Salad Lunches and Radish Dreams

Greenhouse Gardening at Grayson Elementary School

By

Emily Reardon
Department of Horticulture
Michigan State University
East Lansing, MI 48824
August 30, 2005

Table of Contents

Abstract

Salad Lunches and Radish Dreams: Greenhouse Gardening at Grayson Elementary School
By
Emily Reardon

School gardening can be an exciting, economical and effective way to connect students with nature, healthy food, and their own learning. In the Mid-west, much of the gardening season happens when students are on summer vacation. In this study, our purpose was to demonstrate how the school garden curricular connection can be combined with winter greenhouse production and year-round gardening methods in order to enhance and expand experiential learning in temperate climates. In conjunction with the solar greenhouse research at the Michigan State University Student Organic Farm, a research and education grant from North Central Sustainable Agriculture Research and Education funded a project to help present the results to farmers and school gardening programs. A solar greenhouse was built at a local elementary (K-5) school and students planted, maintained and harvested cold-tolerant crops. Three all school salad lunches, in-class salad snacks, and salad sent home in plastic bags all connected students to fresh greens and vegetables. Activities in or about the solar greenhouse were tied to the existing curriculum in subject areas including math, science, social studies, and language arts. Eight students and 5 teachers were interviewed and the qualitative results are presented using a case study format. The story of solar greenhouse gardening at Grayson is one of excitement and hope. Based on our experience, teachers need help initiating and running a year-round gardening program, but appreciate the continuity of gardening throughout the year. Students love getting their hands in the dirt, and enjoyed having the ability to care for their plants. Thirty-five participants attended a daylong workshop providing details about how to use greenhouses for school gardening. The impact of our efforts can be measured by how many schools in Michigan develop greenhouse school gardens in the years to come. Two are currently being planned in Michigan. One in the Ann Arbor school district, and one in the Bath school district.

List of Terms

1. Frost-fabric – A loosely woven translucent fabric used to cover the plants to trap heat and provide protection from frost and cold.

2. Hoophouse - Unheated greenhouse like structure that relies on the sun for warmth

3. Organic Matter – A substance derived from plant or animal material. Organic matter can increase the proportion of available water in the soil, provide a food source for soil organisms, help maintain good soil structure, and is a good source of nutrients. Examples include compost, manure, seaweed, and leaf mould.

4. Raised Beds – A mound of prepared soil raised 6-8 inches above the surface of the ground. Framing the beds with wood, stone, or some sort of barrier can make them permanent.

5. Solar Greenhouse – Unheated greenhouse that relies on the sun for warmth

6. Water Holding Capacity – The amount of water that can be held by the soil, or plants.

"…kids love to garden, they love to dig in the soil,
they like to plant, they like to harvest, they like to observe…"
–Grayson Teacher

Introduction

History of The Grayson Garden

Ten years ago, at an elementary school in north Lansing, two fourth and fifth grade teachers put together a plant science unit focused on the lifecycle of plants. A garden seemed the perfect setting for this unit, and so the Grayson Garden was born. The school had no extra resources for a garden, so they relied on the kindness of the community to begin. A husband of a teaching assistant tilled up the plot behind the school and a grandmother of a student donated seeds.

It was hard to keep the garden going. Teachers felt rushed, shoving seeds into the ground in late May, using what time they could spare to get the garden planted. After school let out, there was no one around to tend to the vegetables, and the food was lost in a sea of hip-high weeds by the time school started up again. Teachers lovingly referred to it as the "Prairie Ecosystem".

Help arrived in 2000 when Laurie Thorp, a sister-in-law of one of the teachers, was asked if she would be interested in lending a hand with the school garden. Thorp was looking for a school to do her field research in agricultural education so this invitation became the perfect entré to her study, (Thorp, 2001).

Dr. Thorp continued to work with Grayson Elementary following completion of her dissertation and employment at Michigan State University. As director of the RISE (Residential Initiative on the Study of the Environment) program at MSU, she encourages

her students to go to the school to help, and works every year with the teachers and students to plan and plant the garden. In 2002 Dr. Thorp connected two MSU students with the school through a course on the Earth Charter where students were required to do an outreach project. Joe and Eric worked a few times a week at the school, helping teachers integrate the garden into classroom activities. The first nine months they volunteered their time and then they were paid through a W.K. Kellogg Foundation Grant. Finally they were paid as garden assistants with Golden Apple Dollars the school received from the district as a result of exceptional academic performance on their annual assessment.

Children's and School Gardens

School gardens, and connecting children to gardening is something that is happening all over the country. In Berkley, California the Edible Schoolyard program seeks to bring gardening into the classrooms and the lunchrooms. "The mission of the Edible Schoolyard at Martin Luther King, Jr. Middle School is to create and sustain an organic garden and landscape that is wholly integrated into the school's curriculum and lunch program," www.edibleschoolyard.org. Here in Michigan, the Children's 4-H garden connects students throughout the year, including the summer, to gardening. They hope to give the child the opportunity to be curious and wonder about the natural world surrounding them (www.4hgarden.msu.edu, Driscoll, 2004 and Berryhill, 2005).

Students can benefit from a year-round gardening experience. In California, the climate allows for outdoor gardening throughout the year and there has been a statewide explosion of the school gardening movement (www.cde.ca.gov/ls/nu/he/). The Michigan 4-H Children's garden takes advantage of an indoor heated greenhouse, as well as many

gardening activities using plants and the computer. The computer is used for activities such as monitoring plant growth in the garden from the classroom, video for problem solving of plant diseases and pest injury, a time-lapse “wondercast”, and an on-line “Wonder Wall” that enables students and teachers to keep in touch with the garden after field trips.

Hoop-houses at Michigan State University

There are many methods of extending the gardening growing season as outlined in the review of the literature. The Michigan State University Student Organic Farm (SOF) has set an example for Grayson with their year-round production in heated and unheated greenhouses. Dr. John Biernbaum, advisor to the SOF suggests 4 simple criteria for winter crop production in unheated greenhouses. These are: 1) the right crops, 2) plant at the right time, 3) provide the right protection, and 4) harvest multiple times. These winter production and harvest concepts combined with field production of vegetables and community supported agriculture marketing methods have allowed the SOF to become a year-round teaching facility and supplier of fresh organic vegetables. For more details please see www.msuorganicfarm.com or Ferrarese (2005).

The winter baby leaf salad greens project at MSU was initiated by Dr. John Biernbaum in 2001 and continued in 2002-03 with research funding from the United States Department of Agriculture Sustainable Agriculture Project and MSU Project GREEEN. The MSU Student Organic Farm was initiated with funding received from the W.K. Kellogg Foundation in 2002 to also support the continued winter production research.

In 2003 funding was received for a USDA Higher Education Challenge grant. Drs. Thorp and Biernbaum proposed that by gardening during the school year in solar greenhouses college students would receive the benefits of learning about organic farming by doing small scale organic farming. In the fall of 2003, a RISE seminar class of 25 students learned how to plant in September and harvest greens all through October to December. In the spring of 2004, the MSU Vegetable Production class learned how to plant in February and have greens until classes finished in May.

Funding was received in 2002 from the North Central Sustainable Agriculture Research and Education Program (NCSARE) to help present the research results to farmers and coordinators of school gardening programs. The first step in the fall of 2003 was to build a solar greenhouse at a local farm, and hold a workshop in spring of 2004 to inform farmers of the possibilities of winter farming and season extension. After the farm workshop, focus turned to elementary school greenhouse gardening. Grayson was chosen because the school already had a garden with interested and involved teachers. The school also had an established relationship with the MSU community through Dr. Thorp, who was also involved with the Student Organic Farm. By early 2003, there was a plan to build a greenhouse at Grayson in the summer of 2004, and the ground work of getting approval and selecting a site began.

Upon my arrival at the SOF in the summer of 2003, I expressed an interest in gardening with children and asked to participate in the project. This was a great opportunity, but my time would now be split between Grayson and the Student Organic Farm, where I was the education coordinator.

Purpose of the Study

While school gardens can be a valuable addition to the curriculum, in Michigan the majority of the school year is in the winter, and only the very beginning and end of the academic year can be dedicated to gardening. However it is clear that many cold tolerant salad greens and vegetables can be grown and harvested throughout the winter in an unheated greenhouse. For a comprehensive gardening program to occur in the Midwest, such as in California, we must bring these two pieces together. The purpose of the study is to demonstrate how the school garden curricular connection can be combined with winter greenhouse production and year-round gardening methods in order to enhance and expand experiential learning in temperate climates. We report what we learned in the process including the reactions of students and teachers, and our recommendations based on one year of experience.

Review of the Literature

Experiential Education

Educating our Youth. As we begin to look into the purpose of education and how it is accomplished we notice a problem right at the start. Children are concrete thinkers, but much of what they are taught today is done in abstract form (Kohn, 1999). From the very beginning we are asking them to learn what they cannot yet comprehend with an apparent goal of memorizing and repeating. Learning is more than this though, it involves understanding relationships and the ability to relate them to life experiences.

Experiential education is a way to give children the opportunity to explore concretely and to come up with questions and answers on their own. This interaction

with objects is important for their own cognitive development. This type of education also allows for different learning styles, giving all children an equal opportunity to engage in learning in whatever manner suits them best.

Constructivism. The importance of experiential education is not a new idea. In 1935, Jean Piaget was writing on the importance of education. He believed in directing learning so the children would become autonomous thinkers, and not simply imitate what they were "learned" as youth (Guber and Voneche, 1977). This is how as a society we become richer in knowledge. If our youth are taught to think and question, they may be less likely to repeat the mistakes of the past. We find similar thoughts in the literature. Dewey (1938) saw problems with information taught as a finished product for students to accept. In a society where change is constantly occurring, information should also be changing. We must not use children as vessels for this finished information (Kohn, 1999), we must instead cultivate a child who understands the world around them and can relate what is learned in school to their daily lives.

Pestalozzi (1915) believed this occurs with young children understanding the objects that surround them. It is through the senses that a child discovers compares and judges what surrounds them. The child's experience then allows them to take their concrete knowledge into the abstract. Freidrich Froebel, the pioneer of the kindergarten movement, saw education as happening as a whole, being inclusive of all a child's activities (Braun et al., 1989). This is important because children have a hard time applying "practically what they have learned in one subject to another," (Braun et al., 1989).

Children, in fact all learners, construct their own knowledge through their past and current experiences, and their relationship with the material at hand, (Marlowe and Page, 1998). When students enter a situation, they bring with them ideas about how the world works. As something is learned, beliefs and understandings are reorganized in order to accommodate this new knowledge (Kohn, 1999). Learning is not just taking in something and putting it away in your head next to what you already know.

These theories on knowledge construction laid the foundation for the pedagogy called constructivism. In this type of classroom the teacher doesn't give a lesson, but directs the student in a way that guides them into activity and interaction (Guber and Voneche, 1977). Kohn (1999) quotes Piaget in his discussion of constructivist classrooms. "The goal of intellectual education is not to know how to repeat or retain ready made truths," education comes from "learning to master the truth by oneself." Selly (1999) offers that in a classroom such as this "successful teaching will lead to growth of understanding, breadth of vision, a wish to pursue inquiry, and a more mature, fluent and articulate style of conversation."

Our traditional educational system is lacking activity and interaction. When children come home from school and say they did nothing, they are probably right, (Kohn, 1999). They came into the classroom and sat in their seats and were receptacles for information fed to them by the teacher. Kohn (1999) wonders along with Dewy whether a child had to "leave his mind behind because there is no way to use it in school." It is the activity and experiences that bring a child in, allowing them to question and create. In 1959, Piaget noted that the International Conference on Public Education even recommended, "In order to increase the interest shown by students in technical and

scientific studies at the primary-school stage, it is advisable to employ active methods designed to develop a spirit of experiment," (Guber and Voneche, 1977, p. 713). The problem also lies in the meaning behind the activity. Meaningful experience should not only relate to the task, but to our daily lives or something we can relate to (Dewy, 1938).

Experiential Education. It has been recommended that students engage in learning through experiential methods (Braun et al., 1989, Dewy, 1938, Eisner, 2002, Kohn 1999,), and shown that different people learn through different styles (Gardner, 1993), but these ideas are often ignored when student learning is assessed. Students are required to take standardized tests, and exams play a major role in their academic achievement. All too often a written exam shows us only whether or not a child has been able to retain information for the exam, not if they actually understood the information, or will even retain it long term, (Guber and Voneche 1977, Kohn 1999). We seem to have forgotten that the point to education is to prepare one for life, not to get good grades (Eisner, 2002).

The accountability that now accompanies testing (oret.lansingschools.net/images/testcalpage20405REV_back%20page.pdf) requires that teachers spend their time preparing children for the exam, instead of engaging them in active learning. We seem to have come back around to this idea that information is static and unchanging, and students are to take it in without questioning and then regurgitate it back on a standardized exam. This ensures that students will no longer play any role in how their learning will be shaped (Kohn, 2000).

Learning is not about memorizing something and then forgetting it later. It is about engaging students in their culture and appreciating how the world works, (Braun et

al., 1989). One way to initiate this kind of experiential learning is to develop critical thinking skills that encourage students to ask questions, frame goals, and figure out how to answer and achieve them, (Eisner, 2002). Experiential education must then take a front seat in our schools, if our children are ever to become critical thinkers. They need to know how their learning is related to their everyday lives (Cook, 1998). Schools today "fail to help students make connections with the real world," (Braun et al., 1989). This is what experiential education can do, it can "pull kids into the school, into learning…and make kids realize that learning isn't just about books, but that life is about learning," (Hawkins, 1998).

