This is to certify that the

thesis entitled

A Model System Linking Formal & Informal Education: Field Trips, Curriculum Standards & the 4-H Children's Garden at Michigan State University

presented by

Stacy Lynn Messenger

has been accepted towards fulfillment
of the requirements for

Master's degree in Horticulture

Norman Lownds
Major professor

Date July 24, 2000

A MODEL SYSTEM LINKING FORMAL AND INFORMAL EDUCATION: FIELD TRIPS, CURRICULUM STANDARDS AND THE 4-H CHILDREN'S GARDEN AT MICHIGAN STATE UNIVERSITY

By

Stacy Lynn Messenger

A THESIS

Submitted to
Michigan State University
In partial fulfillment of the requirements
for the degree of

MASTER OF SCIENCE

Department of Horticulture

2000

ABSTRACT

A MODEL SYSTEM LINKING FORMAL AND INFORMAL EDUCATION: FIELD TRIPS, CURRICULUM STANDARDS AND THE 4-H CHILDREN'S GARDEN AT MICHIGAN STATE UNIVERSITY

By

Stacy L. Messenger

Children begin life's journey as scientists – curious about everything around them, asking questions and "experimenting" to learn about themselves and their world. Informal education plays a vital role in the development of a child's mind and some may argue it could be more influential on their attitudes than formal education. For young children's optimal growth, they should be assured of early childhood experiences that maximize their development.

A model system demonstrating the importance of informal and formal education is developed here as a guide for educators that are presented with learning opportunities outside the classroom. This model demonstrated effective tools and techniques for bridging the gap between children that learn by reading and children that learn by doing.

Unfortunately, the longer children are in school, the less they want to learn about science. This scenario can be changed by starting when children are still curious and alive with the love of science. Science and technology museums, zoos, planetariums, marine exhibits, botanical gardens and similar places can play an important role in stimulating interest in scientific processes and phenomenon. This study serves as a baseline for further research.

❀ To the people who understood why I did this

&

what it took to accomplish ❀

ACKNOWLEDGEMENTS

I would like to acknowledge my advisor, Dr. Norm Lownds. I would also like to thank the other members of my committee, Dr. Robert Herner and Dr. Patrick Dickson.

Thank you to Lisa Johnson-Murphy, a doctoral student in the Department of Communications. Her assistance in the preparation of my surveys was very much appreciated.

Dr. Bridget Behe, a professor in the Department of Horticulture and her graduate student, Jill Hardy were so patient and helpful. They taught me how to use SPSS to analyze the data from the student's surveys. Their help is tremendously appreciated.

Lastly, I would like to thank the principal, teachers, parents and students of the elementary school that we worked at. Without your participation and assistance, none of this research could have been done.

TABLE OF CONTENTS

LIST OF TABLES

CHAPTER 1

INTRODUCTION AND PROBLEM STATEMENT

INTRODUCTION

Children begin life's journey as scientists – curious about everything around them, asking questions and "experimenting" to learn about themselves and their world. Informal education plays a vital role in the development of a child's mind and some may argue it could be more influential on their attitudes than formal education. For young children's optimal growth, they should be assured of early childhood experiences that maximize their development.

A model system linking informal and formal education is developed here as a guide for educators that are presented with learning opportunities outside the classroom. This model demonstrates effective tools and techniques for bridging the gap between children that learn by reading and children that learn by doing. Therefore, this model intertwines two fundamentally important components of learning and this is a direct benefit to children. Research on children's learning has revealed that when children do not have firsthand experiences with the things they are learning about in school, the information that the curriculum seeks to convey will often not make sense to them (NSRC, 1997).

This model works to create a link between the 4-H Children's Garden and educators in the classroom. It is a sustainable link because of unique combinations created through the 4-H Children's Garden and its curator, and teachers and their school districts. It is expected to be further expanded to include pre-service teachers on internships, children in their internship classrooms, teachers that observe their internships and ultimately these new teachers that leave Michigan State University and teach in various cities, states and countries.

Science is the primary focus of this model, however, there are numerous curriculum standards (Michigan Department of Education, 1996) that are met through the programs presented to the children, and the model could be expanded to include all subject areas.

PROBLEM STATEMENT

The mention of science to many fourth and fifth graders evokes moans and groans. Unfortunately, the longer children are in school, the less they want to learn about science. It has been reported that by the end of third grade, almost one-half of all students feel that they would not like to take science; by the end of eighth grade, only one-fifth have a positive attitude toward science (AAAS, 1982). In some classrooms, science is no longer natural curiosity, questioning and exciting, it has become dull, boring and irrelevant. Furthermore, on standardized

college entrance tests, the average science and mathematics scores have been dropping steadily for 20 years (AAAS, 1982).

This scenario can be changed by starting when children are still curious and alive with the love of science. Science and technology museums, zoos, planetariums, marine exhibits, botanical gardens and similar places can play an important role in stimulating interest in scientific processes and phenomenon (AAAS, 1982). As these institutions expand, opportunities for children to learn also expand. Using areas designed specifically for children to romp, play and learn combined with interactive experiences that teach understanding and enthusiasm for science, informal education experiences can have a significant impact on children and their learning. It is becoming evident that schools should pick the most important concepts and skills to emphasize so that they can concentrate on the quality of understanding rather than the quantity of information presented (AAAS, 1989). Therefore, informal education experiences, rich and deep in content, can be a very valuable compliment to formal education.

As children grow older and gain outdoor experiences, their environmental attitudes begin to develop (Pettus, 1974) and it is these attitudes that need attention and direction. Environmental awareness in children is becoming increasingly important in today's society (Surbrook, 1997). As we deplete some resources, we discover new ones. The environment we live in allows us to function as we do and live the lives we live. Without the natural environment or if

it were significantly changed from the one we are used to, our lives would be completely different. For this reason, environmental education should be a part of everyday conversation. Furthermore, children become aware of the natural environment only when they come into contact with it and it affects them in a significant way (Cohen, 1992). If one looks specifically at botanical gardens, these institutions can provide unique and powerful learning experiences focused on plants, people and the environment. In this setting, children can become aware of the frogs, turtles, fish and birds they see living in the garden. They can see vegetables hanging from vines that they might only have seen in the grocery's cooler or a steel can. Through a unique computer program "Plant Problems" they can even "see" the effects of pesticides and fungicides on plants being treated and other living organisms not being treated (Dr. Norm Lownds and the Comm Tech Lab, Michigan State University, 1999). In essence, they can examine an entire ecosystem in ways that have not been possible in the past.

Our model, to link formal and informal education, revolves around the 4-H Children's Garden located on the campus of Michigan State University, East Lansing, Michigan. The mission of the 4-H Children's Garden is: 1) to promote an understanding of plants and the roles that they play in our daily lives; 2) to nurture the wonder in a child's imagination and curiosity; 3) to provide a place of enrichment and delight for children. This philosophy of nurturing a child's imagination and curiosity through hands-on science will enliven and expand children's understanding of, and interest in, science and plants and the roles that

they play in their daily lives. When combined with computer technology, informal education in the 4-H Children's Garden will be expanded beyond the physical boundaries of the garden and available at any time. In short, these programs will make a significant difference.

The research presented deals with integrating technology into the learning experience of children in the 4-H Children's Garden. Integration is defined as utilizing a computer in some of the hands-on activities children participate in during a visit to the garden. The computer is not intended to replace any part of the garden environment, but is intended to expand and enhance their exposure to this unique garden setting. This can be accomplished by providing pre- and post-visit activities and a web-site that encourages children to visit the garden again with their parents, grandparents, and siblings (http://4hgarden.msu.edu).

The key component to having this program reach children in urban, remote and low income areas is teachers. If teachers are equipped and excited, they will venture into their classroom full of new ideas. They will be aware of the potential for quality learning that can occur when they bring their classes to the 4-H Children's Garden, either virtually, through the web-site, or physically. By equipping teachers, children will also be exposed to an environment that is totally new. Other children that have already experienced the unusual hybrid of education and play can share and demonstrate, and thereby excite their peers in a way that teachers are not always able to. This research is important therefore

from an educational standpoint, environmental standpoint and developmental standpoint.

CONCEPTUAL DEFINITIONS

Informal Education is education that takes place outside of the classroom in an environment absent from some of the classroom's limitations.

Formal Education is the traditional way that most Americans visualize "school". It takes place within a classroom consisting usually of one teacher and several students.

A model system is a set of ideas and activities that can be used in many educational situations in order to teach children about a specific subject area.

OPERATIONAL DEFINITIONS

Curriculum refers to standards set by the Michigan Department of Education / Michigan Curriculum Framework.

Third graders are defined as children who are currently enrolled in third grade.

Fourth graders are defined as children who are currently enrolled in fourth grade.

Parents are defined as custodial mothers, fathers and/or legal guardians of the children in this study.

RESEARCH OBJECTIVES

The following research objectives served as the baseline for this research.

1. To collect and analyze initial information on children's thoughts relative to the 4-H Children's Garden, science and technology.
2. To utilize this information to develop a model system that integrates the 4-H Children's Garden (informal education) into classrooms (formal education).
3. To identify unique opportunities and individual components to ensure success and sustainability.
4. To examine the integration of technology into informal educational settings. Integrating technology into the program that children receive generates interest, reinforces materials covered and emphasizes the importance of the child's questions. Technology lessons would provide valuable life-learning opportunities for children and teachers alike.

