/2007

VL = Very Low
L = Low
M = Medium
H = High
VH = Very High

Sender Sample Id	Depth	Lab #	pH	Calcium (Ca) PPM	Magnesium (Mg) PPM	Sodium (Na) PPM	Potash (K) PPM	Iron (Fe) PPM	Zinc (Zn) PPM	Manganese (Mn) PPM	Copper (Cu) PPM	Salinity (EC x K) dS/m	Nitrate Nitrogen (NO3-N) PPM	Phosphorus (Bicarb - Soluble P) PPM	Computed % Sodium (ESP)	Sulfur (SO4-S) PPM	Boron (B) PPM	Free Lime Level
A		711	9.1	4700 VH	220 H	160 M	120 M					.8 L	17.0 M	6.9 L	2.6			High

IAS Laboratories

2515 East University Drive
Phoenix, Arizona 85034
(602) 273-7248

SOIL FERTILITY RECOMMENDATIONS

Lb/1000 Sq Ft

Grower: Onate Elementary

Send To: Morrow Reardon Wilkinson, LTD

Report No: 6631782 Date: 11/26/2007 Page: 2

											AMENDMENTS				
Sender Number	Crop	Nitrogen N	Phosphate P2O5	Potash K2O	Magnesium Mg	Sulfur S	Iron Fe	Zinc Zn	Manganese Mn	Copper Cu	Boron B	Elemental Sulfur	Gypsum	Lime	Leaching of Excess Salts
A	Native Plants	1 a	2 b									30 *+			

*+) Till sulfur into the soil to reduce pH. Disposul, a 95 sulfur product, dissolves readily and can be used if you can't till.
a. Broadcast and water into soil.
b. Till into soil if possible.