Outdoor Education. Outdoor education is a type of experiential education that takes learning to another level. It is a diverse and rich experience, that helps to "describe a heterogeneous world…essential to the development of intelligence," (Shepard, 1977). Pestalozzi (1915) understood the importance of this when he speaks of the child's first experience at school. "We leave children, up to their fifth year, in full enjoyment of nature…And after they have enjoyed this happiness of sensuous life…we make all nature round them vanish from before their eyes." They are crammed into small, indoor classrooms, and expected to sit and be quiet.

When we encourage children to explore the outdoors, we are giving them a gift that will stay with them forever. Young children these days are taught about saving the rainforests and wild animals such as elephants, however most American children will never see a rainforest, and will only see an elephant in a zoo. It is hard to make the connection and truly understand the gravity of the situation if you barely understand what it is you are trying to save. If we can cultivate care and concern for the habitats that

surround us first, we can then later in life appreciate how important it is to preserve all habitats (Sobel, 1996). Children, ages 7 to 11 are ready to learn about the habitat around them. According to Sobel (1996) going outdoors is developmentally appropriate for children of this age; they are ready to explore their world beyond the home. Allowing children to experience the world around them ultimately results in education; "the developing of mental power, the opening of the eyes and the mind, the civilizing of the individual," (Bailey, 1909).

It is important to address the significance of nature in every discipline. "By failing to include ecological perspectives in any number of subjects, students are taught that ecology is unimportant for history, politics, economics, society, and so forth" (Orr, 1992). We then, in the future, will end up with adults who are in no way connected to the natural world that surrounds them, and who have no idea how it could possibly relate to their everyday lives. We also send the message that education is an indoor activity. It must be for the most part, but learning about biological life cycles from a book instead of going outdoors to see it happening all around us, seems defeating (Orr, 1992). David Orr (1992) refers to this learning as "ecological literacy" and believes in order for it to happen, we need to understand that "all education is environmental education." An ecologically literate person has practical competence, an ability to understand practical competence, and an attitude of stewardship (Orr, 1992). An ecologically literate person may be happier as well. Psychologists have shown that contact with nature can improve concentration, help recover from stress, and is correlated with better moods (Braun et al., 1989)

School Gardens. Connecting children to nature is very easy, if you live near wild spaces. Today a child's daily interaction with nature is growing smaller, as we move from rural farms to big cities and experience urban sprawl and habitat destruction. If we are to connect children with nature in the cities we need nature that is accessible. Gardens can help bring nature back to the students. In the Midwest, the Michigan 4-H Children's Garden helps bring children into the wonderful world of gardening. Input from preschool students was used when designing the garden so that it would appeal strongly to children (Whiren, 1995). The garden attempts to engage children through sight, smell, taste, touch, and sound, learning in their most immediate environment (Whiren, 1995).

Visiting a garden with a class or family is a great way to connect to nature. School gardens can help bring that experience closer and more constant, as well as offer many opportunities. We can explore nature, and the life that surrounds us, integrate different learning styles and disciplines, and teach about healthy foods and eating. In a research study conducted on integrating gardening into the curriculum, it was found that gardening provided concrete experiences that contributed to the understanding of many topics within the standard, mandated curriculum, (DeMarco et al., 1999). The garden was used for academic learning, but also for recreation, social experiences, and therapeutic needs (DeMarco et al., 1999).

In inner city LA, gardens are integrated into the curriculum and also used to combat the unhealthy food that invades students lives (Braun et al., 1989). This is through a "Garden in Every School" program mandated by the California Department of Education (www.cde.ca.gov/ls/nu/he/). One teacher from the program comments,

"Instead of eating junk food, the children are eating what they grow," (Braun et al., 1989). Assadourian (2003) also found studies that show children who work in the garden during the year are more likely to try new vegetables than those who did not. As one child pointed out, after making his own stir-fry, "If I didn't make it, I wouldn't eat it," (Lord, 2000). This is an important piece of research if we think about the fact that in 2003 13% of American children were overweight (Assadourian, 2003). This is because children today are "less active and are consuming more high calorie foods," (Harris, 2002). Harris also suggests that school cafeterias are natural learning labs. The partnership between school gardens and cafeterias is the next step. The Edible Schoolyard in Berkley, California has already made this connection and provides students an opportunity to learn in both spaces, while cultivating an appreciation and understanding of the importance of food and its preparation (Crabtree, 1999).

Gardening can be an effective way to address the issue of children's eating habits while at the same time connecting them with nature. It is also an easy way to bridge the gap between disciplines. Science, math, social studies, economics, art, and music are just a few of the subjects that can easily be integrated into a gardening program (Braun et al., 1989).

Here in the Midwest it is challenging to do gardening in schools because of the growing season. The growing season mainly coincides with the school's summer break when children are on vacation. When Midwestern schools do garden they generally plant the garden in the spring and harvest it when students return to school in the fall. Parents or volunteers help tend the garden during the summer months. Anyone who gardens knows that there are a multitude of experiences that occur during the summer. Students

do not have the opportunity to see their plants grow, experience drought, or pest damage, watch fruits form, or do anything hands-on involved with the growing season.

List of Works Cited

Assadourian, E. (2003). "Cultivating the Butterfly Effect." World Watch. Vol. 16. No. 1. P. 28-35.

Bailey, LH. (1903). The Nature Study Idea. The Mason-Henry Press, Syracuse, NY.

Braun, J., Kotar, M., Irick, J. (1989). "Cultivating an Integrated Curriculum: The School Garden." Social Studies and the Young Learner. Vol. 1. No. 3. P. 19-22.

Cook, E. (1998). "A Conversation With Educators." The Edible Schoolyard. Learning in the Real World, Berkeley, CA.

Crabtree, M. ed. (1999). The Edible Schoolyard. Center For Ecoliteracy, Berkley, Ca.

DeMarco, L., McDaniel, A., Relf, D. (1999). "Integrating Gardening Into Elementary School Curriculum." Hrt Technology. Vol. 9. No. 2. P. 276-281.

Dewey, J. (1938). Experience and Education. Macmillian Publishing, New York.

Dobbs, K., Relf, D., McDaniel, A. (1998). "Survey on the Needs of Elementary Education Teachers to Enhance the Use of Horticulture or Gardening in t the Classroom." HrtTechnology. Vol. 8. No. 3. P. 370-72.

Eisner, E. (2002). "The kind of schools we need." Phi Delta Kappan. Vol. 83. No. 8. P. 576-83

Gardener, H. (1993). Frames of Mind: The Theory of Multiple Intelligences. Basic Books, New York.

Harris, K. (2002). "The USDA Lunch Program: New Approaches to Meeting the Demands of Child Health and Nutrition in the 21st century." The Clearing House. Vol. 75. No. 6. P. 310-311.

Hawkins, D. (1998). "The Garden Experience." The Edible Schoolyard. Learning in the Real World, Berkeley, CA.

Kohn, A. (1999). The Schools Our Children Deserve. Houghton Mifflin, New York.

Kohn, A. (2000). "Unlearning How We Learn." Principal. Vol. 79. P. 26-29, 31-32.

Lord, M. (2000). "Schools Fight Fat by Teaching Kids to Eat Their Greens." U.S. News and World Report. Vol. 128. No. 17. P. 60-2.

Marlowe, B., Page, M. (1998). Creating and Sustaining the Constructivist Classroom. Corwin Press, USA.

Orr, D.W. (1992). Ecological literacy. Albany: State University of New York Press

Pestalozzi, J. (1915). How Gertrude Teaches Her Children. George Allen And Unwin LTD. London,

Guber, H and Voneche, J, eds. (1977). The Essential Piaget. Basic Books, USA.

Selly, N. (1999). The Art Of Constructivist Teaching In The Primary School. David Fulton Publishing, London.

Shepard, P. (1977). "Place in American culture." The North American review. Fall 22-32.

Sobel, D. (1996). Beyond Ecophobia. The Orion Society, Great Barrington, MA.

Whiren, A. (1995). "Planning a Garden from a Child's Perspective." Children's Environments. Vol. 12. No. 2. P. 250-255.

Winter Production

Background. In order to produce food year-round in areas with harsher winters some type of protection or heating system may be necessary. Eliot Coleman of Maine has been developing a winter production system since the early 1990's (Coleman, 1998; www.fourseasonfarm.com). Coleman (1998) recognizes the works of Emery Emmert and believes him to be "almost solely responsible for developing the main applications of plastics in vegetable cultivation," (p. 7). Emmert developed a system of using an inner-layer of plastic inside his plastic greenhouses for unheated winter production (in

Coleman, 1998). Along with Emery Emmert, Helen and Scott Nearing ([1954] 1970) developed a system of winter farming in the 40's and 50's. They extended their season, in Maine, "by a small sun heated greenhouse in which we wintered many plants and started others for spring planting," (Nearing, [1954] 1970, p. 100).

Others, along with Coleman are developing systems to fit their own needs. Steve Moore, of Pennsylvania, has developed a passive solar greenhouse winter production method that includes using hot compost for managing a seedling and production microclimate (Byczynski, 2003, Moore and Moore, 1999). Researchers at The Pennsylvania State University (2003) have recently developed interest in year-round production and offer extensive information on construction and use of hoop-houses (plasticulture.cas.psu.edu/). Harden (2003), Head (1984), Colebrook (1989), and Ashton (2001) all offer simple instructions on managing a garden through frost and into the winter. More recently, a series of articles for The New Farm, an electronic publication of Rodale Publishing (www.newfarm.org), were written on the specifics of hoop-house construction and management (Olender, 2005). Another valuable resource with information for farmers that could be transferred to schools is available at www.hightunnels.org. Hoop-houses and high tunnels are not just important in United States winter production. They are also used all over the world to support growing populations. Europe, Asia, and Israel are just a few of the regions working to extend their season (Lamont, 2003).

When thinking about year-round production start with the site. It is important to choose a site that is well drained and accessible (to both people, and utilities). It is also important that there is space enough to orient the hoop-house in an east-west direction,

(Biernbaum in Olender, 2005). The design of the structure is also important. There are a number of commercially available cold frames, or metal-framed hoop-houses that can be used for winter production (Coleman, 1992, Freeman, 1997, www.hightunnels.org). A gothic, or peaked style is common because of the easy snow removal, improved ventilation, light transmission, and condensation runoff.

Hoop-houses can be covered with a single or double layer of polyethylene plastic. Each layer of protection, according to Coleman (1995) creates a microclimate equivalent to moving one climate zone south. In our area, zone 5, a single layer of protection would be as if growing in a zone 6. Biernbaum, in The New Farm.Org, also tells us how a second tunnel can be formed inside the hoop-house to create a microclimate (Olender, April 2005). Biernbaum suggests winter production and harvesting are possible if we consider four key principles (Olender, April, 2005). These are: 1) the right crops, 2) plant at the right time, 3) provide the right protection, and 4) harvest multiple times.

Crops. In order to be successful at winter gardening, specific crops must be chosen. There are lists of cool season crops from Coleman (1992) and others (Colebrook, 1998; Head, 1989; Larkcom, 2001; Poisson and Poisson, 1994). Some suitable crops include arugula, beets, carrots, chard, Chinese cabbage, claytonia, cress, endive, kale, several types of lettuce, mache, mibuna, minutina, mizuna, mustard, spinach, tatsoi, turnips, and vitamin green. Many of these crops have low cost seed, germinate quickly, and are available to harvest in 40-60 days. They also will grow back after harvesting, an important part of making the greenhouse production profitable (Biernbaum et al., 2004).

Certain crops are not tolerant of the freezing temperatures in the wintertime. Tomatoes, peppers, and beans would not last through the winters, while spinach lettuce, greens (mizuna, Tokyo Bekana, kale, tatsoi, claytonia, and mache), chois, radishes, and turnips all grow well. It is important we choose crops that will survive through the freezing temperatures in December and January. The plants can be frozen hard in the morning, but ready to eat in the afternoon after thawing in the greenhouse warmed by the sun.

Planting Time. In order to survive the cold crops must be of a certain size. If the plants are too small, or too big, they will either not grow much or not survive frost or freezing. To get this size it is important to plant the crops at the right time. In Michigan, or heat zone 5 planting takes place in September and October, before the days become too short, the temperatures too cold, and growth slows down.

Protection. The third criteria is having the right protection. Greenhouses are covered with a single or double layer of plastic. The crops are then covered in the house with a layer of frost-fabric, suspended a few inches above the plants. During sunny days, the plants are uncovered so the plants and soil can absorb as much light and heat as possible. The soil absorbs a large amount of heat as well and this is very important. At night, the heat from the soil is released in the form of long-wave radiant energy or thermal radiation. The moisture/water present as condensation on the plastic and frost-fabric freezes and acts like cloud cover to trap or reflect the escaping heat. This is called the “cloud”, or if the water on the cover is frozen “igloo” effect. A microclimate under the frost-fabric is created.

Multiple Harvests. Finally, harvesting, or cutting off the same crop multiple times is important. As mentioned in point No. 2, it is not possible to start new plants later in the fall and during December and January when there is not enough light and it is too cold. If plants are already started they will keep growing slowly or re-grow from the roots. The ability to get multiple harvests off the same crops works to our advantage. We can cut the salad greens in late October, and continue to harvest until winter break. We can also cut in late March, and have greens from the same plants until school is out in June. Depending on the light and temperature, it could take as little as 10 days for the next harvest or as much as 30 days.

List of Works Cited

Biernbaum, J.A., M. Timm-Cook and S. Houghton. 2004 Hoophouses for Year-round Local Food and Farming. A training presentation and manual for farmers. Self published. 313 pgs.

Byczynski, L. 2000. We're hoophouse converts. Growing for Market Vol 9:11.