LIMITATIONS OF RESEARCH

This study was exploratory and describes the ideas that children have about science, scientists, computers and their favorite things in the 4-H Children's Garden. It also briefly looks at the participation of parents in the learning process and their ideas about how their children learn. The information gathered is

considered baseline and will serve as a starting point for additional research. From this point, further investigations will lead to a more complete understanding of how to effectively integrate informal learning opportunities provided by the 4-H Children's Garden into the elementary school science curriculum.

The main limitation of this study was the difficulty in finding an appropriate measurement tool. Two surveys were developed for the classrooms, a general information survey and a science information survey.

Additional surveys, including CERI (Children's Environmental Response Inventory, Bunting & Cousins, undated) could be used in the future, in conjunction with surveys like the ones used in this study. This additional survey has been proven to be a reliable and valid instrument if left in its original form (Castle, 1996).

SUMMARY

The result of this project is the collection of baseline information from which a comprehensive model can be developed that will demonstrate a variety of ways to integrate the unique informal education opportunities possible through the 4-H Children's Garden into elementary school science curricula in Michigan. The 4-H Children's Garden will be seen as a vital resource to be utilized by teachers to encourage learning and comprehension of various subjects, especially science. The end result will be students that have a greater understanding of the subjects

presented to them through the bridge created between informal and formal education.

CHAPTER 2

REVIEW OF THE LITERATURE

INTRODUCTION

Gardening with children is not a new idea. It has been in school curricula for 100 years, perhaps more. Agriculture used to be a part of everyday life and it is the reason that our school year has been 9 months long for many years. This 9 month school year allowed children to help on the farm and get an education too. Recent changes in the length of the school year from 1,047 hours (about 180 days) to 1,086 hours (about 200 days) or longer, demonstrates a change in society. Some charter schools are extending the school year even longer. Today, we are less an agricultural community and more industrialized and commercialized. Therefore, despite the large influence of agriculture in teaching many years ago, this important knowledge is no longer emphasized and seems less important to everyday life. Children no longer recognize their favorite fruit growing on the trees in an orchard. They don't realize that wild strawberries exist in the metro-park down the road and through the efforts of plant breeders, there are sometimes golf ball-sized strawberries in the grocery store. They are content to know that strawberries come from the store; that is until they are told differently. Most children are eager to learn, and finding out that a strawberry comes from a short little plant and that they taste even better fresh from the field

than from the grocery store is really exciting! It is this type of interest in plants and how and why they are important that has sparked the craze of children's gardens. It is the importance of hands-on, tactile experiences that has encouraged teachers to step outside the classroom to teach. It is the reaction of children to these experiences that has caused people to build more and more of these cool, "made for kids" places in the heart of the city. In some ways we are moving backwards to a time when agriculture was part of normal life and in other ways, we are moving in a direction of enlivened education that it exciting and new.

In 1915, the Department of Interior, Bureau of Education, implemented a school supervised home garden program and curriculum. Experience had shown that in a course in gardening, the field work and the classroom work were of about equal importance (U. S. Bureau of Education, 1915). This is still true today, 80 years later. Young people can learn more readily about things that are tangible and directly accessible to their senses – visual, auditory, tactile, and kinesthetic (AAAS, 1989). In addition, a textbook should be used only as an encyclopedia and as a guide for classroom experiments (U. S. Bureau of Education, 1915).

PRESENT DAY

Hands-on or experiential learning is an ever changing, challenging curriculum to teach. Taba (1962) noted that learning experiences, not content, are the means for achieving a wide range of objectives; knowledge and understanding are the

exceptions (Horton & Hutchinson, 1997). Lessons become experiences that widen (a child's) vision, opening their eyes to the wonders of learning and the joys of discovery (Haugland & Wright, 1997). Therefore, students should be actively involved in exploring phenomena that interest them both in and out of class (AAAS, 1993).

In response to this need to explore outside the classroom, science and technology museums, zoos, planetariums, marine exhibits, botanical gardens and similar places are establishing a variety of programs aimed at schools (Morrissey & Worts, 1998). They are characterized by hands-on activities and unique experiences. Questions remain, however, as to the most effective programs, delivery, follow up, integration into formal education and sustainability. In addition, how should the providers of these programs reach new teachers?

In the 4-H Children's Garden, children can visit and experience plants (nature) set-up to be viewed from their venue – adults have to get on their knees to really appreciate the design of the 4-H Children's Garden. It also provides vegetation and places in which to form nests and shelters, important components of childhood play and development (Nabhan & Trimble, 1994). Children from further away, can visit virtually through the web-site (http://4hgarden.msu.edu) or the CD-ROM virtual tour. Although these are not hands-on experiences in terms of the garden, they become hands-on experiences through use of a computer. In

addition, there will soon be opportunities for children to teach/tell other children through the internet of their experiences.

From a developmental standpoint, the interactions between children in children-based gardens are precious and rarely documented. The contagious enthusiasm spreads like giggles through a classroom amongst children in the garden. It becomes a race to find something new and unusual. Who can find the pumpkin peaking out from underneath a huge leaf? Who can spy a butterfly slurping nectar? Because of this "race", children want to visit the gardens more often and they spend their time searching for the coolest stuff to show their friends and classmates on the next trip there. It is through this awe-filled world that teachers can begin to bridge the gap between play and learning and between formal and informal education. Math for measuring, reading for the many signs, literature references and plaques throughout the plantings, science, and art creates every curve of design. Teachers in any discipline can encompass a subject completely in the garden.

Computers can add to experiences in the garden, creating anticipation of the visit, opportunities for the classroom to conduct experiments, follow-ups on certain aspects of the garden, sharing the experience through a web-site with a friend on a rainy day and finally providing encouragement to return in the future. As stated by Heppell (1995), the ability to solve problems and communicate using the computer will be a fundamental facet of literacy for the next century. In

the five years since Heppell's article was printed, we have seen tremendous growth of the internet. Even on television commercials, the message is hardly complete without the appearance of a "www" address on the screen. A teacher also stated that "the children are going to live for another 70 years into the next century and a significant part of their lives will have to do with technology. It is critically important that they have an understanding to be proactive in that world, both in work and leisure." (Sanger *et. al*, 1997).

Children are born with a curiosity about new and unusual things. They seem to be attracted to computers, whether or not they are allocated computer time (by a teacher) (Sanger *et. al*, 1997). There is an interesting parallel that Lovejoy (1991) points out in that some plants act almost as magnets, drawing children back again and again. Just like exploring a new place, children explore computers and this aspect of their development makes it significantly easier for them to be taught with, and about, computers. Furthermore, it has been observed that students are more focused and task-oriented when working with computers (Snyder, 1994). Overall, the development of a more interactive, cooperative and collaborative atmosphere was observed of children using computers in the classroom (Sanger *et. al*, 1997).

Computers can be a source of fascination and motivation for children (Sanger *et. al*, 1997). Therefore, when using computers in the 4-H Children's Garden, children are doing two things they enjoy, playing outside and using a computer, it

seems that the learning threshold would be greatly increased as material is presented to them.

Within this project, there were several essential "players". The content and scientists were drawn from the 4-H Children's Garden, sustainability from a variety of areas including interests of teachers, the presence of the Children's Garden, and lastly, online interactions that demonstrate integrated use of technology as a learning tool. Even with these essential elements, this model is not content specific. It identifies the components that are necessary to make it work; it gives the teachers practice and therefore experience and confidence; and follows a process that is highly adaptable to other subjects. This project uses the 4-H Children's Garden and science as the content. By curtailing the negative attitudes about science that tend to develop as children progress through their elementary education, there is great potential for significant regional effects and eventual national effects, as others utilize this model system.

For successful integration and sustainability, Buckingham (1993) believes that information technology education must find a way of developing the relationship between what is taught in schools, and the technology that children are exposed to in the home. With the internet boom, many households have access to the web and the relationship Buckingham refers to is a reality. In other areas, schools could serve as the source for technology while the 4-H Children's Garden could serve as the educational arena.

As computers become more powerful, they offer more options and deeper opportunities for interaction (Mintz, 1998). As mentioned above, children and youth are drawn to such media (computer interactives), as are people with some knowledge of computers or other advanced technologies (Dierking, 1998). This makes technology integration an important issue, as people hurry through life. Stimulating, intriguing environments of learning and playing will bring people back to visit again and to learn more. Perlin (1998) states that media, if properly used, can enhance exhibits, reach and engage audiences, and illuminate works of art. Furthermore, a goal of the children's garden is also encapsulated in Perlin's chapter when she says that "the audiences for programs available through electronic networks can be expanded considerably beyond a museum's immediate community or even prescribed constituency for outreach programs (1998).

SUMMARY

In conclusion, integration of technology is becoming a necessary step in a child's education. The 4-H Children's Garden as an essential tool, is demonstrating the importance of nature to a child. The combination of nature and technology can help create forms of dialogue between and among people in different sites, across disciplines and ages, without the limitations of time and location (Morrissey & Worts, 1998). Technology can do and be so many things, if it is utilized in a fashion that teachers and children understand. We still face the

same challenges that we have in the past, of preventing computer instruction from becoming individualized instruction (Rizza, 1981). It is important to keep in mind that children need to be socialized and encouraged to learn (Smith, 1981), and that is a part of the job of a teacher. The teacher is an integral part of the education process (Charp, 1987) and must remain so as we move forward with technology. For that reason, teachers are a very necessary element in the integration of technology into the 4-H Children's Garden at Michigan State University and informal education everywhere.

By establishing links with teachers from all content areas, not only can scientific and technological literacy be improved, eventually mathematical skills, language and writing skills, and artistic skills can also be refined through science. Each teacher can develop and expand innovative ideas branching from an initial scientific experience.