Colebrook, B. 1998. Winter Gardening in the Maritime Northwest: Cool Season Crops for the Year-Round Gardener.

Coleman, E. 1992. Four Season Harvest: How to Harvest Fresh Organic Vegetables From Your Home Garden All Year Long. Chelsea Green Publishing Company, White River Junction, VT.

Coleman, E. 1995. The New Organic Grower: A Masters Manual of Tools and Techniques for the Home and Market Gardener. Chelsea Green Publishing Company, White River Junction, VT.

Freeman, M. 1997. Building Your Own Greenhouse. StackPole Books, Mechanicsburg. PA.

Head, W. 1989. Gardening Under Cover: A Northwest Guide to Solar Greenhouses, Cold Frames, and Cloches. Sasquatch Books. Seattle, Washington.

Lamont, W (editor). 2003. High Tunnel Production Manual. The Pennsylvania State University. 160 pgs.

Nearing, H. and Nearing, S. [1954]1970. Living the Good Life: How to Live Sanely and Simply in a Troubled World. Schoken Books. New York, New York.

Olender, K (2005). "Organic University: Greenhouses for year-round food and farming." http://www.newfarm.org/features/2005/0305/gh1/index.shtml

Poisson L. and G Poisson. 1994. Solar Gardening: Growing Vegetables year-round the American Intensive Way. Chelsea Green Publishing Company, White River Junction, VT.

www.newfarm.org, July 2005

www.hightunnels.org, June, 2005

Methods

A note about language…From this point on a hoop-house, or high tunnel will be referred to as a solar greenhouse, or simply greenhouse. (Traditionally, greenhouses are heated with heating systems, and plants grown in pots on benches. A solar greenhouse has no heating system, and is heated only by the sun.) We will use the term solar greenhouse for ease of comprehension.

Solar Greenhouse Site Selection and Preparation

During the fall of 2003 we evaluated several possible sites for the solar greenhouse and considered easy access, a source of water for irrigation, protection from wind, absence of shading, and avoiding any septic or drain fields. A greenhouse at our latitude (41 degrees) would normally be oriented east to west to maximize winter light but due to sight limitations the greenhouse was oriented north to south.

The first step in building the solar greenhouse was soil preparation. This began in the fall of 2003, an entire school year before the solar greenhouse was built. The site chosen had sandy soil, most likely course fill sand, without much organic matter. In order to make sure the plants would have enough nutrients and to increase water-holding

capacity, it was important to add organic matter. Our plan was to use methods suitable for organic certification (www.ams.usda.gov/nop/indexIE.htm). In the fall, leaves, old straw, and small amount of animal manure based compost were added to the site. Early the following spring, the site was fenced off with chicken wire and colored flags. Organic materials, such as leaves and grass clippings, were obtained from people involved in the project. The existing sod was eliminated using a method called "sheet composting" (Stout, 1971), a technique of mulching without using chemicals. During an all school field day in early June, while some students planted the outdoor garden, any live grass and weeds that had grown through the compost was mowed and the sod was tilled under with a Troy Built Rototiller. Finally, after the area was tilled, more llama, sheep and horse manure based compost from Dr. Biernbaum's home farm was applied. We estimate that approximately four trailer loads (7 cubic yards) was applied over a 30' x 50' area, resulting in a layer about 1.5 inches thick. The soil was tilled, and kept watered in order to encourage weed seed germination, which would ultimately help reduce weeds in the garden. We also added a 25 lb. bag of 3-1-5 alfalfa based organic fertilizer (Bradfield Industries 610A E. Battlefield #203 Springfield, MO www.bradfieldind.com/). Based on the growth of the crops, we had more than adequate soil fertility.

Greenhouse Source and Construction

Price quotes were obtained from four manufactures. The one selected was the least expensive and the only one that fit the budget. A 30' x 48' greenhouse without roll-up sides but large endwall doors was chosen.

Actual construction of the solar greenhouse began in August. The solar greenhouse came with a detailed set of assembly instructions, although not all do. The

majority of the overhead frame was completed in two main workdays and the remaining work was completed over three months. Teachers, students, and local farmers were invited to participate in the frame construction over 2 days in August. Teachers and students even turned out in the rain on the second day! Dr. Biernbaum led the construction, having eight prior greenhouses under his belt. The rest of the crew were novices. Teamwork and excitement motivated the group to complete the project in 2 days.

It was decided that there would be raised beds and woodchip pathways in the solar greenhouse. This would help to keep the weeds in the paths down, and create easily defined boundaries in the solar greenhouse. The boxes and frames for the frost-fabric were built shortly after the frame was complete. Frost-fabric is a lightweight white fabric that covers the plants in order to create a microclimate during the winter. There were to be 4-8'X8' boxes in the middle of the solar greenhouse, and two boxes that extended the length of the solar greenhouse, 9' wide (Appendix A, B). The wooden boxes were made with pieces of 1" X 4"'s. Boxes were screwed together and lifted into the greenhouse, where they were filled with soil from the pathways.

Pathways were two feet wide. The top 2-4 in. of the pathways was shoveled into the beds prior to covering the pathways with woodchips donated from The Giving Tree Farm. A 25#lb bag of Bradfield Alfalfa fertilizer was applied with the compost after the beds were formed. We also added approximately 40 cubic feet of peat moss to the plots. We arranged with a local garden center to purchase, at a very reduced price, all the broken or ripped bales of peat they had set aside during the spring season. A 6' x 11' space in the center was left in order to create a meeting area. MSU students and faculty, as well as Grayson teachers built the boxes over an evening.

The endwalls were the next step in the solar greenhouse construction process. This took place over a few weekends in September by Dr. Biernbaum and myself. Help came from General Motors employees who were also helping build greenhouses at The Giving Tree Farm. It was not possible to get help from the school staff at this time. School had just started and teachers were very busy.

The final step was covering the greenhouse with plastic. This was delayed until October. We also needed a warm (greater than 50F) calm day. Farmers from the Student

Organic Farm came out to aid the students. The fourth and fifth graders pulled the plastic over by attaching ropes to one edge of the plastic using tennis balls. Students took turns securing the plastic with wire woven into a track. Kindergarteners came out and sat on the plastic while it was being secured.

Tools and Seeds

All materials used in the were purchased from the Johnny's Selected Seed catalogue (www.johnnyseeds.com). A broadfork, three-pronged claw, 30" landscape rake, stirrup hoes, and hand hoes were obtained (Appendix A). They had been tested and were proven to work well in solar greenhouses by Eliot Coleman (1995) and the MSU Student Organic Farm. A salad spinner, 100 feet of floating row covers, hand tools, thermometers for the greenhouse, and a rain gauge also came from Johnny's (Appendix C).

Wood and conduit had to be purchased for construction of the raised beds and frost fabric frames. Two hundred sixty feet of ½ in. conduit and one hundred thirty feet of ¾ in. conduit were needed to construct twenty-six frames (Appendix C). We also

bought about 200 feet of top quality garden hose and sprinkler and watering devices (Appendix C).

Fall Planting

Fall crops were planted as soon as arrangements could be made. Each classroom had their own 8'X 8' garden plot. The leftover area (16' X 8') was dedicated to salad greens for all school lunches. Students came out in groups of five or six and planted half of the garden plots with transplants that were started at the SOF. Our main transplants were lettuce and pac choi. Students were each given 2 plants to transplant into their garden plot. No garden tools were needed, the soil was prepared ahead of time so hands were sufficient. A hole was made in the soil and the transplant placed gently into it. The students were told to gently cover their plant so no potting soil was exposed.

Parents and teachers were invited to attend an evening planting of seeds (Appendix H). Radishes, turnips, lettuce, kale, mizuna, Tokyo Bekana Chinese Cabbage, claytonia and mache were planted in the other half of the garden plots. Seeds were counted out ahead of time and placed in labeled plastic vials. The large packets of seeds were not brought outside for fear of being spilled. A wooden template was borrowed from the MSU Student Organic Farm. This aided in marking where seeds should go. Seeds were chosen based on research from the MSU Student Organic Farm.

Fall Harvest

Harvesting began in late November. MSU students and faculty came to assist in the harvest. Small groups of students came from each classroom to harvest. Each student came out to the solar greenhouse with a pair of kid scissors, and pots, and bowls from the kitchen were used to put the cut greens into. As the bowls were filled the cut greens were

put into pillowcases. At any one time, there were at most 10 students and 4 adults in the solar greenhouse.

After harvest was complete, a few students stayed behind to wash and spin salad in the school kitchen area. All washing had to be done in bowls in the sink because the sink is not food-grade.

Outreach Workshop

A Greenhouse Gardening Workshop was held Friday, March 25, 2005. Thirty-five people attended, from all over Michigan and parts of Ohio. The cost of the workshop was $30 per person. Dr. Biernbaum spoke about how to build solar greenhouses, while Dr. Thorp and I presented information on curriculum integration and the Grayson greenhouse, respectively (Appendix D).

Spring Planting

Spring planting began in mid-February. Students planted only seeds, no transplants were done. Seeds were planted at a fairly high density (about ½" apart). To begin, students made a line in the garden with their fingers. They were then given 10-20 seeds and told to sprinkle them in the line. The seeds were covered with compost in order to see where they had been planted.

Classrooms checked on the garden two to three times a week and would water if needed. A watering schedule was not made because I also watered with the kids during lunch when I was there. Students watered using a hose, with a breaker attached, or a watering can.

Spring Harvest

Spring harvest began by early April and ended the last day of school, June 10th. Harvest was similar to the fall, but because the weather was better, washing and spinning took place outside on a picnic table. A Rubbermaid tub was used for washing outside. A single classroom, very interested in gardening, did much of the harvesting. During spring, harvesting was also done by entire classrooms as well as with small groups of students.

Distribution of Greens

An all school lunch was planned for December 14th, 2005. In agreement with the health inspector, we made sure the salad was not washed in the sink, because it was not food grade, and that the salad and dressings were kept on ice during distribution. Also, adults wearing rubber gloves put the salad and dressing onto plates.

On December 13th fourth and fifth graders harvested about thirty pounds of salad from the school plot. The large amount of salad was washed in a metal washtub loaned by the Student Organic Farm. It was spun dry in the institutional size salad spinner, purchased from Johnny's Seeds with grant dollars. The salad was kept cool in a walk-in cooler on the MSU campus.

Two MSU graduate and two undergraduate students helped with the distribution of the salad during lunch. The salad and salad dressing were placed in serving bowls over ice, as required by the health inspector. Two stations were set up on carts provided by the lunch cashier. Two people plated the salad, while two served the salad to students sitting at the tables. Two hundred and fifty students, from grades K-5 each received a plate of salad with ranch dressing. The leftover salad was bagged and sent home with faculty and staff.

Two more all school salad lunches were held. A special needs classroom arranged the second lunch which took place on Friday, April 22nd. My only involvement was to give them some ranch dressing to use, and to help serve salad. Their teacher and I plated salad, and fifteen students served it wearing rubber gloves. The students took home the leftover salad.

The final salad lunch took place on Tuesday, May 10th. The salad was plated in the kitchen area, keeping the helpers out of the lunch aide's way, and allowed for plating more than one salad at once. It was done successfully with only two people this way. Once again, two hundred and fifty students received a plate of salad with ranch dressing.

Along with the salad lunches, and salad in the classrooms, salad was sent home with the students. Over 100 students had a Ziploc gallon bag of salad go home with them. Students were also able to eat greens, radishes, and turnips fresh from the garden.

Curriculum Integration

Teachers were encouraged to integrate the solar greenhouse into their curriculum. I offered any help they needed, from brainstorming, to execution of lessons. The school principal required each teacher to do at least one garden lesson each semester (Appendix E). Work continued throughout the year integrating the greenhouse into all different disciplines (Appendix E).

Development of Interview Questions

A set of interview questions was developed over the summer of 2004 (Appendix F). Questions were developed with the help of Dr. Norm Lownds, Dr. Laurie Thorp, and Dr. John Biernbaum. Questions were chosen based on our interest in knowing how the solar greenhouse was different from the outdoor garden, what types of activities

were liked/disliked, and how activities such as harvesting and eating greens were enjoyed. We were also interested in how the program could be improved in the future. UCRIHS (University Committee on Research Involving Human Subjects) approval was received in October of 2004. One single set of questions was developed for both the teachers and the students.

Data Collection

Data collection began once all consent forms were collected (Appendix G). Teacher consent forms were distributed at an after-school faculty meeting. After three weeks only four were returned. A second set of consent forms was placed in teachers' boxes with a request to read and sign. Seven more were returned, with a total of nine in agreement to interview. Purposive sampling (Patton, 1990) was utilized to identify teachers willing to participate. This type of sampling, unlike probability sampling, focuses in-depth on a relatively small sample of highly involved subjects. Although only 5 teachers were interviewed, these subjects were considered because of their participation in the project. Two teachers were unable to participate due to personal reasons.

When the study was originally designed we also planned to interview parents and students. However, parental work schedules and transportation issues combined to make parent interviews not happen. Classroom teachers distributed student consent forms. It was hoped that 25 students would be interviewed for this project but only 8 students returned forms. Another class was recruited in order to have more students. No consent forms were returned.

Interviews began on Monday, April 11th 2005 and continued until Wednesday June 8th 2005. All interviews were tape-recorded. Teachers were interviewed first,

because all consent forms were obtained earlier. Teachers were sent a letter asking to choose a time when they would be available to be interviewed. Three different times per day were offered. If these times were not convenient, special arrangements were made to fit the teacher's schedule. Interviews took place during school in the teachers lounge, in the classroom, and on the playground. The teachers were able to choose wherever they felt the most comfortable. Teacher interviews took place over 2 months. It was very hard to combine the already full schedule of teachers with my school schedule. My time was more flexible, so if needed, I fit myself into the teachers' schedules. Student interviews took place over 2 consecutive days and were held in the library or in a small book room. This was to ensure privacy for the students. Interview protocol was followed during all interviews. Follow-up questions were asked when appropriate.

Data Analysis

Tape-recorded interview responses were transcribed. Interview transcripts were read through and coded for themes. Peer Debriefing (Lincoln and Guba, 1985) then took place with Dr. Thorp to review the analysis for themes. Themes were discovered after reviewing each interview multiple times. Similar topics surfaced as answers to many different questions and are therefore defined as themes. Teacher and student interviews were evaluated separately. Questions were then separated into units for analysis. Two units were compared for similarities within individual units, and between the two.

Case Study

The following case study is the researchers story of one year at Grayson Elementary. The first section contains discussions of what happened in the solar greenhouse, from planting in the fall, to the distribution of salad greens. The second half is a discussion of integrating the solar greenhouse, as well as myself into the school culture and curriculum. Results from the interviews are woven into both sections of the case study.

In the solar greenhouse…

Construction. While much of the construction work was completed by Dr. Biernbaum and myself, many students participated in many of the steps of the construction of the solar greenhouse. Four came to help build the frame in the summer. Fifty students participated in covering the greenhouse with plastic. Students were involved in order to create a sense that this was their greenhouse. These small steps were very important to the integration of the greenhouse into the school and for developing a sense of ownership with the students. Because the students felt a sense of ownership, for them activities associated with the greenhouse would have more meaning for the children, in other words they would be intrinsically motivated to plan, plant, and care for *their* greenhouse, rather than externally motivated or motivated by an external system of reward. Learning can be intrinsically motivated when it is spontaneous, during play for example (Csikszentmihalyi, 1995). The greenhouse, if students felt ownership of the structure, could easily become a space for spontaneous education.

Fall Planting. Planting took place throughout the month of September. It took more time than I expected, partly because of my own divided schedule. The long planting schedule can also be attributed to the desire to have all the students plant something, even if it was just one transplant. The garden was also planted without the plastic cover, or the endwalls. The weather was warm enough during September for the seeds to germinate. The students helped pull the plastic film over the solar greenhouse, as mentioned above, in early October.

This first time around, parents planted the seeds while each student transplanted. This was a great activity for many reasons: 1) Plants are much larger than seeds and easier for younger students to handle. 2) It is mentally stimulating for the students to see the exposed root systems of the plants and think about the amount of space roots need to grow underground. 3) It is also advantageous for the students because they can see where they, and their fellow students have planted.

In this case, I grew the transplants. It would be much better if the students were involved in growing the transplants. This would have been another opportunity to see the seeds, watch them emerge, care for them and plant finally them in the garden. Growing

transplants is an important part of gardening with children and should be included whenever possible. Unfortunately, because of the short time between the start of school and when plants must be transplanted, there was not enough time to have students start the seeds. If a volunteer was able to start and care for transplants, they could be brought into the classroom when school begins, and students could care for them until transplanting.

Ensuring student involvement was a number one priority, as was involving the entire Grayson community. Students were able to transplant during school, and seed with their parents and teachers in the evening. A seeding party was planned for early September. Parents, students, and teachers were invited to plant the other half of the solar greenhouse on evening (Appendix A, H). The group that arrived planted all of the seeds.

The type of crop that was planted was very important. Crops were chosen based on previous research done at the Student Organic Farm. The researcher chose which crops were planted where. The radish variety chosen was French Breakfast, and the turnip was Hakurai – which grown in cool weather is very tasty to eat raw. These varieties are also recommended for their beautiful colors, and mild flavor.

Fall Harvest. Under ideal conditions, baby leaf salad greens can be ready in 21-28 days. Crops at Grayson, planted in early September, were ready by early November, which is consistent with the expected timing. It took time though to develop my schedule at the school with my other class and SOF responsibilities. We didn't harvest our first greens from the greenhouse until mid-late November, a week or two past the ideal harvest size (about 3 inches tall).

Harvest was very simple for the students, because everything (except the radishes and turnips) was harvested the same way. Students were shown how to cut, and then allowed to harvest from any bed in the solar greenhouse. At harvest, students brought their art scissors, washed of course, and cut the leaves as previously instructed. Cut leaves were placed in plastic bowls which, when filled, were dumped into a pillowcase. This process requires no specialized tools.

Washing the harvest took place in the kitchen area but only a few students were involved because there wasn't enough room for everyone. There was a limited amount of counter space, and only one small double sink. After washing, the salad was put into a giant salad bowl, and turnips and radishes into small baskets. The harvest, paper plates,

forks, and ranch dressing were placed on a cart and rolled into each classroom for a salad snack. The school owned all of the materials, except for the plates, forks, and dressing.

Spring Planting. The fall planted crops didn't survive winter break in edible condition. There were extreme cold temperatures during the third week in December. Outdoor temperatures reached -10F on December 24th and greenhouse temperatures reached 4˚ F and 12˚F a few days later. Under normal conditions at the SOF, greenhouse temperatures near the crop do not go below 15F, even with -20F outside. This unusually low greenhouse temperature and subsequent crop loss was probably due to the lack of a cover in the ends of the solar greenhouse (it was not totally sealed). Some other possible reasons for the low temperatures and crop loss could be the crops grew too large to tolerate the cold temperatures. The soil may have also dried out. An important point is that because we were not at the greenhouse every day, the frost protection cover was not removed so the sun was unable to heat the plants and soil. I found this crop loss initially upsetting, but later I considered it a good experience.

Carrots were an exciting addition to the spring crop plan. There was not enough time in the fall to plant them (planting must occur in the first week of August), but just enough in the spring. If a volunteer was able to come and plant carrots, perhaps with a few students, in early August, carrots would be possible for the fall. The carrots in the spring were planted the week of Feb. 15th, at least a week before the rest of the crops. Rulers were used to guide planting the seed 1" apart.

For spring planting, no transplants were used, only seeds. This was because no transplants were started in time. Seeding was a great experience though. Planting salad greens with seeds is a very simple and unforgettable event. When asked what was most memorable and most useful, many students commented on the planting. The students loved the seeds, they enjoyed holding them, planting them, and looking at all the different types of seeds Mother Nature offers. This was a similar to the findings of Thorp (2001). One student remembered, "planting seeds and planting our signatures with seeds. That was fun." Another remembered "pulling out weeds and planting a lot of stuff 'cause it's just so fun."

For spring planting, students and teachers were allowed to choose how they wanted their garden to look. Many teachers designed garden plans that were specifically tied to what they were doing in the classroom. Others who often integrated the garden allowed their students to decide. Students were asked what they were doing in class, and thought of ways to bring that into their garden design. For example, a first grade classroom was working on the word "at" and words containing "at" such as pat, cat, and

bat. Students chose to plant salad greens in the shape of the word “AT”. Other classes chose to have fun looking plots, with hearts and stars. This was a memorable part of the experience. A student recollected, “I remember planting our little square and we put a “G” in it and we planted radishes on the outside and the “G” was lettuce.”

Watering the garden took place much more during the spring, March-June, than in the dark times of winter, October-December. In the fall, the subsoil still had moisture from rain before the plastic was installed. The soil really begins to dry out about 2 months after covering the greenhouse with plastic so regular watering is important in the early stages of greenhouse growing. During recess students lined up and each had an opportunity to water a section of the solar greenhouse. While students were waiting, or instead of using the hose, they could fill a watering can. The hoses had water breakers on them and were kept on the “mist” level. This ensured that the plants didn’t get blasted away or over watered. It also meant that each student had an opportunity to water. The flow of water could be turned on and off at the watering end of each hose.

Students enjoyed watering more than anything, this was a major theme that emerged in the analysis of the interview data. It also made students feel that their role in the project was important. One student said, “It was fun to help out and stuff because sometime you guys didn’t have a lot of people and so you needed help…we watered the plants and sometimes we planted them and checked on them.” When asked what students found to be most useful, or the best thing about the solar greenhouse, most talked about watering. One student commented, “Well, I think you should water the garden because if you don’t water the garden you won’t have any vegetables. And the earth has to do everything, and you should just help water and stuff.” Regular participation in watering

helped give students confidence and ownership of the solar greenhouse, and the plants growing in it.

Spring Harvest. Harvest occurred more frequently in the spring than in the fall. Plants were growing rapidly in the sunny warm weather and were therefore harvested multiple times a week. One classroom was involved significantly more than others because their teacher took the initiative herself and brought the students in to harvest at least once a week. This was the beginning of a show of ownership for the solar greenhouse.

Small groups, from all classrooms, were brought out to harvest, but three classes also each came to harvest as an entire group. This was an idea was sparked by a teacher's comment about using the solar greenhouse. She said, "…there's no way I can go there with ½ the class, who's gonna watch the rest of my kids?" She had never been inside the solar greenhouse because she was always watching other students. The remaining classes came to harvest came all together. Because harvest is very simple and was done throughout the solar greenhouse the entire class was able to harvest. It inspired another teacher to say she remembered harvest the most because "I was with the whole class when they did it…"

Distribution of Salad Greens. Preparing the salad lunch was not as much of a hassle as I expected it to be. The school lunch cashier, who was supportive of the project offered to call food services to make sure we were allowed to do it. We got the ok, as long as it checked out with the health inspector. He made a surprise visit one day and gave us information on how to safely have an all school salad lunch.

We had to make sure we were careful integrating ourselves into the lunch schedule. Students only have a short amount of time to eat, 15 minutes, so lunchtime is very regulated. The lunch aides helped serve the salad. In return, we helped wash tables and clean up between lunch groups. This helped make the lunch smoother.

During the lunches it was discovered that the ranch dressing was very important. Students love ranch dressing. Although some ate the salad plain, most were very insistent upon having ranch dressing on their salad. Although there were only 15 minutes to eat, some students found time to have 2, even 3 helpings.

Along with integrating the solar greenhouse into the curriculum, feeding the students was an important goal of the solar greenhouse project. Many of the students come to school with hungry bodies. I heard teachers on many occasions comment on the hunger they see in their students. One in particular would take the leftover cereal boxes from the day, so her students could have a snack. “Sam is always hungry,” she commented. We wanted to provide students with fresh vegetables they may not see every day, if at all.

Eating the salad lunches made the students feel great. One student said, “It was really cool…you made those and then like you’re eating them.” Several other students said, “I felt happy…” and “[it] felt good cause you’re eating stuff right out of the school’s garden.”

The second salad lunch was a very significant event. I had done all of the preparations for the harvesting and lunch before. This time a classroom of 15 special needs students wanted to do the salad lunch, so they checked with the lunch aides, harvested and washed the greens, and passed out the salad wearing gloves. This showed that a class and a teacher, had taken significant ownership of the solar greenhouse and felt

comfortable to use it on their own, and showed initiative independent of me. I had hoped for something like this to happen the entire year.

The final school lunch was the most successful. A 4th/5th grade class of 20 students harvested and washed the greens. Together, I learned, with the lunch staff, how to successfully integrate fresh salad greens into their lunch program. Plating the salad in the kitchen, instead of out in the cafeteria kept the students from wandering around for salad, something the lunch aides disapproved of (they said it added to the chaos). There was also more room, so it was now possible to plate more than one salad at once.

The solar greenhouse was so productive during the spring season that salad lunches did not use all the greens. One of the teachers had already sent home extra salad with her students, and inspired me to do the same with the rest of the school. Just over 100 students were sent home with ½ # Ziploc bags of salad.

At the end of the school year there was more salad left in the garden that was not harvested. This could be minimized by planning for more aisle space and less production area. It also shows that there is plenty of room for different ideas about how to use the

space in other ways. Alternatively, teachers and families could be invited to continue to harvest greens into the summer.

Into the elementary school….

The purpose of the study was to demonstrate how the school garden curricular connection could be combined with winter greenhouse production and year-round gardening methods in order to enhance and expand experiential learning in temperate climates. The second half of this case study contains observations and discussion about working within the elementary school. It will show how the greenhouse provided experiential learning while connecting to the existing curriculum. The section will flow from working with teachers, students and staff, into thoughts on integrating the garden into the existing curriculum. Finally, results from the interviews with teachers and students will be presented and discussed.

Integration into Grayson – Building Trust with Teachers. Building trust is important when trying to create ownership in a project. Thorp (2001), advises all that elect to initiate school garden projects to establish trust with the teachers and school administration. I began building trust with the teachers before the school year began through visiting the school and attending staff meetings. I tried to learn early in the school year about how much teachers wanted to be involved and how much gardening experience they had. (Appendix H). Teachers have very busy days so making myself readily available was one way to encourage teachers to participate. If gardening could be easy and not add more work to their overloaded schedules then many would be willing to try it.

A second way to build teacher trust was to follow through with my suggestions/offers. This may sound like a no-brainer, but there are many times when projects don't get finished or ideas and suggestions are thrown out with no intention of follow through. It was important that I come to a teacher with the intention of working together and helping as much as I could. This showed teachers that the project was a serious one, and that I was dedicated to helping everyone participate.