Through teacher development, the integration of computers will enhance and strengthen the role of education that the 4-H Children's Garden plays. Children of different ages, geographic areas, socioeconomic classes, and ethnicity can all learn and benefit from a program such as this. It is also vitally important that "youngsters are permitted to proceed as rapidly as they grow in skills and understanding. We must permit the child to become what at first he pretends to be" (Brandwein, 1962). This is one of the constant struggles in today's classroom; challenging at least most of the students, most of the time. If children

can proceed at a speed consonant with their growth; they can proceed as individuals (Brandwein, 1962).

In addition, schools should pick the most important concepts and skills to emphasize so that they can concentrate on the quality of understanding rather than on the quantity of information presented (AAAS, 1989). This is something that we can learn from Japanese culture. Their science book is very thin because only a few topics are covered in very great detail versus our "pile it on" technique in which both the teacher and student can become frustrated. First, because the students do not retain the information and second because there is so much information to learn. This sort of "cramming it in" is not working, as evident in scores on assessment tests.

A more effective approach, easily done in an informal education setting, would focus on one topic (i.e. habitats) and teach it through several different stations with different, but related activities. Students would build, color, cut, observe, draw and use a microscope. These activities are tangible and directly accessible to their senses - visual, auditory, tactile, and kinesthetic. With experience, they grow in their ability to understand abstract concepts, manipulate symbols, reason logically, and generalize. Concrete experiences are most effective in learning when they occur in the context of some relevant conceptual structure. If students are expected to apply ideas in novel situations, then they must practice applying them in novel situations. Learning often takes place best when students have

opportunities to express ideas and get feedback from their peers. Students respond to their own expectations of what they can and cannot learn. If they believe that they are able to learn something, they usually make headway. What is more, students are quick to pick up on expectations of success and failure that others have for them (AAAS, 1989).

The Michigan Curriculum Framework (1996) serves as the foundation for education in Michigan schools. Several of these standards are met in the programs that we have in the 4-H Children's Garden. Science and mathematics are the primary ones covered, including:

- Content Standard 3 in Mathematics, Section III. Data and Analysis, which covers: 1. making and testing a hypothesis
- Content Standard 2 in Science, Section III. Use Scientific Knowledge from the Life Sciences in Real-World Contexts, which covers: 5. describe functions of selected seed plant parts.

Numerous other standards can be addressed in the same lesson. There are even standards in Language Arts and Social Studies that are easily integrated into garden programs. Hands-on experiences and tangible objects that the kids can relate to make learning fun and memorable. Building on this type of informal education creates a solid understanding of the concepts taught.

In the 4-H Children's Garden experience, computers and CD-ROMs are combined with scissors, markers, crayons, and glue sticks. It is not the entire

curriculum that is changing, it is the way materials are presented, the way activities are worked on in groups and the integration of technology as a part of the program rather than a machine that is a reward for completing your work first. "Young children who will grow up in a high-tech world need a low-tech, high touch environment" insists Dr. Lillian Katz. Early childhood is a special time for brain development of special systems that will underlie many different kinds of learning. (Healy, 1990). For this reason, it is important for this type of educational experience to be presented at the elementary school level. Part of the pressing need for hands-on experiences stems from the fact that as today's children grow, they have increasingly little contact with the natural world (NSRC, 1997).

In summary, the use of field trips that include computer integration to enhance classroom learning should be based on the following principles:

1. Field trips are a particularly effective means of gaining certain desired understandings
2. Field trips give students first-hand experiences that would not be possible in the classroom setting
3. Field trips are an integral part of the curriculum
4. Field trips should be planned as an extension of a classroom unit of study (Lankford, 1992).

This sort of inquiry-based experience has been shown to foster the development of certain skills needed for effective problem solving (NSRC, 1997).

Finally, it would seem that the best time to reach teachers with the idea of, and experience using, informal education to supplemental formal classroom training would be as part of teacher education programs. Such possibilities exist between the Technology Center, located in the College of Education, and the 4-H Children's Garden. These facilities can further encourage the involvement of teachers of varying expertise.

It is important to know what students think about the subject matter that is presented because this can allow an educator to "break down" some of the boundaries that have been put into place. It can teach an elementary school student that science is a "way cool" subject and that it is not all textbook material. Science is a hands-on, getting dirt all the way up to your elbows, experience! The use of the 4-H Children's Garden and technology further demonstrates the experiential learning process that can really get kids enthused about school.

Once this information is gathered from students, their input should be included in the revised programming, in and out of the classroom. This would help to ensure that the students are being taught in a way that addresses their concerns and apprehensions and rejuvenates their natural curiosity.

Identifying key elements that help to ensure success and sustainability is yet another factor that can be determined by observing students. If an educator

notices what objects or concepts really ignite interest, these can be used as a springboard into other areas of investigation.

Lastly, technology has a place in educational programs. Successful integration seems to be determined by the activity performed using computers. These activities should generate deeper interest in a subject, should reinforce it, and should also address questions that the students have.

CHAPTER 3

METHODS

SUBJECTS

The subjects of this study were 34 third graders, 35 fourth graders and their families (custodial mothers, fathers or guardians). There were 33 girls and 36 boys. They were recruited from Ingham County School District in Michigan. One elementary school from Okemos Public Schools was chosen for this study. This school is considered a suburban school and has teachers that visit the 4-H Children's Gardens with their classrooms. Demographic information on the students can be found in Chapter 4.

SELECTION OF SUBJECTS

The school was selected because of its association with Dr. Norm Lownds, Curator of the 4-H Children's Garden and Assistant Professor at Michigan State University. The principal of the elementary school was contacted and asked for permission to work with some of the classes in her school. Individual teachers were then approached and asked to participate in this research project. Approval was granted from The University Committee on Research Involving Human Subjects (UCRIHS) to survey children that had parental permission (Appendix A & B). In addition, the parents were encouraged to contact the project

investigator, Dr. Norm Lownds and/or Dr. David Wright, Chair of UCRIHS by telephone if they had any questions at any time during or after the completion of the project. Confidentiality was assured and summary reports will be provided to anyone that requests them and also to the teachers and principal involved in the study.

Because our main focus was the attitudes of children, their responses were still considered even if their parents chose not to participate in the parent survey. A total of 35 parents were a part of this project.

ACTIVITIES DONE WITH EACH CLASS

The third grade classrooms visited the 4-H Children's Garden on a field trip. Prior to their visit, they were studying habitats and this was the topic of their field trip as well. The students were divided into groups of scientists, including: tree, vegetable, butterfly, plant, frog, soil, and people scientists. In the garden, students investigated different aspects of their organism's life. The topics covered included: habitat, predator/prey relationships, life cycles, relationships with humans, technology and further investigations. In addition, the student's questions were addressed. They used the program "Plant Problems" to investigate a few of the yearly battles between the plants in the garden, the people, the bugs and the fungi that all live in or use the garden. See Appendix E for materials.

Dr. Norm and myself visited the fourth grade classroom in person. The students were again divided into groups of scientists including: spruce, perennial, annual, and maple tree. These groups were chosen because they are the plants that live in the school's yard and garden. Activities were based on investigation, preservation and extensive follow-up with technological tools, i.e. "Talk Back". As scientists, the students collected bags full of materials from their plants and the surrounding area. They also made written observations and lastly, digital images were taken. Once in the classroom, everyone, including their teacher, got a chance to look at an aphid's tailpipes and the honeydew they make. Over the next few days, the teacher of this classroom had them observe their specimens further. Eventually, the students used a program called "Talk Back" to further investigate their specialty areas. "Talk Back" is a chat based program that allows the students to connect via the internet with a "real live scientist" at Michigan State University (http://4hgarden.msu.edu/askdrnorm). There were some directed activities in which they all visited a web-site together or answered a question posed by the scientist, but the main purpose of the program is to allow students to ask questions of a grown-up scientist.

DESCRIPTION OF INSTRUMENTS

Three surveys were used in this study. The parent survey was developed to determine some of the past experiences children had been given in terms of outdoor exposure. Two classroom surveys were designed to determine demographic information and generalized student attitudes toward school,

science and the 4-H Children's Garden. The classroom surveys were developed with the assistance of Lisa Murphy-Johnson, a doctoral student in the Department of Communication who specializes in evaluation techniques. The results were analyzed using SPSS, a common tool used by sociologists and other scientists analyzing data from surveys. This process of analysis was possible with the assistance of Dr. Bridget Behe, Horticultural Marketing Assistant Professor in the Department of Horticulture and Jill Hardy, a graduate student in the Department of Horticulture.

General Information Surveys

The general information survey was given to both third and fourth graders (Appendix C). It asked demographic questions, as well as questions directly related to the 4-H Children's Garden. These responses were separated into two groups, children that had visited the 4-H Children's Garden and therefore knew what was there, and children that had not visited. There were also gender comparisons. The surveys also contained questions relating to the program that each grade received. The third graders received a program at the 4-H Children's Garden related to habitat, while the fourth graders' program was an outdoor exploration of different plant types while playing the role of scientists. The fourth grade program also included ongoing interaction with Dr. Norm through a computer aided communication system called "Talk Back" in which the fourth grade scientists interacted with each other and a "grown-up" scientist, Dr. Norm Lownds.

Science Information Surveys

The science information survey was also given to third and fourth graders and concentrated on science questions, such as "What is science?" and "Who can be scientists?" (Appendix C). It also asked each student what their favorite subject was and who helped them with their homework.