Finally, I was very sensitive not to force my thoughts and ideas onto the teachers. The school, district, and state mandate much of a teacher's day so it was important not to be one more "expert" telling a teacher what to do. It is crucial that the solar greenhouse not become something they have to do a certain way. The solar greenhouse was meant to be a space for creative integration, unique to a teachers and classrooms own style of learning. For example, teachers were given "Garden Lesson" sheets (Appendix E) to write down what lessons they did in the garden. The principal with the intention of encouraging teachers to use the solar greenhouse/garden initiated this. They were to do one "Garden Lesson" per quarter. Teachers found this to be just another added burden. One noted, "…it seemed like it was forced, with no guide lines…"

Building Trust with the Principal. Principal support of a greenhouse project can make or break it. At Grayson, the principal was involved in the project from day one. She was invited to discuss possibilities, and was included in every step, from site selection to harvest dates. She even came out to help during greenhouse construction. In order to gain support, it is important to show how the greenhouse will be integrated into daily school life, as well as the curriculum. It was crucial to show that the greenhouse would not take away from the learning already happening in the school, it would only

enhance it. She is under pressure from the district to make sure her school performs well on standardized tests. This is why it is important, from the very beginning, to show ways the greenhouse can be integrated into the curriculum and work within the benchmarks of the district and state.

Building Trust with Students.

Earning the trust of students extremely important. Without it, they may not want to come out to the solar greenhouse to garden. That was my main concern. It was important they know it was a safe place to have fun and learn. The students, because of the wonderful people who preceded me, almost immediately accepted me. I wasn't a teacher. I wasn't the principal, the lunch aide, or the custodian. I was different, I was "Miss Emily", involved in the garden; Thorp (2001) stresses the importance of this, that if we become too closely aligned with "schooling" the garden will lose its magic. All of this had to be held in balance though. Always taking time to answer questions was my first strategy. Every student is important and so are his or her questions. It was also helpful to be around the students outside of the classroom. Spending time playing at

recess, or sitting in on a fun activity in class were just a few ways of getting to know who the kids were, and for them to know me a little.

Building Trust with Staff. A lot of the space needed to wash and spin salad, and set up the school lunches was in the kitchen area. This was also the office area of the lunch cashier Ms. Hobbs. It was nice to be in this area to get a good idea of how the lunches ran and to make myself known to the lunch aides. Because I needed to use this area so much it was important I respect the space (that was not mine). One of the major ways I integrated myself into this space was to ask permission to use it, and ask how it was to be used. By this I mean asking where I could work, keeping out of the way and how I should go about cleaning up. Simple things, like putting bleach down the drain when I was done made our relationship better. This may sound silly but it kept this project from seeming like a burden to the staff. And even though the garden project is secure regardless of the staff's opinion, it is helpful to have support. For example, when I wanted to do the all school lunch Ms. Hobbs offered to call "downtown" and check on what we needed to do to make it happen. This saved time and connected her to the project even more. She also was always helpful in giving constructive feedback after lunches. She was glad the students were getting healthy foods and wanted to make sure we succeeded.

When I arrived to do this project I was warned that there were people who didn't support the gardening program and would be less supportive. One example was the custodian. She grew up on a farm and "couldn't understand why anyone would want to do it ever." This was completely opposite from my experience of discovering and cherishing farming later in life. I grew up in the suburbs and couldn't understand why

anyone wouldn't want to garden. I didn't have to be her best friend, though I needed to figure out what she needed from us to feel more involved.

The first thing I could think of was respect. Our feet were always wiped off when we came into the building, or as much as we could. If I noticed she had just mopped the gym, we would go in through another door. If she asked me to do something, like move the hose off the grass for the lawnmowers, I would do it right away. I also tired to keep her involved in everything we were doing. When we planted I'd see her in the hall and say, "We're planting today!", or "Come and see our seedlings!".

Our relationship became a jovial one, and we learned to make jokes with each other and help each other out when possible. For example, she was very nice to help clean up an outdoor salad mess that happened while preparing an all school lunch. The students and I were coming to clean it up when we noticed she was doing it for us. She insisted on helping, telling us sincerely it was no problem. Was this the same person I had been warned about?

Working within the complex school culture. When working with teachers it is important to remember that their time is very scheduled. A teachers day is as regulated as a students and a garden support person must be flexible and understanding when working with them. Aside from in the classroom, teachers were available to talk with me either before school, after school, or during lunch. If I offered up a few times and none worked for a teacher, I may have to change my schedule a bit to accommodate them because my time is more flexible than theirs. Lunch is typically a good time to catch teachers to talk, although it is also a great time to have fun in the garden with the students. Going to talk

when the students were in gym, or art, or music was also a good time. Sometimes I would just have to catch them in the halls and talk fast while we walked.

Careful communication with teachers is vital to success. Sometimes I couldn't talk to all the teachers, so on top of face-to-face interaction notes were put into mailboxes. Notes were an effective method only if short and to the point. Just like there isn't a lot of time during the day for teachers to talk, there is not a lot of time to respond to notes. I learned quickly not to take this personally. On top of my one dinky note, teachers receive paper upon paper filled with information they are supposed to absorb and pass onto their students. I eventually began to write notes addressed specifically to each teacher, instead of a general note. I also began writing options for my questions (circle yes or no, which time you're available, etc.). Teachers then weren't expected to write a response, and could read and return the note quickly.

A final way I tried to communicate with teachers was by attending staff meetings. Five minutes during each meeting to update teachers about what was happening at the garden was enough. There were also opportunities to talk individually with teachers before the meeting. Unfortunately my MSU class schedule conflicted with most of the staff meetings.

Teachers not only have limited time to talk and plan, they also have limited time when it comes to teaching. Most teachers thought it would be difficult to work in the solar greenhouse on their own. It was important that there was someone there to aid in the planning and the facilitation. One teacher stated that "Gardening, even in a solar greenhouse is a lot of work, takes a lot of time, which is really hard on a teachers

schedule." Another finds "There's so much you can do with [the solar greenhouse], it just takes time to plan things…"

Curriculum Integration. Every minute of a students day at school is regulated; how much recess they get, when they have library, gym, math, and lunch. Trying to add gardening into the mix can be complicated. Because Grayson had low test scores the year before, it was very important to the principal that the gardening program align with the benchmarks of the Lansing School District, and the state of Michigan (Appendix E). I worked with the teachers to come up with creative ways to integrate the garden. I could offer what the garden needed, and the teacher offered what the classroom needed. We worked together to fuse these needs. Some teachers have less experience in experiential education, and/or in gardening and therefore it was important to work together to best meet students learning needs.

Year-round gardening gives teachers the opportunity to incorporate experiential learning into their curriculum throughout the school year. Both teachers and students recognize this. One teacher notes, "…it's really bringing it all to life for them to really see the cycle from seeds to a harvest and then back to seeds again." A teacher further reinforced this thought with the comment, "it's not part of the everyday educational experience, it's hands-on and that fires kids up". Another teacher noted, "They learn a little bit at a time and all year it sticks with them so much more…"

Students also like having the solar greenhouse. One student commented, “I like the solar greenhouse because we can plant the seeds and then watch them bloom.” Another noticed, “watching it grow, not watching is grow up fast but seeing it grow everyday was cool.” Finally, when asked about the best thing about the greenhouse, one student replied, “It’s kind of easier to learn about that that stuff instead of having to just open a book and just write about it.”

The following sections will show how gardening was integrated into the classroom. It took place on two main levels: in the classroom and in the solar greenhouse.

In the classroom. My work in the classroom was something that took place mainly with a special needs class. Every Friday after winter break was spent in this classroom doing different activities connected to gardening.

There were also activities that took place in other classes. Two first grade classes of 23 students each made pizza from scratch, starting with the wheat berries. The activity was then also conducted in the special needs classroom of 15 students.

Working in the classroom is a great way to get to know the kids better. I got to spend time with each child, learning a little bit more about them. It was also a chance for them to see me more and get to know me. Finally, doing activities in the classroom was a great chance to keep the students involved in gardening even during the dead of winter. Although the solar greenhouse is there to allow students to garden all winter, we had break during January, after the plants were done from fall harvest, and before we planted again in February.

Teachers also found ways to integrate gardening and the solar greenhouse into the classroom throughout the year without my help or participation. They integrated gardening into many different disciplines, including language arts. Teachers made comments about their integration such as, “We did more with it language arts style…” and “We did a poem about the hoophouse…to work on our literacy…” The students wrote and read/sang a song about the solar greenhouse. (Appendix I). They also worked on an art project designing their own solar greenhouses. A fifth grade teacher found

ways to integrate literacy in journalism style. I was invited to this classroom one day and the student "journalists" asked me questions they had about the solar greenhouse. They then each wrote an article about the solar greenhouse, one of which was published in the school paper.

There are additional ways the solar greenhouse could be integrated into the classroom. A teacher notes, "…in terms of econ, science, math, I think getting really creative you could find a lot of ways to tie it into the curriculum."

In the solar greenhouse. Working together, we also found ways to integrate activities in the solar greenhouse into the existing curriculum. One of the first ways was through math activities. While half a classroom was planting seeds for the garden, the other half was doing math outside the solar greenhouse, estimating and measuring the perimeter.

Another way the garden was integrated into the curriculum was through design of the garden plots. The first planting of the garden plots was very haphazard, no plan really of what the plots would look like, only that they would be in straight lines. Coming from a farming background it took me a while to understand gardening with children is less

"linear" than farming. Straight rows are important for tractors but not for scissors. Once I got past this, the excitement of plot design took over. Different teachers/students chose different looks. A second/third grade classroom, learning about American history decided to plant different seeds in the shape of the revolutionary war flag. There was a special needs classroom that created a garden of different shapes for different crops. A fourth/fifth grade classroom studying geometry measured and planted seeds in the shape of equilateral, isosceles, and scalene triangles. This was a way to tie gardening to geometry. This was a great activity for the students, and the teacher loved it. "My geometry unit is always in the winter and I wouldn't have been able to do the triangle and show the kids how fun gardening can be and how different it can be if we didn't have the solar greenhouse."

An interesting way the greenhouse was incorporated into learning was through responsibility. Students from a special needs classroom were in charge of opening and closing the doors on sunny days. They had to make sure they knew what the weather would be for the day, so they would know whether or not to open the doors. They also had to keep track of time. They were told to open the doors at 9:30, and close them at 3:30. According to their teacher, students who had no interest in learning how to tell time were all of a sudden very time savvy. They would make comments such as, "Hey Ms. Smith, 5 minutes," or "It's 9:30, time to go!" This was a learning experience that was unexpected and unplanned.

How the greenhouse is integrated does not have to be either in the classroom or in the greenhouse. For example one teacher brought the class out to harvest salad. One student was in charge of taking notes. The students participated in every step of the

process, from harvest, to washing, to eating. After they were done the students went back into the classroom to write a "How to make a salad" paper (Appendix I).

Interview Themes and Results

From the interviews with 5 teachers the following themes were discovered:

- The heat/warmth in the solar greenhouse during the winter caught the attention of both teachers and students. It surprised and excited them that it was could be so warm in the wintertime.
- Teachers all found ways to incorporate the solar greenhouse into their curriculum, many not associated with science. They mentioned literacy, math, economics and art.
- Communication was an important issue. There needs to be more planning early on, so teachers can be prepared for what the solar greenhouse can offer them.
- Not enough TIME…Teachers can't do it alone. They need help planning activities in the solar greenhouse, as well as help with the students when they are in the solar greenhouse.
- A few teachers mentioned continuity. The solar greenhouse is there all year-round and gives the students the opportunity to be involved with it longer. Also, students are learning the entire year, instead of just a few weeks.

From the interviews with 8 students the following themes were discovered…

- Watering, watering, watering!!! Students mentioned watering in association with caring for the plants, as well as helping out.

- The solar greenhouse was much warmer than they expected it to be. It was so unusual for them to be able to go in there and be warm when it was so cold outside.
- Taking part in designing the classroom plots inspired many students. They remember what shapes they did, and even what they planted.
- Planting was also important. Students really enjoyed planting and almost always referred to it when asked what they enjoyed most.

Themes were discovered while reviewing the interviews as a whole, before analyzing data associated with individual questions. Two questions were selected for further analysis, and responses were compared within those units of analysis. These questions were "What do you remember most from your solar greenhouse experience?" and "What would you like to do again?" When asked the first question, all eight students responded they remembered planting. While only three students specifically mention it being fun, no student refered to planting in a negative way. When asked what they would like to do again, five of the eight students would like to plant again. The other three were all different, one wanting to eat radishes, a second would like to throw the cover [plastic] over again, and a third would like to just help out more.

Conclusions, Recommendations, and Reflections

The following section contains my thoughts and ideas about this experience, and offers my conclusions and recommendations for future projects such as this one. In brief I will make observations and recommendations about the sustainability of the project,

crop varieties, planting (space and time), harvesting greens, tools, pests, and a few odds and ends.

1) Sustainability

One of the most important criteria for projects such as this is the sustainability. When I use the term sustainable I am referring to whether or not there will be someone there to take care of it and use it year after year and if there are resources available to keep the greenhouse supplied with tools, seeds and fertility.

To begin, there has to be commitment and dedication when it comes to a project such as this. It's not like a garden in the sense that if you don't want a garden one season, you just don't till it up. If you build a solar greenhouse and then don't use it, you're left with this large structure on your land, just blowing in the wind. The commitment has to come first from the principal and teachers. The commitment doesn't mean they have to do it all themselves. It means the principal and teachers have to commit to working with someone to grow and harvest the vegetables, and integrate it into their curriculum (in our case). Support of the custodial and lunch staff is also important. Much of the time is spent in their space, if they don't want a project to succeed, it won't.

This type of project also has to be sustainable even when there is a high teacher turnover rate. Many teachers leave year after year and so there is no guarantee they will stick with the program. Grayson is experiencing that this year. The two teachers who were most actively involved in the solar greenhouse and garden are not returning next year. Also Grayson is experiencing a drop in students, from 250 to 100, and is perhaps under the threat of closing.

For these reasons, it is also important to have long term support of an outside group. This group must be dedicated to the project and willing to stick with it year after year. This support can come from a local university, college, high school, Master Gardeners, or a local farm. There are many farmers interested in making a connection with schools and families. The Giving Tree Farm is a local organic farm down the road from Grayson. They were interested in connecting with the parents and greater community to continue to provide healthy food outside of the school setting. Unfortunately, most students were bussed to the school and many parents did not have transportation to the school, or the farm. There are also many different community groups that may be willing to dedicate time to a project such as this. Local church groups and elders may have time and volunteer for the school.

Another option is to create a school gardener position. Many schools may not be able to afford to pay someone to come and help. One way around this may be to offer vegetables in return. This year, we had more vegetables than we knew what to do with. It would have been possible to keep at least two people supplied with greens, even after all the students had their share. This is also a suggestion when trying to obtain volunteers for the summer, or winter break. Offer greens or other vegetables as payment.

The next sustainability concern would be economic resources for gardening. The Grayson project was funded by a NC SARE grant. Funding through grants is one way to receive money. Some other suggestions for grant funding would be the National Community Gardening Association. They have a kids gardening website (www.kidsgardening.com) that offers funding for school gardening projects, enough to buy seeds and tools. It is a very competitive grant, so if you plan to apply for this one,

do so early. The Center for Ecoliteracy is another great resource, as is The Edible Schoolyard. Funds for Grayson also came from local sources such as the Future Farmers of America foundation, and the Capital Area foundation. Grayson also received an America the Beautiful grant.

Grayson also had concerns about resources other than funding. We benefited from the Garden Project in Lansing. Registering to become an official Garden Project garden gave the school access to seeds and transplants, tillage help, and information. If there is something like this in the area, I would highly recommend becoming a part of it.

2) Greens

It is important to grow simple plants and greens. The ones we grew were easy to germinate and grow. This helps because not everyone can be an expert on plants. In the solar greenhouse at Grayson, we planted a variety of different greens. Spinach, mizuna, lettuce, claytonia, mache, Tokyo Bekana, kale, and beet greens were just a few. After the first planting I made a few observations. The first thing I would recommend would be to not plant claytonia and mache. They are great greens for winter farming because both tolerate the cold temperatures but I would not recommend them for school gardening for a few different reasons. First, the claytonia seeds are very small. It is hard for tiny fingers to work with seeds that are so minute. Second, both of these plants grow very slowly. You could plant these two greens first, about a week before the others, but in my experience, this just complicates things. Finally, these greens are difficult to harvest. One of the things that makes working with greens so great is that they grow fast and are easy to harvest. All of the other greens grow in an upward direction and are easy

to grab and cut. Mache tends to grow flatter, and more outward than upward making it more difficult to harvest.

There are some greens varieties I would recommend. Tokyo Bekana Chinese Cabbage is a little different, like a cold hardy lettuce, but I noticed that students enjoyed munching on this green. Red Russian Kale is a kale with a purple stem and slight color that is neat for students to see. Beet greens take longer but are very flavorful and beautiful. Freckles lettuce was also a big hit. As a farmer I sometimes think Freckles can look like a diseased plant, and it tends not to do as well as others in the wintertime. As a school gardener, Freckles is fun because it is green lettuce with red speckles on it. This might be a lettuce to plant in the spring solar greenhouse planting.

3) Other Vegetables

Aside from salad greens, there were many other vegetables planted in the garden. The first planting had lettuce heads, pac choi, beets, turnips, and radishes. As stated earlier, the turnips and radishes were a big hit! They are fun to harvest (just pull them out of the ground) and are full of flavor. When grown in cooler temperatures radishes and turnips are not as hot (spicy). Hakurai turnips are crisp and almost sweet, I find them to be a bit like a juicy apple. French Breakfast radishes are long and bi-colored (red and white) and were the biggest hit of the garden! I would do more radishes in the future. Both of these can be fun to harvest and eat raw, or chop up and put into a salad.

Beets are something I would grow again for greens, but unless I had more time to dedicate to cooking, I would not grow them again for their roots. I would make the same recommendations for pac choi. There are many fun cooking activities that can be done with these vegetables, there just has to be the time and dedication to cook them. I had a hard enough time keeping up with the greens, and only one teacher came to harvest without me. Lettuce heads are good to do, I found that just having lettuce to cut as salad mix, instead of having it get big for heads, was simpler. For the second planting, I decided not to do any pac choi or lettuce heads.

Two final plants I would highly recommend are spinach and carrots. Spinach, the Space variety, was a very big hit. It can be used in the salad mix, eaten fresh right in the greenhouse, or in it's own spinach salad. You can also cook it. Many students were afraid to try it, but soon realized it had a much better flavor than the frozen spinach they were used to. Spinach is also very cold hardy and grows and tastes best in cooler temperatures.

Carrots were also a big hit! They take a little too long in the fall, you must plant them in August to have any before the weather is too cool and days are too short. You can plant them in mid to late February though, and have carrots for the end of the school year. I suggest using the varieties with the shortest days to maturity, such as Mokum or Nelson.

4) Solar greenhouse size and set up

The solar greenhouse we built was a 30'x48' structure (Please refer to the chart in the appendix). Paths were 2 feet wide with a center section roughly 8'x10'. Some observations I made during the school year were that the amount of total growing space

(1048 sq. ft), was almost too much for the school. This was about 2/3 of the total space in the greenhouse (1500 sq. ft). There was actually so much food we couldn't keep up with harvesting and eating all of it. Because the greens re-grow and can be harvested multiple times there was never a dull moment during harvest. The solar greenhouse provided enough food for the entire school to have salad 5 times, and some classes more than that.

There was too much growing space and not enough space to easily move around. Things could get a bit tight with the paths only 2 ft. wide. This is enough space for one child to stand in the path, with barely any room to pass. Also, although students were told not to run in the solar greenhouse, they do. The more aisle space there is, the less chance there is of someone tripping, or running into someone. I would recommend paths of at least 3 ft. wide, perhaps even 4'.

A third thing to think about when building the solar greenhouse, is accessibility. We built 4-8'x8' boxes in the center of the solar greenhouse. The sides of the solar greenhouse also had raised beds that were 9' wide. This is too large for anyone to reach into. In order to get to the center, or outside edge of the raised beds you must walk in the beds. Pathways were marked out in the beds but were not always so easy to see. Plus, little feet sometimes have a hard time staying where they are supposed to stay. It is much easier to tell students to only walk on the woodchips.

We built 4' x 8' beds in the outside garden this spring. This size worked better when planting, they were more accessible for the students. The beds could be even smaller. The length is not an issue, it is the width. If the beds are wide enough so that a child can reach half way in, they are perfect. Beds that are 2' x 8' would even work. The

nice thing about making beds is that if the design does not work out – it can be modified. We may try cutting some of our beds in half next year.

With these thoughts in mind, I think it is fair to say that when building a solar greenhouse, more aisle space, less planting space, and more accessible planting space are good things to think about.

5) Tools

The tools purchased from Johnny's were helpful in some ways. The broadfork, three pronged claw and thirty-inch rake were not useful for the solar greenhouse project. They are too big for the students to use effectively. The broadfork is fun for students to use, with adult supervision, but if budget is of concern, don't bother with it. Digging forks can be just as effective. Of the three, I would recommend the three-pronged claw. This is manageable for the older students and is easier to use in the raised beds. Once again though, it is not necessary.

I would recommend a salad spinner for washing the salad. We bought an industrial size spinner that cost around $200 dollars. This large expense is not necessary. Smaller, less expensive salad spinners can be found, or can be substituted for mesh bags that can be spun around. The salad spinner was interesting for the students to see. They enjoyed spinning, and feeling the force applied vs. the speed of the spinner inside.

Planting took place by hand, just using fingers to make lines and holes. We also used a wooden grid, which slid back and forth on the soil to make lines. Students enjoyed sliding the grid on the soil, but also enjoyed making shapes with their fingers.

This was used more than any other tool. This is not a necessary tool, but it was fun to use, and can be built by a teacher or parent.

6) Planting

Planting overall went well, once I got over my obsession with straight lines. Students enjoyed putting both seeds and plants into the ground. Planting salad greens is also fun. Although the seeds are much smaller than say, a bean seed, each student can plant a handful in a small area. One suggestion I do have for planting is to try to work with smaller numbers of students at a time. This provides more supervision for the students, and can help give an idea of how many seeds were dropped and where.

When planting seeds I would recommend two things. The first is to make sure you hold on to the seed package. If you leave it lying around, next thing you know students will have there hands in it and a lot of seed can be wasted. I gave each student about 10 seeds at a time, this kept them from dropping too many in one space at a time. Seed packages were also not brought out to the solar greenhouse. Seeds were measured out before hand and brought out in cups with lids. Second, use a darker soil, or compost to cover the seeds once they have been planted. This will show clearly where seeds have been planted. This is especially important if you are working with groups of students as opposed to all of them at once. I also think it is important to give each student an opportunity to plant something, even if it is just a few seeds.

In the spring we planted everything at the same time, all within a week. This then meant that everything was ready to harvest at the same time. When 1048 sq.ft of greens are all ready at the same time, things can get a little overwhelming. I would suggest

trying to plant in succession, perhaps a week apart. This will spread the harvest time in the spring and you will not have to worry about things becoming overgrown.

7) Harvesting

Harvesting is fun and very easy for the students. As stated earlier, greens are very simple to harvest and can be harvested with kid scissors. When the garden was planted, each class had their own plot they worked in and checked on. Everyone shared in the watering of the entire solar greenhouse, and students checked on the whole thing. For harvest, students were able to harvest anywhere in the solar greenhouse. This was for a couple of reasons. First, because we planted all at once, all the greens were ready around the same time. Nothing was too small to harvest. The second reason was because of space. Students could spread out to harvest and weren't on top of each other trying to harvest. This also gave students the chance to harvest different greens, or only harvest their favorite one. Because we used this style of harvesting, it is hard to say how much space is right for a single class. It also depends on how much time and dedication there is to cooking and preparing the fresh veggies. For the first all school lunch greens from one 8' x 16' space were cut. This was plenty, if not too much.

Washing the greens was a wonderful experience. In the winter you have to do it inside, but as soon as the weather gets warm enough, I suggest doing it outside where there is more space, and can be very enjoyable. We also spent time picking through the greens before washing them. Sometimes large weeds and roots got mixed in with the salad so it is best to pick through it first. This takes a little longer, but is worth it. It is also a way to turn a two-person job into a 5-8-person job.

8) Pest Management

During colder temperatures, mice lived in the solar greenhouse. There was enough food to go around, so that wasn't the problem. They would eat our spinach seeds, their favorite. This was a problem for us. In some spaces, we didn't get any spinach. Mousetraps are not really an option because of the students around. I did use them a couple of times on the weekends, or vacations. Live mouse traps can be used to trap and relocate them, but they must be checked every day though. The mice were no longer a problem after the weather got warmer, they moved into the lush fields next door. This is something I do not have a solution to, but it is important to be aware of the issue before beginning.

9) Interview Thoughts

During data collections I noticed that the students were having trouble remembering activities from the fall, and years past. In the future it would be helpful to interview students twice, once in the fall and once in the spring. Also, it is hard to probe young students. There vocabulary is not as expansive as an adults and it is therefore hard to get much more than "cool" or "fun". This also could mean that the questions were too vague and needed to be more concrete.

10) Things to make life easier….

One thing I never would have thought to put into the solar greenhouse was a coat rack. Because it is warmer in the solar greenhouse students want to take their coats off. I would throw mine on the woodchips and have the students put theirs on top of mine, but a coat rack would have been much nicer. Having lots of small bowls to harvest into is a good idea too. A couple of students can share one, and everyone can split up. When it is full, they can put it into a larger bin.

11) Final thoughts and Conclusions

After spending a year working with a local elementary school I have come to a few conclusions. The first is that working outdoors with children is one of the most exciting adventures of my life. They are full of energy and interest, and they love to watch things grow! It can also be very hard though. One hopes, when they begin a project such as this, that help and interest would come out of the woodwork. That is not the reality of the situation, or, it was not my reality. Teachers are busy and on strict teaching time lines. Parents are busy and some can't afford the time to come out to volunteer. Finding outside help is extremely important when beginning garden projects. I also hope that in the future the public school system will recognize the importance of school gardens and healthy food in the cafeteria. Finally, I'd just like to say that connecting the garden, and eating healthy to the curriculum is an effective way to teach our youth. Thank you Grayson for this amazing experience!

List of Works Cited

Berryhill, K. (2005). "Stimulating Science Wonderment and Developing Scientific Knowledge Through Mulit-Day Field Trips and Post-Field Trip Follow Up." MS Thesis, Michigan State University, East Lansing, Michigan.

Coleman, E. 1995. The New Organic Grower: A Masters Manual of Tools and Techniques for the Home and Market Gardener. Chelsea Green Publishing Company, White River Junction, VT.

Csikszentmihalyi, M. (1995). "Intrinsic Motivation in Museums: Why Does One Want to Learn?" Public Institutions for Personal Learning. Dierking, L, and Falk, J. eds. American Association of Museums. Washington.

Driscoll, E. (2004). "Fostering Wonder and Curiosity: Immersion Field Trips in the Michigan 4-H Children's Garden." MS Thesis, Michigan State University, East Lansing, Michigan.

Ferrarese, M (2005). “It takes a village to raise a salad...” MS Thesis, Michigan State University, East Lansing, Michigan.

Lincoln, Y, Guba, E. (1985). Naturalistic Inquiry. Sage Publications. Beverly Hills, CA.