Parent Survey

The purpose of the parent survey was to gather demographic information and to determine their child's prior exposure to science and the outdoor world. For instance, parents were asked if they had a flower garden, vegetable garden, both or neither (Appendix C). They were also asked to describe their yard and home setting. Lastly, they were asked questions regarding how best they thought their child learned and their children's favorite outdoor activities.

RESEARCH QUESTIONS

The main purpose of these surveys was to collect baseline information about the students' opinions on the 4-H Children's Garden, science and technology/computers. We investigated further to get an idea of how they felt these three areas could be integrated.

It was also determined who brings children to the garden. This information is the beginning of a foundation for a link between the parents, teachers and the 4-H

Children's Garden. This linkage will be most visible between the school and the garden and the linkages with parents will presumably take longer to establish due to hectic schedules, less contact and distribution of information.

DATA COLLECTION

Child Data

Once permission was granted, each child was presented with a set of surveys to complete as a class assignment. Instructions were given to the teachers in order to facilitate this (Appendix D). One survey was used to collect general information and the other sought science information. This initial set of surveys served as a baseline and was distributed in mid-October. The second survey set, given in April of this year, was very similar to the first, however, at the request of the teachers, the students were interviewed and their responses were recorded as precisely as possible. This helped minimize classroom disruption and was more time efficient. At the same time in April, a set of surveys was also distributed to a comparison group. The comparison group was a fourth grade classroom that had not received the program. They may or may not have previously visited the 4-H Children's Garden.

Parent Data

The data generated from the parents that participated was through a survey that the students took home from school and returned within one week.

Coded Data

The surveys were coded with a number, which allows for confidentiality of the families involved because names were no longer associated with responses. The secondary investigator was the only individual responsible for coding and entering data. Once the information was entered in SPSS, the participants' names are no longer directly associated with their responses. Results of these surveys and analysis are found in the next chapter.

DATA ANALYSIS

Data was analyzed using SPSS, a statistical program that is widely used by the social sciences. Comparisons were made with responses from the other students, by class, time of survey and also by gender.

CHAPTER 4

ANALYSIS OF RESULTS AND DISCUSSION

GENERAL INFORMATION

The sample was made up of 34 third graders, 35 fourth graders and 35 parents. The student population consisted of 33 girls and 36 boys. The students were either in third or fourth grade at an elementary school in Okemos, Michigan. The families were from East Lansing, Okemos, Haslett or Lansing, with the most living in East Lansing, followed by Okemos. Very few lived in Haslett or Lansing, Michigan, which is expected because these cities are not part of the school district that this elementary school is located in.

DEMOGRAPHICS

Parent Surveys

The parent survey provided the most demographic information. Of the parents that responded, nearly 3% live in an area described as rural/farm, nearly 71% live in a subdivision and about 26% live in a town or city. Almost 80% live in a house, while 6% live in trailers and 6% live in apartments. The remaining 8% live in homes that fall under "other" and this could include duplexes, townhouses and condominiums. About 80% have a small yard that is less than 1 acre, less than 18% have a medium yard (1-2 acres) and almost 3% have no yard. We asked

the question "how long have you lived in your current home" to give some indication of familiarity to the area and the activities in the community. Almost 66% of the families have lived in their current home for 5 years or more. Nearly 6% have lived there for 3 to 5 years, 17% for 1 to 3 years and about 11% have lived in their current home for less than 1 year. Nearly 79% of the mothers are between the ages of 36-45 years old and nearly 68% of the fathers are also. Occupations varied widely with as many as 45 different jobs listed for the mothers and fathers that participated. The most common job for mothers was a "stay at home mom" (30%), followed by teaching (9%). The most common jobs for fathers were professors, nearly 15%, followed by engineers, nearly 12%. Most of the other occupations had only one entry for both mothers and fathers. College graduate was the most common level of education for mothers, nearly 58%, followed by graduate/professional school (27%). For fathers, 47% reported having attended graduate/professional school and 29% having college degrees. Income levels ranged nearly 7% in the $20,001 – 30,000 range, nearly 23% in the $30,001 – 55,000 range, 16% in the $55,001 – 75,000 range and nearly 55% in the over $75,000 range.

Student Surveys

The third graders ranged in age from seven to nine years old with the most common age being eight. The fourth graders were between nine and ten years old with most being ten years old.

Outdoor Activities

In addition to demographic information, we asked the parents if they had gardens, about their children's favorite outdoor activities and how their children learned best. Fourteen percent do not have a garden at their home, 3% have a vegetable garden only and about 29% have a flower garden only. About 54% have both a flower and vegetable garden at home. Seventy nine percent of the children participate in the gardening activities.

Soccer, sports in general and swimming were the most popular outdoor activities according to parents. Most children enjoy playing outside very much (nearly 89%) and only 11% moderately enjoy it. Thirty-four percent of parents listed three activities that they did as a family together, 26% listed four, 17% listed five or more, 17% listed two and only 6% listed one activity that they do together as a family.

Table 1. What is your child's favorite outdoor activity?

Response	Frequency	Percentage
Lots of Sports	6	17.6%
Soccer	6	17.6%
Swimming	4	11.8%
Anything Outdoors	3	8.8%
Basketball	3	8.8%
Bike Riding	3	8.8%
Playing	3	8.8%
Roller Blading	2	5.9%
Roller Hockey	2	5.9%
Running	1	2.9%
Trampoline	1	2.9%

Information on visitation to the 4-H Children's Garden was as follows: 11% have never visited, 34% rarely visit, almost 46% occasionally visit, less than 6% come often and less than 3% visit as much as possible.

GARDEN INFORMATION

Non-Visitor Expectations

For the third graders, the following question was posed: "What would you like to see and do in the 4-H Children's Garden?". Most wished to find animals, 23.5%, followed by flowers and the maze, both about 18%. Asking children what they want in an area such as the 4-H Children's Garden is one of the most important steps in designing a place especially for them. Before the design of the garden in 1989, an extensive study was done by garden designer Jane Taylor of the Department of Horticulture and Dr. Alice Whiren of the Department of Child Development. This study focused on determining what the children thought a garden should be and what they wanted it to be (Whiren, 1995). The results from the survey of third graders were consistent with the findings of Dr. Whiren in that the students wanted to see animals and flowers of many kinds. Once the garden was "complete", it seemed to be missing one thing, according to the pint-sized visitors: a yellow brick road. Today a yellow brick road has been added - to the delight of our most important visitors.

Table 2: Summary of responses to: What would you like to see in the 4-H Children's Garden?

Response
Maze
Spitting Frogs
Butterfly Garden
Plants
Flowers
Jungle Gym
Playing War with my Brother
Bananas
Bridge
Frogs/Tadpoles
Pond
Chimes
Playground
Animals
Tree House
Milking Cows
Yellow Brick Road
Computer
Pollution Effects
All of the Garden
Train
Plant Roots Display
Water Fountain
Sensitive Plant
Lily Pads
Cameras
Alphabet Garden

Garden Visitation

At the time of the first survey, approximately 51% of the third graders had visited the 4-H Children's Garden. By the time of the second survey, about 85% had visited. The second response makes sense as the second survey was administered after the class had visited Michigan State University Greenhouses

and the 4-H Children's Garden. Most of the fourth grade class (89%) that was part of our project had visited the 4-H Children's Garden prior the outdoor program we did with them at their school. The fourth grade comparison classroom had a slightly lower percentage that had been to the garden before, 77% having visited. Of the 4 classes surveyed, 73% of all the students had visited. Most of the students had come to visit the 4-H Children's Garden with a class as a school field trip (44%). About 21% of the students reported it was their mom that had brought them to visit and 32% reported they came with either a family member (other than their mom), their dad or both parents. The remaining responses included a friend's parent and a day camp had brought them. The remaining students did not respond to the question.

Table 3: Who brought you to the 4-H Children's Garden?

Response	Frequency	Percentage
Teacher/School/Class	32	43.8%
Other Family Members	23	31.7%
Mom	15	20.5%
Camp	2	2.7%
Friend's Parent	1	1.4%

Every summer there are a series of special activities that take place on various days of the week in the 4-H Children's Garden. We asked how many students had been to such events. Less than 6% of the third graders had attended summer events and only 11% of the fourth graders had attended.

Best Part of the Garden

We asked the students what they liked best in the garden and would like to show their siblings. For third graders, the responses varied widely, with the most popular response being the flowers (26%). Nearly 24% said that they would like to show people the maze. Interestingly, after the program with Dr. Norm and myself, only 7% listed the maze as what they would like to show others and nearly 19% wanted to show people the computer in the garden house. The computer response is an example of an interactive learning experience that integrated a computer and made a unique impression on the students. Fourth graders said the maze was what they liked best about the garden. Combining responses from all four classrooms, but excluding 32 students that did not answer, slightly more than 22% chose the maze, followed by nearly 14% for flowers and nearly 14% for plants, with computers, the pond and everything in the garden each at 7%. See Table 2 above.

Coolest Thing Someone Has Shown Them (Students)

When asked what they had been shown that was really cool, 44% of third graders responded that the computer was really cool! The maze was the top response in both fourth grade classrooms as the coolest thing they had been shown in the garden. Combining all four classrooms, while excluding 46 students that didn't respond, 26% thought the maze was the coolest thing in the garden followed by 13% responding that is was the computer. As stated earlier, the answers varied widely in these responses.