Moore, S. and C. Moore. 1999. “Inside a passive solar greenhouse, crops thrive both winter and summer.” Growing for Market. 8(12):10-12.

Patton, (1995). Qualitative Evaluation and Research Methods. Sage Publications. Newbury Park, CA.

Stout, R. (1971). No Work Garden Book. Rodale Press. Emmaus, PA.

Thorp, L. (2001). “The Pull of the Earth: An Ethnographic Study of an Elementary School Garden.” Unpublished doctoral dissertation, Texas A&M University, College Station, Texas.

www.edibleschoolyard.org, July 2005

www.4hgarden.msu.edu, July 2005

www.cde.ca.gov/ls/nu/he, July 2005

www.msuorganicfarm.com, July 2005

www.ams.usda.gov/nop/indexIE.htm, June 2005

www.bradfieldind.com/, June 2005

www.johnnyseeds.com, July 2005

www.farmtek.com, July 2005

Photographs of Greenhouse and Tools

#1 Tools for Solar Greenhouse

#2 Greens covered with plastic

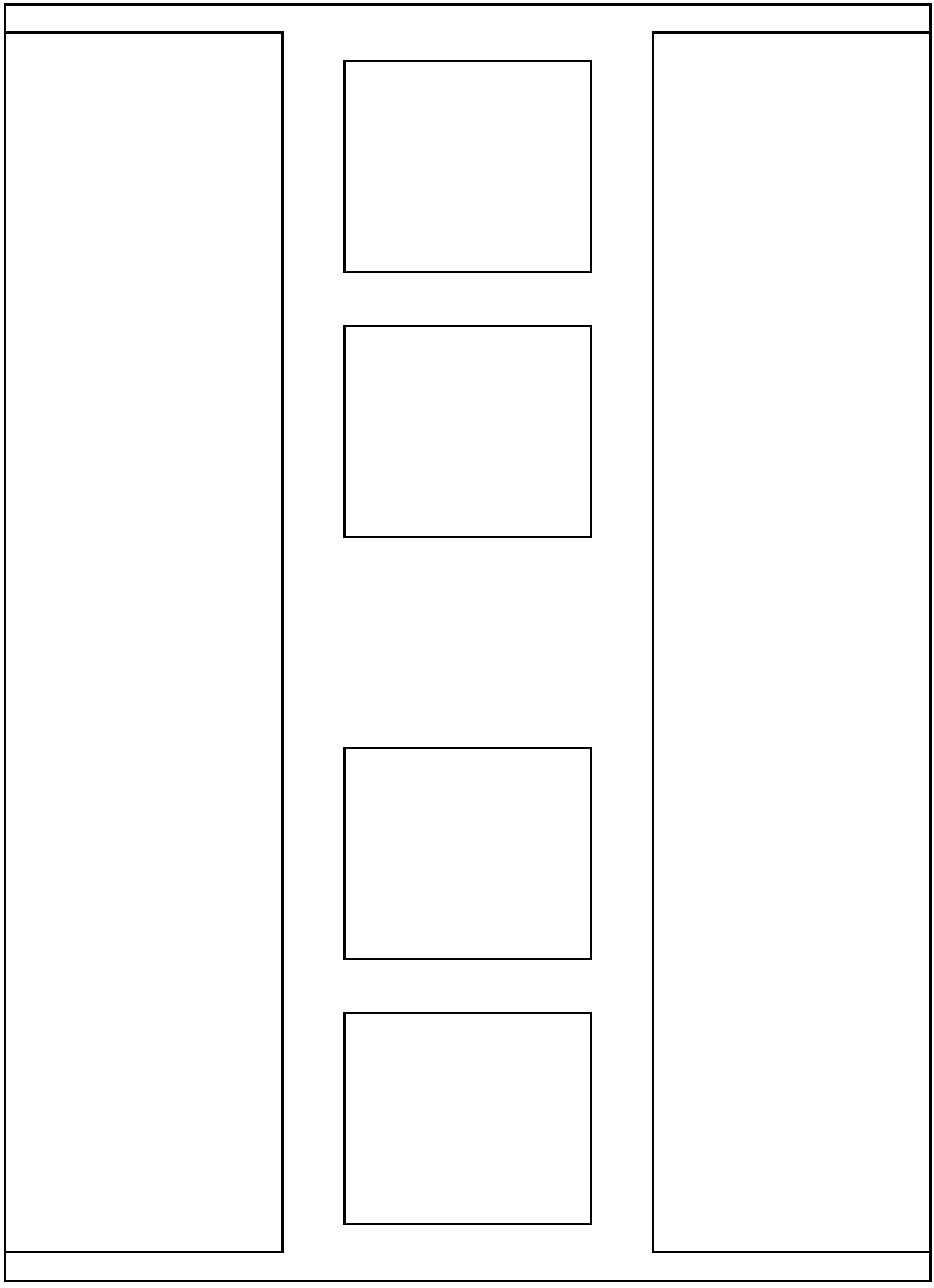
#3 Planting Party with students and parents

#4 Finished Endwalls with open vent

#5 Finished Solar Greenhouse

#6 Greens growing in raised beds

Solar Greenhouse Layout



Solar Greenhouse Purchases and Prices

School Greenhouse Garden Price List

Tools

Quantity	Description	Total Price
1	3-toothed cultivator	$34.50
3	Hand Hoe	$33.00
2	Needle Nose Shears	$47.00
1	Rain Gauge	$4.50
1	Soil Thermometer	$24.50
2	Wooden Garden Labels	$56.90
1	3 1/4" Stirrup Hoe	$33.50
1	5" Stirrup Hoe	$36.50
1	Row Markers	$4.20
1	Bed Preparation Rake	$60.85
1	Broadfork	$140.20
1	Salad Spinner	$197.75
	Total Cost	**$673.40**

Seeds

Quanity	Description	Total Price
1 Mini	Kolhrabi, Purple	$2.75
1 Mini	Crispino Head Lettuce	$2.50
1 Mini	Mei Qing Choi	$2.60
1 Mini	Tatsoi	$2.00
1 Mini	Rikor Leek	$2.40
1 Pkt	Laura Leek	$2.50
1 Pkt	Winter Density Lettuce	$4.00
1 Pkt	Marvel of Four Seasons	$1.60
1 Pkt	Davigon Radish	$3.30
1 Pkt	Mokum Carrot	$3.70
1 Pkt	Giant of Italy Parsley	$2.10
1 Pkt	Parmex Carrot	$4.00
1 1/8 oz.	Claytoina Greens	$7.00
2 1.4 oz	Mibuna Green Spray	$10.10
1 1/4 oz	Hakurei Turnip	$5.90
2 1/2 oz	Integrata Red Lettuce	$10.50
1 oz	Vit Greens, Mache	$4.25
1 oz	Freckles Lettuce	$8.35
1 oz	Aruba Lettuce	$13.10
1 oz	Chiggoa Beet	$3.90
1 1/4 lb	Tokyo Bekana Greens	$24.10
2 500 seeds	Redbor Kale	$15.10
1 25M Seeds	Red Ace Beet	$21.00
1 1/4 lb	Mizuna Asian Greens	$8.20
1 lb	Red Russian Kale	$26.80
	Total Cost	**$191.75**

Temperature Measuring

Description	Total Price
Watchdog	$95.00
Radiation Shield	$44.00
Total Cost	**$139.00**

Fertility

Description	Total Price	Notes
Peat Moss	$21.00	less than cost
Bradfield Alfala	$70.00	
Compost		donated
Total Cost	**$91.00**	

Greenhouse Structure

Description	Total Price	
Farm Tek Greenhouse	$3,100.00	10% discount
Greenhouse Endwalls	$441.91	
Base Boards (2x8)	$69.76	
Concrete	$10.68	
6 ft. U-Post	$15.88	
Total Cost	**$3,638.23**	(no shipping)

Watering

Description	Total Price
3, 50' Hoses	$75.74
Soft Hose	$20.00
Sprinkler	$24.77
Buckets	$11.96
Watering Can	$20.00
Wand	$5.96
Total Cost	**$158.43**

Growing Beds

Description	Total Price
Wood (2X8)	$191.08
3/4" Conduit	$89.55
1/2" Conduit	$104.30
1"X100' SF Pipe	$19.98
Polyethylene Plastic	$10.97
Screws	$19.93
Row Covers	$125.80
Total Cost	**$561.61**

Summary

Tools	$673.40
Seeds	$191.75
Temperature	$139.00
Fertility	$91.00
Greenhouse Structure	$3,638.23
Watering	$158.43
Growing Beds	$561.61
Total Cost	**$5,453.42**

Workshop Agenda

Connecting the Greenhouse to the Curriculum

Connecting the Greenhouse to the Curriculum

Grade	Subject Math	Science	Language Arts	Social Studies
Second		Standard: III.2.e.1-4 (fourth quarter) Animals. See Fourth grade science. V.3.e.1. Temperature cloud cover. Example: Can record temperature in hoophouse on sunny and cloudy days.	Standard: Third quarter. Performance Tasks. Write a How-To-Paper. Example: Write a paper about how to make a salad (from harvest to plate) Standard: Fourth quarter Narrative Text. Example: Write a hoophouse poem and sing it.	
Third	Standard: First quarter Measurment. Measure the hoophouse and the garden plots. Example: Estimate the length of the hoophouse, perimeter of hoophouse, etc.	Standard: III.5.e.2 Science Journals. Example: Growing plants in the hoophouse and have plant conferences. How is my plant doing? What might it still need? What have I given it and why might that effect how it looks?		Standard: Fourth quarter. Know the signifance of the US Flag. Example: Learn about the Revolutionary War flag and plant seeds in shape of flag, using different seeds for different colors.
Fourth	Standard: Fourth quarter Geometry. Identify and construct angles (right, obtuse, acute). Example: Measure and plant seeds in angles. Return when they have sprouted to identify them.	Standard: III.5.e.1 (fourth quarter) Food chains and food webs Example: Unexpected in the hoophouse was a baby bunnies nest. Why would they be there? What do they eat, what eats them?		
Fifth		Standard: V.3.m.1-3 (third quarter) Weather. Example: Condensation forms in the hoophouse, temperature can be recorded, humidity measured.	Standard: First quarter, written Narrative Text/ Informational Text. Example: Interview with garden person. Ask about the hoophouse, get the facts. Write an infomational paper about the hoophouse for the school	

Student/Teacher Interview Protocol

1. Was gardening in the hoophouse different from gardening in your outdoor garden? How and why?

2. What kinds of activities in the hoophouse do you remember the most? Do you remember harvesting the salad greens and eating them? How did you feel when you ate them?

3. Can you tell me about some of the things you/your students learned from the hoophouse experience? If nothing, why do you think this is so?

4. Was there anything you would change about your hoophouse experience? What would you like to do again?

5. What was the most useful/beneficial thing about the hoophouse?

6. Do you have a garden at home, or would you like to have one someday? Why?

7. Is there anything else you would like to tell me about your hoophouse experience?

Feeding, Educating, and Exciting Youth in Year-Round Hoophouse Gardens

Parent Consent Form

Dear Parent(s) or Guardian(s),

My name is Emily Reardon and I am a graduate student at Michigan State University in the horticulture department. I work at the Student Organic Farm and have an interest in teaching youth about where their food comes from and the importance of eating healthy. This is why I am helping to cultivate a relationship between Grayson Elementary School and MSU's Student Organic Farm

The school garden at Grayson has had a meaningful impact on the children who use it. Unfortunately, during the main growing season (May-Aug.) school is out. The kids have the opportunity to plant the garden, but not to tend to it. A hoophouse is an unheated greenhouse structure that will allow your children have a hands-on learning experience, while providing them with fresh salad greens and other cold hardy crops. Your child's teacher is encouraged to incorporate the hoophouse into their classroom curriculum. Students will harvest the food they have grown and provide the cafeteria with 3 salad lunches.

Hoophouse gardening is the focus of my master's degree thesis research. I am interested in looking at how the hoophouse affects teacher attitudes towards experiential learning, student attitudes towards school, and parent attitudes towards their child's activities at school. No research has been carried out that shows how to incorporate gardening into schools where the growing season is not during the school year. It is our hope that the hoophouse will reinforce the lessons learned in the garden, and provide students the opportunity to eat fresh greens in the wintertime.

To examine these topics I will use questionnaires, observation and interviews. Throughout the year I will make observations and conduct interviews to further understand if and why students like the hoophouse, if it has brought parents closer into the school community, and whether or not teachers find it to be a useful learning tool. The interviews with students will be tape recorded to ensure the accuracy of the data collected. The interviews will last no longer than 45 minutes. The information gathered through the course of this study will be used for the purposes of this project only and the confidentiality of all participants will be maintained. No names will be used. I will ensure your privacy and the privacy of your child will be protected to the maximum extent allowable by law. Please talk to your child and inform them of the study.
If you are willing to allow your child to participate in the research as described above, please read and sign below.

You are being asked to have your child participate in the hoophouse study at Grayson elementary school. Details of the study are discussed above. You have also met with Dr. John Biernbaum or Emily Reardon to discuss the study and your child's involvement. Your child's participation is entirely voluntary and you are free to discontinue their involvement in this project at any time without explanation. If you choose not to be involved with the research project, your child may still be involved in the activities in the hoophouse. Your child's privacy will be protected to the maximum extent allowable by law. Your signature below indicates your voluntary agreement to have your child participate in this study.

_____ _____

(Parent signature) (Date)

☐ By marking this box, your are indicating that you voluntarily agree to allow your child to be tape-recorded.

Or if you choose not to have your child participate in this study at this time, please sign below.

_____ _____

(Parent signature) (Date)

If you have any questions about this study please contact Dr. John Biernbaum or Emily Reardon.

If you have further questions about your rights as a study participant, or are dissatisfied at any time with any aspect of this study, contact Peter Vasilenko, Ph. D., Chair of the University Committee on Research Involving Human Subjects (UCRIHS).

Thank you,
Emily Reardon
Graduate Research Assistant, Dept. of Horticulture, MSU. A224 Plant & Soil Sciences, East Lansing, MI 48824. (517) 355-5191 x 340, reardone@msu.edu

Dr. John Biernbaum
Professor, Dept. of Horticulture, MSU. A234 Plant & Soil Sciences, East Lansing, MI 48824. (517) 355-5191 x 344, biernbau@msu.edu

Dr. Peter Vasilenko
Chair of the University Committee on Research Involving Human Subjects, MSU, 202 Olds Hall, East Lansing MI, 48824. (517) 355-2810, ucrihs@msu.edu

You are also being asked to participate in the hoophouse study at Grayson elementary school. Details of the study are discussed above. You have also met with Dr. John Biernbaum or Emily Reardon to discuss the study and your involvement. Your participation is entirely voluntary and you are free to discontinue your involvement in this project at any time without explanation. Your privacy will be protected to the maximum extent allowable by law. Your signature below indicates your voluntary agreement to participate in this study.

_____ _____

(Parent signature) (Date)

☐ By marking this box, your are indicating that you voluntarily agree to be tape recorded.

Or if you choose not to participate in this study at this time, please sign below.

_____ _____

(Parent signature) (Date)

If you have any questions about this study please contact Dr. John Biernbaum or Emily Reardon.

If you have further questions about your rights as a study participant, or are dissatisfied at any time with any aspect of this study, contact Peter Vasilenko, Ph. D., Chair of the University Committee on Research Involving Human Subjects (UCRIHS).

Thank you,
Emily Reardon
Graduate Research Assistant, Dept. of Horticulture, MSU. A224 Plant & Soil Sciences, East Lansing, MI 48824. (517) 355-5191 x 340, reardone@msu.edu

Dr. John Biernbaum
Professor, Dept. of Horticulture, MSU. A234 Plant & Soil Sciences, East Lansing, MI 48824. (517) 355-5191 x 344, biernbau@msu.edu

Dr. Peter Vasilenko
Chair of the University Committee on Research Involving Human Subjects, MSU, 202 Olds Hall, East Lansing MI, 48824. (517) 355-2810, ucrihs@msu.edu

Feeding, Educating, and Exciting Youth in Year-Round Hoophouse Gardens

Student Assent Form

Feeding, Educating, and Exciting Youth in Year-Round Hoophouse Gardens

Your teacher and parent(s) have talked to you about the Hoophouse Project at your school. As a part of the project you will work with Michigan State University Student Organic Farmers and will help them figure out what makes the hoophouse interesting and exciting. You will also help them determine if it is fun to learn in the hoophouse. You will be asked to answer questions about your experiences in the hoophouse. Sometimes you will be tape recorded so we can remember exactly what you said. Your privacy will be protected to the maximum extent allowable by law. When we report the results of the project we will not use your name. If at any point you do not want to be part of this study please tell a researcher, parent, or teacher and we will stop observing and interviewing you.

Your signature below indicates that you voluntarily agree to participate in this study.

_____ _____

(Student Signature) (Date)

☐ By marking this box, your are indicating that you voluntarily agree to be tape recorded.

Or if you choose not to participate in this study at this time, please sign below.

_____ _____

(Student Signature) (Date)

Feeding, Educating, and Exciting Youth in Year-Round Hoophouse Gardens

Teacher Consent Form

Dear Teachers,

My name is Emily Reardon and I am a graduate student at Michigan State University in the horticulture department. I work at the Student Organic Farm and have an interest in teaching youth about where their food comes from and the importance of eating healthy. This is why I am helping to cultivate a relationship between Grayson Elementary School and MSU's Student Organic Farm. We are attempting to establish a connection with the local community and inform youth of the importance of healthy food.

The school garden at Grayson has had a meaningful impact on the children who use it. Unfortunately, during the main growing season (May-Aug.) school is out. The kids have the opportunity to plant the garden, but not to tend to it. A hoophouse is and unheated greenhouse that will allow the children have a hands-on learning experience, while providing them with fresh salad greens throughout the school year. Teachers are encouraged to incorporate the hoophouse into their classroom curriculum. Students will harvest the food they have grown and provide the cafeteria with 3 salad lunches.

Hoophouse gardening is the focus of my master's degree thesis research. I am interested in looking at how the hoophouse affects teacher attitudes towards experiential learning, student attitudes towards school, and parent attitudes towards their child's activities at school. No research has been carried out that shows how to incorporate gardening into schools where the growing season is not during the school year. It is our hope that the hoophouse will reinforce the lessons learned in the garden, and provide students the opportunity to eat fresh greens in the wintertime.

To examine these topics I will use questionnaires, observation and interviews. I plan to give two questionnaires, one before teachers use the hoophouse, and one after using it for the year. The questionnaire will evaluate how teachers respond to incorporating the hoophouse into their classroom curriculum and will take approximately fifteen minutes to complete. Throughout the year I will make observations and conduct interviews to further understand if and why students like the hoophouse, if it has brought parents closer into the school community, and whether or not teachers find it to be a useful learning tool. The interviews with students will be tape recorded to ensure the accuracy of the data collected. The information gathered through the course of this study will be used for the purposes of this project only and the confidentiality of all participants will be maintained. No names will be used. I will ensure your privacy and the privacy of your students will be protected to the maximum extent allowable by law. Please talk to your students to inform them of the study.

If you are willing to participate in the research as stated above, please read and sign below.

You are being asked to participate in the hoophouse study at Grayson elementary school. Details of the study are discussed above. You have also met with Dr. John Biernbaum or Emily Reardon to discuss the study and your involvement. Your participation is entirely voluntary and you are free to discontinue your involvement in this project at any time without explanation. . If you choose not to be involved with the research project, you may still use the hoophouse for classroom activities. Your privacy will be protected to the maximum extent allowable by law. Your signature below indicates your voluntary agreement to participate in this study.

_____ _____

(Teacher signature) (Date)

☐ By marking this box, your are indicating that you voluntarily agree to be tape recorded.

Or if you choose not to participate in this study at this time, please sign below.

_____ _____

(Teacher signature) (Date)

If you have any questions about this study please contact Dr. John Biernbaum or Emily Reardon.

If you have further questions about your rights as a study participant, or are dissatisfied at any time with any aspect of this study, contact Peter Vasilenko, Ph. D., Chair of the University Committee on Research Involving Human Subjects (UCRIHS).

Thank you

Emily Reardon
Graduate Research Assistant, Dept. of Horticulture, MSU. A224 Plant & Soil Sciences, East Lansing, MI 48824. (517) 355-5191 x 340, reardone@msu.edu

Dr. John Biernbaum
Professor, Dept. of Horticulture, MSU. A234 Plant & Soil Sciences, East Lansing, MI 48824. (517) 355-5191 x 344, biernbau@msu.edu

Dr. Peter Vasilenko
Chair of the University Committee on Research Involving Human Subjects, MSU, 202 Olds Hall, East Lansing MI, 48824. (517) 355-2810, ucrihs@msu.edu

Feeding, Educating, and Exciting Youth in Year-Round Hoophouse Gardens

Principal Consent Form

Dear Principal,

My name is Emily Reardon and I am a graduate student at Michigan State University in the horticulture department. I work at the Student Organic Farm and have an interest in teaching youth about where their food comes from and the importance of eating healthy. This is why I am helping to cultivate a relationship between Grayson Elementary School and MSU's Student Organic Farm. We are attempting to establish a connection with the local community and inform youth of the importance of healthy food.

The school garden at Grayson has had a meaningful impact on the children who use it. Unfortunately, during the main growing season (May-Aug.) school is out. The kids have the opportunity to plant the garden, but not to tend to it. A hoophouse is an unheated greenhouse that will allow the children have a hands-on learning experience, while providing them with fresh salad greens. Teachers are encouraged to incorporate the hoophouse into their classroom curriculum. Students will harvest the food they have grown and provide the cafeteria with 3 salad lunches.

Hoophouse gardening is the focus of my master's degree thesis research. I am interested in looking at how the hoophouse affects teacher attitudes towards experiential learning, student attitudes towards school, and parent attitudes towards their child's activities at school. No research has been carried out that shows how to incorporate gardening into schools where the growing season is not during the school year. It is our hope that the hoophouse will reinforce the lessons learned in the garden, and provide students the opportunity to eat fresh greens in the wintertime.

To examine these topics I will use questionnaires, observation and interviews. I plan to give two questionnaires, one before teachers use the hoophouse, and one after using it for the year. The questionnaire will evaluate how teachers respond to incorporating the hoophouse into their classroom curriculum and will take approximately fifteen minutes to complete. Throughout the year I will make observations and conduct interviews to further understand if and why students like the hoophouse, if it has brought parents closer into the school community, and whether or not teachers find it to be a useful learning tool. The interviews with students will be tape recorded to ensure the accuracy of the data collected. The information gathered through the course of this study will be used for the purposes of this project only and the confidentiality of all participants will be maintained. No names will be used. I will ensure your privacy and the privacy of your teachers and students will be protected to the maximum extent allowable by law.
If you are willing to participate in the research as stated above, please continue to read and sign below.

Many of your teacher and students are being asked to participate in the hoophouse study at Grayson elementary school. Details of the study are outlined above. You have also met with Dr. John Biernbaum or Emily Reardon to discuss the study and your involvement. Their participation is entirely voluntary and you are free to discontinue your involvement in this project at any time without explanation. . If your teachers choose not to be involved with the research project, they may still use the hoophouse for classroom activities. The privacy of your teachers and students will be protected to the maximum extent allowable by law. Your signature below indicates your support of your teacher's and voluntary agreement to participate in this study.

_____ _____

(Principal signature) (Date)

☐ By marking this box, your are indicating that you voluntarily agree to be tape recorded.

Or if you choose not to participate in this study at this time, please sign below.

_____ _____

(Principal signature) (Date)

If you have any questions about this study please contact Dr. John Biernbaum or Emily Reardon.

If you have further questions about your rights as a study participant, or are dissatisfied at any time with any aspect of this study, contact Peter Vasilenko, Ph. D., Chair of the University Committee on Research Involving Human Subjects (UCRIHS).

Thank you

Emily Reardon
Graduate Research Assistant, Dept. of Horticulture, MSU. A224 Plant & Soil Sciences, East Lansing, MI 48824. (517) 355-5191 x 340, reardone@msu.edu

Dr. John Biernbaum
Professor, Dept. of Horticulture, MSU. A234 Plant & Soil Sciences, East Lansing, MI 48824. (517) 355-5191 x 344, biernbau@msu.edu

Dr. Peter Vasilenko
Chair of the University Committee on Research Involving Human Subjects, MSU, 202 Olds Hall, East Lansing MI, 48824. (517) 355-2810, ucrihs@msu.edu

Examples of Researchers Communications

Teacher involvement in the garden/hoophouse project

How involved would you like to be in this project?

Completely involved in all decisions

Involved in only major decisions

Will help, but want to be told what needs to happen

Want to use the garden in many of my lessons

Just to do my 4 lessons

Are you interested in working with other teachers outside of school on this project?

Yes
No

Are you interested in working with parents on this project?

Yes
No

Please feel free to add any additional comments you may have.

Thanks!

Examples of Researchers Communications

Hello Teachers!

If you have not yet returned the consent form (or have misplaced it ☺) I am putting a second copy in your mailbox. Please read it over and sign and place it in my mailbox by FRIDAY. This is critical to my research and would greatly appreciate a response! Thank you so much! I understand you are busy and greatly value your participation!

Emily

Hello Teachers and Staff!

The hoophouse construction is coming along☺. There are just a few more tasks to take care of before it is complete. The first is construction of the end walls. We began this last weekend but it would go much faster with more hands. If you are available any time this weekend please let me know and I will try to get a group together. It will be fun!!:)

Thanks and have a great day!
Emily

Hello Families!

As many of you know, we here at Grayson pride ourselves on our wonderful garden program. We have been working hard all year to grow salad in our hoophouse, and will soon plant our outdoor garden. One of the problems we are having with the hoophouse is that there is TOO MUCH SALAD!!! Goodness☺ We thought students would enjoy showing you what they have been working hard on all year. This salad has been harvested and washed by the students here at Grayson and we would like to offer it to you! Please make sure to wash the salad again before eating!:)

Thanks so much!

Examples of Researchers Communications

Examples of Researchers Communications

Examples of Researchers Communications

Examples of Researchers Communications

WHAT ABOUT THE WORMS???

Hey there teachers!!! I wanted to remind you about a light green piece of paper that was put in your mailbox recently. John Peterson, the worm man, is looking for teachers interested in having worm bins in their classrooms. He will come to your classroom and build one with your kids. He teaches them all about worms, and how to care for the bin.

ICK! WHY WOULD I WANT ONE OF THOSE????

Worm bins are great to have around. You can teach kids about worms☺, decomposition, and the importance of composting and recycling. I'm sure there's even more! Grayson even has it's own library of worm books (ok, so there's only 7 or 8, but that's more than most schools!)

WHAT ABOUT THE BUGS???

Valid point. John shows the kids what not to put into the bin, how not to over feed them, and how to care for the bins so as not to attract bugs. If you have concerns, talk to a teacher who currently has a worm bin.

SIGN ME UP!!!!

If you are interested let me, Emily, know and I will contact John. Thanks and have a great day!

Examples of Students Works

Examples of Student Works

Examples of Students Works

Examples of Students Works