Who Takes Care of the 4-H Children's Garden

Next, we wanted to evaluate how much the students knew about the 4-H Children's Garden. One of the questions we asked was "who takes care of the garden?". Of the children that had not visited the garden, 35% thought Dr. Lownds took care of the garden, which is true. Eighty-two percent of the children that had visited the garden before also thought Dr. Lownds took care of the garden. This suggests that students have discussed this amongst themselves and they are passing along information that is important to them. Along the same line, we asked who works in the garden and 75% of the children that had not visited before said Dr. Lownds, while 49% that had visited before said Dr. Lownds also. In both cases, it was a majority that thought Dr. Lownds also worked there.

Table 4a: Who takes care of the 4-H Children's Garden? (students that have NOT visited the garden previously)

Response	Frequency	Percentage
Dr. Lownds	8	34.5%
Owner	5	21.7%
Government	4	17.4%
Director/Boss/Manager	3	13.0%
Judge	2	8.7%
College Students Studying That	1	4.3%

Table 4b: Who takes care of the 4-H Children's Garden? (students that have visited the garden previously)

Response	Frequency	Percentage
Dr. Lownds	50	82.0%
Michigan State University/Spartans	4	6.3%
Owner	2	3.2%
Director/Boss/Manager	1	1.6%
Adults/People	1	1.6%
Government	1	1.6%
Gardeners	1	1.6%
Scientists	1	1.6%

Do Scientists Work in the Garden

In all cases, the majority of the students thought that scientists worked in the garden, although what they did in the garden varied widely. Activities involving care for the flowers and plants were the top answers for all the classrooms.

Table 5a: Who works in the 4-H Children's Garden? (students that have NOT visited the garden previously)

Response	Frequency	Percentage
Dr. Lownds	15	75.0%
Volunteers	2	10.0%
Adults/ People	1	5.0%
Gardeners	1	5.0%
Assistants/Helpers	1	5.0%

Table 5b: Who works in the 4-H Children's Garden? (students that have visited the garden previously)

Response	Frequency	Percentage
Dr. Lownds	29	49.2%
Assistants/Helpers	9	15.3%
Scientists	6	10.2%
College Students Studying That	5	8.5%
Michael, Evan and/or Mom Lownds	4	6.8%
Adults/People	2	3.4%
Butterflies/Bugs	2	3.4%
Michigan State University/Spartans	1	1.7%
Volunteers	1	1.3%

SCIENCE INFORMATION

Science & Learning

Seventy-seven percent of parents believe that their child loves science and another 23% say that their child likes science. These two figures are encouraging to all different types of educators. Compared to other studies, this percentage is very high (AAAS, 1982). Ninety-four percent of parents liked science and about 6% were indifferent towards it. In this case, there is a possible relationship between parents liking science and their children enjoying it as well.

Students should be actively involved in exploring phenomena that interest them both in and out of class (AAAS, 1993). In this case, the phenomenon is the outdoors. Outdoor education, in whatever form, often involves young people

living, moving and learning in the outdoors in ways that provide challenging opportunities for adventure and self-discovery (Gair, 1997).

The way children learn can be very important to teachers and parents. Some children respond best to reading assignments and absorb and retain information that is presented in books. Other children learn best by listening to a teacher or parent explain a new concept. Still another group of children needs to experience the situation in order to learn and retain pertinent information. Complicating matters further, some children require a combination of the above situations, depending on the subject matter. Understanding how a child learns can be extremely important to educators and parents because it determines the success of that child's retention of information and overall performance in school. Fifty percent of parents felt their children learned best by having both reading and visual/tactile lessons, nearly 29% responded that having a person to ask questions of and assist him/her as s/he learns something brand new was best. Eighteen percent thought a large volume of reading followed by a discussion worked best, and lastly, less than 4% said a concrete object for him/her to look at and touch was best.

When parents were asked what their child wanted to be when he/she grows up, sixteen different responses were given. The most popular occupation was veterinarian (15%) followed by performer/singer/actress (12%), followed by teacher, writer/poet, engineer and doctor (9% each).

Table 6. What does your child want to be when s/he grows up?

Response	Frequency	Percentage
Veterinarian	5	15.2%
Performer/Actress	4	12.1%
Teacher	3	9.1%
Writer/Poet	3	9.1%
Engineer	3	9.1%
Doctor	3	9.1%
Scientist	2	6.1%
Artist	2	6.1%
Changes Mind Often	1	3.0%
Captain of the Red Wings	1	3.0%
Fire Fighter	1	3.0%
SWAT Team Member	1	3.0%
Inventor	1	3.0%
Figure Skater	1	3.0%
NHL Player	1	3.0%
Nurse	1	3.0%

Favorite Subject

Fifty percent of third graders in the initial survey chose science as their favorite subject. In the second survey of third graders, 74% chose science. The fourth graders also liked science, with 31% stating science was their favorite subject, while 23% stated it was math. This is encouraging to teachers as well. In the second survey of fourth graders, favorite subjects were math (39%), science (28%), and reading (22%). The fourth grade comparison class tied with 35% preferred science (35%), math (35%) and social studies (18%).

What is Science

Asked what science is, third grade students' responses were: something you learn at school (32%) and the study of animals and other living things (23%). By

the second survey, their ideas of science had changed and 36% stated science was "experimenting" and 16% thought it was "the study of animals and other living things". In the initial survey for the fourth graders, responses had a wider range varying from the study of the earth (23%), the study of animals and other living things (15%), the study of everything (15%), and studying and research (15%). In the second survey, 33% responded that science was the study of nature, and nearly 17% said it was the study of everything. Finally, 33% of the comparison class of fourth graders responded that science was the process of discovering, exploring, and figuring things out. There was an even distribution of nearly 12% for the study of movement, for the study of the earth and for the study of nature.

Name a Famous Scientist

The classes were also asked to name a famous scientist. Albert Einstein was named by 21% of the students, with Bill Nye, The Science Guy named by about 20%, followed by Thomas Edison (13%) and Dr. Norm (13%). "Everyday scientists" were also named: Mr. Stephenson (39%) and Dr. Norm (17%). Both questions had a wide range of answers.

Table 7: Name a Famous Scientist – All classes combined

Response	Frequency	Percentage
Albert Einstein	16	21.1%
Bill Nye, the Science Guy	15	19.7%
Thomas Edison	10	13.2%
Dr. Norm	10	13.2%
Mr. Stephenson	6	7.9%
Galileo	6	7.9%
Ben Franklin	3	3.9%
John Glenn	2	2.6%
Me (the student)	2	2.6%
Jane Goodman (Goodall?)	1	1.3%
Felder	1	1.3%
Jacques Costoeau	1	1.3%
Teacher	1	1.3%
Newton	1	1.3%
Charles Darwin	1	1.3%

What is a Scientist

"What is a scientist?" generated 14 different answers. In the initial survey of third graders a scientist was: someone who studies science (28%), and someone that studies about living and non-living things in nature (20%). The second survey generated similar results: someone who studies science(27%), someone who explores/invents/discovers and figures out things (20%) and someone that studies things (20%). About 46% of the fourth graders in their initial survey responded that a scientist was someone who asks questions and someone that studied the earth (31%). The second survey generated a wider range of answers including someone who studies living and non-living things (22%), someone who studies or teaches science (17%) and someone that does chemistry (17%).

Finally, the fourth grade comparison class stated that a scientist is: someone who studies science (29%), someone that discovers/explores/invents and figures things out (24%) and someone that asked questions (12%).

What Do Scientists Study

The students were asked "what do scientists study?". Third graders, in the first survey, stated that scientists study animals/living things and nature (36%). In the second survey, scientists study science (28%) and lots of things (28%). Fourth graders stated that scientists study the earth (31%), animals/living things, nature and lots of things (22%). The fourth grader comparison class stated that scientists study lots of things (35%). At the time of the first survey, the students were studying the earth.

What Tools Does a Scientist Use

The tools scientists use are important and can be of great interest to kids. In the first survey, 25% of third graders thought the magnifying glass was really important. In the second survey, 41% thought magnets were the most important tools. Each response was related to what they were studying in class at the time. Fourth graders responded that telescopes were the most important tool (39%). They had just finished their space unit. In the second survey, 22% felt the computer was the most important tool, which is presumably in response to continued work with Dr. Norm. This was followed by the telescope (17%) as a tool that a scientist uses. The comparison classroom had a wide range of

answers: your brain, a computer and measuring items like cups and spoons were each identified as important tools by 13% of the students.

How Does the 4-H Children's Garden Help You Learn About Science

Visitors and non-visitors alike agreed that the best way for the 4-H Children's Garden to help them learn about science was by teaching them things about plants and flowers in the garden. Secondly, they suggested the garden would help them study living things.

Table 8: Summary of responses to: How does the 4-H Children's Garden help you learn about science?

Response
Electricity is Needed to Run the Computer
Fertilize the Plants
Learn about Air Pollution
Learn About Frogs
Learn about the Computer
Learn Science Stuff
Learn the History of the Land
Look at Chemicals in Plants/Flowers
Look at Producers
Rain Helps the Plants Grow
Smell the Flowers
Study and Bugs and Flowers
Study Flower/Plant Diseases
Study Living Things
Study Magnets
Study the Bugs
Study the Fish
Study the Plants/Flowers
Study the Tadpoles

Can You Do Experiments and Be a Scientist

Nearly all of the students agreed that they could do experiments and be scientists. Only 1 or 2 students in each class did not agree. This suggests that additional hands-on lessons would reinforce the students' understanding of science. For the investigation question where students had to put the steps in order to complete a scientific investigation, of 105 surveys only 11 were answered correctly. (See Appendix C). This demonstrates a need for reinforcement of this topic, as well as multiple applications of the scientific process.

TECHNOLOGY INFORMATION

How Have You Used a Computer

In the initial survey of the third graders, 46% had used a computer for science work. This increased to 61% in the second survey. For the fourth graders 62% had used a computer for science and this increased to 89% in the second survey. Finally, 88% of the comparison group had used a computer. Similar results were found for the question of "have you looked up "stuff" for science on the internet?". Very few students had used the computer to write science reports.

Is a Computer in the Garden/Should a Computer be in the Garden

Because computer integration is one of our main objectives, the students were asked if a computer was in the garden, if it should be in the garden and if so,

what would it be used for. Of the children that had never visited the garden before, 54% did not think that a computer was in the garden, but 50% thought there should be one there. Of the children that had visited the garden before, 27% were not aware of it being there and 73% knew that there was a computer in the garden. Of this same set of students, 79% thought a computer belonged in the 4-H Children's Garden. Many students were quite emphatic that computers belonged in the garden.

Uses of a Computer in the Garden

Possible uses of a computer varied widely with non-visitors suggesting it be used for identifying plants and flowers as well as assessing diseases (50%). The students that had visited before suggested it be used for plant and flower identification (30%), games (16%), and research (15%). The game and research ideas are explained by the interactive CD-ROM game "Plant Problems" mentioned earlier. Students used this program as part of their garden visit activities. This game focuses on the effects of pesticides and fungicides on the entire garden - plants, people, frogs, dragonflies and butterflies.

Table 9a: Uses for a computer in the 4-H Children's Garden (students that have NOT visited the garden previously)

Response	Frequency	Percentage
Identifying Plants/Diseases/Names	12	50.0%
Games	3	12.5%
Keeping Track of Money and People	2	8.3%
Keep From Getting Lost	1	4.2%
Security/Guarding	1	4.2%
Writing Stories	1	4.2%
Entertainment	1	4.2%
Using it to Move Something	1	4.2%
Making Maps	1	4.2%
Running Sprinklers	1	4.2%

Table 9b: Uses for a computer in the 4-H Children's Garden (students that have visited the garden previously)

Response	Frequency	Percentage
Identifying Plants/Diseases/Names	18	29.5%
Games	10	16.4%
Research	9	14.8%
Making Maps	3	4.9%
Virtual Tours/Internet/Chatting/Downloading	3	4.9%
Running Sprinklers	2	3.3%
Experiments	2	3.3%
Keeping Track of Money and People	1	1.6%
Typing	1	1.6%
Security/Guarding	1	1.6%
Homework	1	1.6%
Controlling the Train	1	1.6%
Studying Things	1	1.6%
Teaching about Pollution	1	1.6%
Asking a Question	1	1.6%
Effects of Habitat Destruction on Animals	1	1.6%
Butterfly Information	1	1.6%
Cameras	1	1.6%
Public Opinion	1	1.6%
Weather	1	1.6%
Showing Exhibits	1	1.6%

What Did You Like Best about the Program/Activities

The third graders that visited MSU and the 4-H Children's Garden and the fourth graders that were part of the outdoor exploration were asked what they liked best about their program. Thirty seven percent of the third graders liked the computer part best while 47% of the fourth graders said that was the best part.

CHAPTER 5

CONCLUSIONS AND DIRECTIONS FOR FUTURE RESEARCH

DISCUSSION

Why Did We Do This Research?

The Mission Statement of 4-H Children's Garden is to promote an understanding of plants and the roles they play in our daily lives; to nurture the wonder in a child's imagination and curiosity; and to provide a place of enrichment and delight for children. By integrating formal education into our informal education programs, the curriculum standards of Michigan and the objectives of the 4-H Children's Garden fit together like a lock and key.

Why Did We Involve Schools?

Children begin life's journey interested in science - asking questions, curious about everything, experimenting to learn about themselves and their world. The present situation is that many elementary teachers feel poorly prepared to teach science. Some teachers and students believe they HAVE to be experts and therefore, they do not attempt to teach or learn about science. Students need role models in order to aspire to become a scientist. It has been reported that by the end of third grade, almost one-half (50%) of all students feel that they would not like to take science; by the end of eighth grade, only one-fifth (20%) have a

positive attitude toward science (AAAS, 1982). A group of third graders were asked the questions "Do you know a scientist?". "Nope. They're all DEAD." Their response is humorous in some ways, yet painfully true. That is what some students are taught in school. The scientists that they study lived a long time ago and now, they are dead. This is one reason that scientific experts are essential for their input in content in curriculum development teams. Without an expert opinion, there is the potential for incorrect information to be incorporated into curriculum.

Learning science is something students do, not something that is done to them. Hands-on activities are not enough - students also must have "minds-on" experiences (National Science Education Standards, 1996). Our goals for this project were to gather baseline information on outdoor family activities, knowledge about the 4-H Children's Garden, and ideas about science and technology. In addition, we would be exposing students to "technology enhanced" field trips. An important outcome of this project is that students see the 4-H Children's Garden as an important science "tool".

Our Findings

Most of these students live in a suburban area and families are familiar with the area and the activities offered by the community. In the home, most students have been exposed to horticulture and participate in numerous outdoor activities as a family. The 4-H Children's Garden is a community resource that families

visit and it is utilized by school classrooms, although few students attend summer programs.

In the case where computers were used in our program, it was demonstrated that an interactive learning experience that integrated a computer made a unique impression on the students.

Based on some of our results regarding what could be found in the garden, it appears that students are discussing the garden amongst themselves. The main reason for this conclusion is that the dance chimes and spitting frogs are unique to the 4-H Children's Garden. The most encouraging finding from this study is that students believe they can be (are) scientists!

The third graders we worked with enjoy science, and teacher/parent involvement may be the reason for this. There was a strong emphasis on science curriculum with some of the teachers that we worked with. Their individual passions for science seemed to spread to the students during the activities. Additional observations and surveys in other elementary schools would give educators a better idea of how students view science. This view can be important in determining the necessary teaching approach.

There is now a link established between the 4-H Children's Garden and the classrooms at the elementary school we worked with. This is evident in the high

percentages of students that know Dr. Norm takes care of the garden, he also works there and he was ranked number two in the "everyday scientist" question. Most of the students that had visited the 4-H Children's Garden came with a class on a field trip. There was a very low percentage that had visited during the summer months or for special programs. It may be possible to encourage more participation by distributing the Summer Events Calendar for the garden to parents during parent/teacher conferences. Some parents may not be aware of the events we offer at various times. There are many other reasons that summer event attendance is low and this could include: parents work during the day, summer vacations and other activities might interfere, parents do not realize the benefit of our programs, parents are not aware of our adherence to curriculum standards, and parents may not know that the 4-H Children's Garden welcomes daycare centers and babysitters to attend. It is unknown to the extend that parents are linked to the 4-H Children's Garden. It is possible that because it was a question on the parent survey that parents may tend to take their children there more often. The extent to which this happens will have to be determined in follow-up surveys. There is however, a new connection that is established simply by communicating with the parents and letting them know that we are doing our best to help improve science learning by their children. Parental participation is an area that will need to be expanded in the future. This study served only to open the door to parent participation. As more programs are carried out with students, more information will get taken home and this will most likely generate more interest on the part of parents. This is a very important area to pursue

given the importance of the parent's encouragement and support at this stage of development and in all of a child's education.

The online resource for students to ask questions of a "grown-up" scientists became a reality through the "Talk Back" program developed and created by Dr. Norm and the Comm Tech Lab at Michigan State University. Students can "see" that their questions are so important that we developed a special program, so they would have immediate access to scientists that will answer their questions and work with them to support learning. One hundred percent of the students that had used "Talk Back" wanted to do more with it.

Integrating technology into the program did generate interest in the classrooms and this becomes evident in the responses to what tools does a scientist use and what would you most like to show someone at the 4-H Children's Garden. It is expected that as the third graders move on to fourth grade, they will work with Dr. Norm on the computer and they too will feel that the computer is a valuable tool that scientists use in the garden. Perhaps in the future, the third graders will use the CD-ROM "Plant Problems" more often, which will reinforce the role that computers play in problem solving.

PERSONAL OBSERVATIONS

There was pure amazement in the faces of the students we worked with in these programs. They kept saying "Wow!", "Cool", "Come look at this!", "Will you take a

(digital) picture of this? It's really neat!". There were student to student interactions, teacher to student interactions and interactions with us as well. There was not a moment of "down time", no time to get bored and start thinking about something else. There was a sharing of information that was happening naturally, without intentional initiation. It was amazing to me to see these students come alive and listen and talk as fast as possible about the really cool aphid that they saw for the very first time followed by the excitement to show it to their teacher. At the end of the day, the students did not even want to put away their things to catch the bus home. They lost track of time and did not want it to end. As they ran out the door, some kids asked, "Can we do this again tomorrow?". That was the grand finale!

DIRECTIONS FOR FUTURE RESEARCH

The primary goal of this project was to develop a model that can be easily applied to other diverse situations in which an informal education program could effectively enhance and expand formal education. This model would form sustainable relationships and links between informal and formal education, relationships that may not currently exist. Sustainability is created by integrating the informal education program of the 4-H Children's Garden (one of the best in the nation) into the formal education program (the classrooms of elementary schools). The components of the model, the 4-H Children's garden, teachers, classrooms, and scientists may change, but the linkages remain. The content could easily be changed so that the model could serve as a blueprint for

incorporating useful, hands-on content into various situations and subject areas. Additionally, this model is built using components (4-H Children's Garden, scientists, teacher's passions (interests)) that are already established, further promoting sustainability.

The 4-H Children's Garden already has several science programs developed around garden content. Interactions exist between the 4-H Children's Garden and area elementary schools. Computer technology is quickly being integrated with plants and wildlife. Technology is already providing an amazing tool for education and it is the desire of the garden curator to continue to expand this tool in the garden and to teachers though the College of Education. By linking with the College of Education, one of the best in the country, there would be opportunities to work with visiting classrooms and designing experiences for the children. Numerous additional opportunities will exist for upper level classes in the College of Education including curriculum and learning development.

Sustainable linkages through pre-service internships will provide a foundation for pre-service teachers and reach several hundred students throughout Michigan, at all grade levels, as the pre-service teachers do their internships and are placed in diverse areas.

In-service teachers, interns, scientists and the 4-H Children's Garden would all be actively connected and interacting on a regular basis promoting an

environment rich in new ideas from many different aspects of education. Online resources could serve as a portfolio of the program's progress, its attributes, as well as areas that need modifications, and a resource for teachers and students.

Eventually, by introducing students within the College of Education at Michigan State University to the 4-H Children's Garden, the aspect of informal education will no longer be a distinct and separate sort of education, but another resource to be utilized by the teacher to encourage learning and comprehension of various subjects.

IMPLICATIONS FOR PRACTICE

In the very near future, this informal education project will be presented in a few classes within the College of Education. Eventually, more classes with be added to the program as interest and manpower grows. Ideally, this program will serve as a model for other universities and institutions of education throughout the United States.

As far as information transmittal, as pre-service teachers incorporate the project into their developing teaching style, the goals of the program will be dispersed over a wide geographical and demographic area. Teachers within the schools may have an interest and educational facilities in that area of Michigan may also be interested. Therefore, over a period of a few years, many people within the State of Michigan could be tied, in one fashion or another, to this model

developed and implemented at Michigan State University. Ancillary materials, such as curriculum, could also be far-reaching as described above. Flyers and advertisement, provided by classes linked to the Department of Horticulture, would also serve to inform the public and the area schools of the program. In addition, summer workshops will be offered for in-service teachers to further expand this effective model and create an optimum learning environment.

Gardening is a dynamic springboard into the worlds of botany, nature, ecology, art, color, design, folklore, and literature; into the worlds of history, geography, economics, cultural diversity and mathematics; even into the worlds of music, drama, and dance. In addition, gardening sets the stage for discovery learning, questioning, seeking answers and information, problem solving and creating hypotheses. It provides opportunities for observing, reflecting, recording, classifying, analyzing, synthesizing, reporting data and communicating (Jurenka & Blass, 1996). Gardening provides the meaningful content for almost any subject. Further development of this model will continue to have a great impact on elementary education for years to come.

The 4-H Children's Garden can:

- provide the context and content to link formal and informal education
- excite children about science and help them see themselves as scientists
- demonstrate how technology can expand and enhance hands-on discovery

- establish and promote linkages between formal and informal education that do not currently exist
- create a model that is sustainable
- make an important difference in science education

CONCLUSIONS

The primary goal of this project was to develop a model that can be easily applied to other diverse situations in which an informal education program could effectively enhance and expand formal education. Important findings include:

- Most of the children are engaged in outdoor activities with their families, including gardening.
- Most of these students have visited the garden with both family and classes.
- In general, students like science and think of science as exploration and discovery.
- Students thought of many ways that the garden can help them learn science and they believe computers belong in the garden.

The 4-H Children's Garden programs will enable students to identify their assumptions, use critical and logical thinking, and consider alternative explanations. By doing this, students actively develop their understanding of science by combining scientific knowledge with reasoning and thinking skills.

APPENDIX A

APPENDIX A: COMMUNICATION WITH PARENTS

Dear Families,

My name is Stacy Messenger and I am a graduate student at Michigan State University pursuing a master's degree in Horticulture, focusing on Education. I am interested in the effects of informal education on children and their understanding of science. Informal education is loosely defined as learning that takes place outside of the classroom. Currently, I am studying the relationship between field trip experiences and classroom learning. It is my thinking that hands-on experiences can strongly reinforce textbook learning, as well as increase interest in subject material. For some children, this experiential learning may be the key to liking school. Few studies have been done with young children.

I am looking for families of 3rd and 4th graders to participate in this study. Participation involves parents filling out a survey form about activities that you do with your children to establish a baseline of the exposure 3rd and 4th graders as a group have had in science. This form should only take about 10 minutes to complete. Children would be involved at school, as part of their instruction from their teachers. They would do activities as a class with Dr. Norm Lownds, curator of the 4-H Children's Garden at Michigan State University and myself. This program is pre-approved by your child's teacher and he/she will be actively involved in its delivery. Your children will be asked to complete a survey about the 4-H Children's Garden at Michigan State University, as well as general questions about science.

Attached you will find a permission slip that would give authorization for your child to participate in the survey at school and would have you fill out and return the survey mentioned above. I cannot promise this will be beneficial to your child; however, children have enjoyed doing these activities. In addition, no child will be forced to participate in the survey, should they choose not to. The information gathered from this study will be used for the purposes of this project only and the confidentiality of all participants will be maintained. Filling out the permission slip does not obligate you to participate in the study. You may drop out at any time.

I would very much appreciate your cooperation and assistance with this project. Please take a few moments to fill out the attached permission slip and survey. Please return this entire booklet in the return envelope one week from the date you received it. Your child should return it to their teachers and I will collect them from him/her. If you have any questions or concerns, please feel free to contact me. Thank you for your help.

Sincerely,

Stacy L. Messenger (517) 887-1150
Dr. Norm Lownds (517) 432-5657 – Graduate Advisor/Curator of the 4-H Children's Garden
Dr. David E. Wright (517) 355-2180 - Chair, University Committee on Research Involving Human Subjects

APPENDIX B

APPENDIX B: PERMISSION SLIPS

ADULT PERMISSION SLIP

You have read the letter explaining the project about children and their interest in science. You can discontinue your involvement in this project at any time without explanation. You voluntarily agree to participate in this research project and complete the following survey.

_____ _____

Parent Signature Date

CHILD PERMISSION SLIP

You have read the letter explaining the project about children and their interest in science. You hereby give permission for your child _____ to participate in this project. You can discontinue your child's involvement in this project at any time without explanation. You voluntarily agree to allow your child to participate in this research project.

_____ _____

Parent Signature Date

TEACHER PERMISSION SLIP

You have read the letter explaining the project about children and their interest in science. You have also spoken to Dr. Norman Lownds about your role in the classroom during his visits. You agree to work with Dr. Lownds and Stacy Messenger on presentations in my classroom. You can discontinue your involvement in this project at any time without explanation. You voluntarily agree to participate in this research project.

_____ _____

Teacher Signature Date

PRINCIPAL PERMISSION SLIP

You have read the letter explaining the project about children and their interest in science. You have also read the survey administered to the parents and the classroom surveys administered to students. You know that Dr. Norman Lownds and Stacy Messenger will be working with a few teachers in this school during the school day and that their presentations will not interfere with normal instruction and standards. You can discontinue your school's involvement in this project at any time without explanation. You voluntarily agree to participate in this research project and complete the attached survey.

_____ _____

Principal Signature Date

APPENDIX C

APPENDIX C: INSTRUMENTS

PARENT SURVEY

The goal of this survey is to find out the past experiences that young children have had with science in an informal (outside of the classroom) setting. Please indicate your response to the questions below by placing a check mark in the box beside the best answer to the question. Please check one answer, unless otherwise stated. This survey should be filled out by the custodial parents.

1. Where do you live in the community?
   - ❑ Rural/Farm
   - ❑ Rural/Non-Farm
   - ❑ Subdivision
   - ❑ Town or City

2. In which type of housing do you live?
   - ❑ House
   - ❑ Trailer
   - ❑ Apartment
   - ❑ Other

3. Do you have a yard where you and your family reside?
   - ❑ No Yard
   - ❑ Small Yard (less than 1 acre)
   - ❑ Medium Yard (between 1-2 acres)
   - ❑ Large Yard (2 or more acres)

4. How long have you lived in your current home?
   - ❑ Less than 1 month
   - ❑ Less than 1 year
   - ❑ 1-3 years
   - ❑ 3-5 years
   - ❑ over 5 years

5. Do you plant a vegetable garden or a flower garden at your home?
   - ❑ No
   - ❑ Vegetable Garden
   - ❑ Flower Garden
   - ❑ Both a vegetable and a flower garden

6. Does your child participate in gardening activities?
   - ❑ Yes
   - ❑ No

7. What is their favorite outdoor activity? _____

_____

8. To what extent is your family involved in outdoor activities? (Check all that apply).
   - ❑ Ride bikes together
   - ❑ Go for walks (walking the dog counts)
   - ❑ Go to parks and do outdoor activities there
   - ❑ Visit the 4-H Children's Garden at Michigan State University
   - ❑ Other _____
   - ❑ None

9. How often does your family go to the 4-H Children's Garden?
   - ❑ Never
   - ❑ Rarely
   - ❑ Occasionally
   - ❑ Often
   - ❑ As much as possible

10. What other family members accompany you and your child/children on these outdoor excursions? (Check all that apply).

- ❑ Grandparents
- ❑ Older siblings
- ❑ Younger siblings
- ❑ Aunts/Uncles
- ❑ Other _____

11. Does your child enjoying playing outside?

- ❑ Very Much enjoys playing outside
- ❑ Moderately enjoys playing outside
- ❑ Doesn't really like to play outside
- ❑ I have to force him/her to play outside

12. What is your age?

Mother

- ❑ 18-25 years
- ❑ 26-35 years
- ❑ 36-45 years
- ❑ 46 – up

Father

- ❑ 18-25 years
- ❑ 26-35 years
- ❑ 36-45 years
- ❑ 46 – up

13. What is your occupation?

Mother _____

Father _____

14. What is the highest level of school you have completed?

Mother

- ❑ 8th grade or less
- ❑ Some High School
- ❑ High School Graduate
- ❑ Some College
- ❑ College Graduate
- ❑ Graduate or Professional School

Father

- ❑ 8th grade or less
- ❑ Some High School
- ❑ High School Graduate
- ❑ Some College
- ❑ College Graduate
- ❑ Graduate or Professional School

15. Please check the amount that comes closest to your total net income (including all forms) before taxes last year in 1999.

- ❑ Less than $10,000
- ❑ $10,001 – 20,000
- ❑ $20,001 – 30,000
- ❑ $30,001 – 55,000
- ❑ $55,001 – 75,000
- ❑ Over $75,000

16. Does your child:

- ❑ Love Science
- ❑ Like Science
- ❑ Dislike Science
- ❑ Hate Science
- ❑ I don't know if s/he likes science or not

17. Does your child seem to learn best when
    - ❑ There is a concrete object for him/her to look at and touch
    - ❑ There is a large volume of reading material to be discussed after reading
    - ❑ There is a person to ask questions of and assist him/her as s/he learns about something brand new.
    - ❑ When both reading and visual/tactile lessons are administered together.

18. How often does your child have science homework?
    - ❑ Never
    - ❑ Once a week
    - ❑ Twice a week
    - ❑ Three times a week
    - ❑ Four times a week
    - ❑ Five times a week

19. Who provides the most assistance with his/her science homework? (check all that apply)
    - ❑ Older Brother
    - ❑ Older Sister
    - ❑ Mom
    - ❑ Dad
    - ❑ Younger Brother
    - ❑ Younger Sister
    - ❑ Friend
    - ❑ No one
    - ❑ Other _____

20. Do you like science?
    - ❑ Yes
    - ❑ No
    - ❑ Indifferent

21. What does your child want to be when he/she grows up (Please don't ask them this question now. Answer according to previous conversations with them)?

_____

22. Is there anything else that you would like us to know about your child and the subject of science? _____

_____

_____

Thank you very much for taking time to fill out this survey. We hope that our study will make a difference in education of young children.

SCHOOL SURVEY –

Below is an example of the survey your child will complete in school, as an assignment. There are slight variations to the questions for the different classes completing the survey, depending on the materials presented to them and grade level (3rd or 4th). The goal of this survey is to find out the experiences that young children have had with science in an informal (outside of the classroom) setting.

Name: _____
First Name and Initial of Last Name

General Information - Connected Classrooms

Please answer these questions. There are no wrong answers. We need the wise answers of 3rd graders so we can make trips to the 4-H Children's Garden even better.

1. How old are you? _____
2. Are you a: Boy Girl
3. What city do you live in? _____
4. How many brothers and/or sisters do you have? _____
5. How old are your brothers? _____ How old are your sisters? _____
6. What would you show them if you took them to the 4-H Children's Garden?

   _____

7. Have they ever shown you something really **COOL** in the 4-H Children's Garden?

   _____

8. Have you been to the 4-H Children's Garden before? Yes No
9. Who brought you? _____
10. Who takes care of (is in charge of) the 4-H Children's Garden?

    _____

11. Who do you think works in the 4-H Children's Garden?

    _____

12. Are there computers in the 4-H Children's Garden? Yes No

13. What are computers in the 4-H Children's Garden used for?

_____

_____

14. Do you think there should be a computer in the 4-H Children's Garden?
    Yes No
15. What are you studying in science right now? _____
16. Can you think of any way the 4-H Children's Garden might help you learn about science? _____
17. What did you like best about the program Dr. Norm did with you?

_____

18. Do you remember what you learned when you visited the greenhouses at MSU this fall? _____
19. What is a habitat? _____
20. What group were you in? Butterfly Frog Tree Soil People
21. What did you learn about your habitat?_____

THANKS FOR ANSWERING THESE IMPORTANT QUESTIONS!!

Name: _____
First Name and Initial of Last Name

Science Information - Connected Classrooms

Please answer these questions. There are no wrong answers. We need the wise answers of 3rd graders so we can make trips to the 4-H Children's Garden even better.

1. How old are you? _____
2. Are you a: Boy Girl
3. What is science? _____

_____

4. Have you learned about famous scientists? Yes No
5. Write the name of one scientist that you have heard of or read about.

_____

6. Scientists are not always famous. They can be everyday people, your neighbor, your mom or your dad. Can you name one that you know?

_____

7. What is a scientist? _____

_____

8. What does a scientist study? _____
9. What kind of tools does a scientist use? _____
10. Do you think that scientists work in the 4-H Children's Garden? Yes No
11. If they do work in the garden, what do they study? _____

_____

12. Can third graders do science experiments? Yes No
13. Can third graders be scientists? Yes No
14. Can teachers be scientists? Yes No

MORE ON BACK!

15. Arrange these things in the order that you would do them to do a science experiment (put a 1 in front of the thing you would do first, a 2 in front of the second thing until you have them all numbered).

_____ Do an experiment
_____ Ask a question
_____ Explain your answer
_____ Make a hypothesis
_____ Find an answer
_____ Do research
_____ Ask new questions

16. Have you ever used computers in science?	Yes	No
17. Have you ever used a computer to:		
18. Look at science "stuff" on the computer?	Yes	No
19. Create science reports?	Yes	No
20. Create science experiments?	Yes	No
21. Write science reports?	Yes	No

22. What is your favorite subject in school? _____
23. Who helps you the most with your homework? _____
24. Who helps you with your science homework? _____
25. Who helps you with your math homework? _____
26. Who helps you with your spelling words? _____
27. Who helps you with your social studies homework? _____

Thanks! Great work!

APPENDIX D

APPENDIX D: COMMUNICATION WITH TEACHERS

Dear _____, Date:_____

The following surveys are used to collect information from your students. This information will be gathered again to measure the progress your students have made. Please follow the instructions below so that the information we gather is as consistent as possible from one classroom to the next. Thanks!

- Administer both surveys to ALL of your students.
- When assisting your students, please do not suggest an answer for them.
- If it is not possible to administer these surveys as individual assignments, please note this, the reason, and the manner in which the kids were divided into groups. It would be greatly appreciated if each child completed his/her own survey.

Thanks for your cooperation. If you have any questions about giving these tests to your students, please contact Norm Lownds at 432-5657 or Stacy Messenger at 887-1150.

Dear Teachers- 4/10/00

The packet that needs to be distributed to your students contains a parent survey, a permission slip and a copy of the survey that your students will take in class. Each child in your class needs to take one packet home for his/her parent to sign and also have them complete a parent survey. This is explained in a letter to the parents.

Please distribute these forms as early in the week of 4/10/00 as possible and have your students **return them to you** within a week or less of distributing them. Dr. Norm Lownds or myself will be collecting these packets on Friday, April 21 from you. It is very important that we have all of the packets back to us by this date. Thank you very much for your assistance.

Stacy Messenger
887-1150 Please call me if you have any questions or concerns. Thanks.

Reminder

Just a reminder note that you should have received a packet of information from school that your son/daughter brought home. This packet explains a survey that your son/daughter may take, if permission is granted. It also contains a survey for you, the parent, to complete, if you agree to participate. Please complete the permission slips as appropriate and send this packet back to school with your child. Your child's teacher will collect the permission slips and return them to me. Thank you for your help.

Sincerely,
Stacy L. Messenger
(517) 887-1150

APPENDIX E

APPENDIX E: MATIERALS LISTING

Materials Listing of 3rd Grade Activities

Connected Classrooms Field Trip
LIVING THINGS

October 13, 1999

1. Arrive about 12:30 pm, gather in the Amphitheater

2. Introduction to what we will be doing

3. Break into groups within each class - Tree Scientists, Vegetable Scientists, Butterfly Scientists, Plant Scientists, Frog Scientists, Soil Scientists, People Scientists

4. Explorations

a) Life Cycles	Creation Station
b) Habitat	Around the garden
c) Pyramid of numbers / Predators	By the garden house
d) Interactions with People	Kiosk in the tree house
e) Your Questions	Throughout the garden

5. Wrap up — Amphitheater

6. "Play time" (10 to 15 minutes)

Name _____ Scientist Group _____

LIFE CYCLES

What changes do the living things you study go through in their life?

1. Write out the parts of your living thing's life cycle.

2. How long does each part last?

Life cycle part	How long does it last?	

3. Create your living thing's life-cycle using the paper strips:

Tan	=	1 week
Yellow	=	1 month
White	=	3 months
Green	=	1 year

a) Tape paper strips together to create the life cycle of your living thing.

b) Once you have them taped into one long piece, turn that into a circle. (for the trees, can you make it into a spiral with one circle for each year?)

c) This is your life cycle!

4. Write out one question that you have about your life cycle.

_____

_____

_____

Name _____ Scientist Group _____

HABITAT

Where do the living things that you study live?

1. Go to the area in the garden where you think they would live.
   Look over their habitat and decide, what in their habitat gives them:

   Shelter: _____

   Food: _____

   Winter protection: _____

2. Draw a picture of the habitat:

3. Write out one question that you have about this habitat.

_____

_____

_____

Name _____ Scientist Group _____

PYRAMID OF NUMBERS

1. Building pyramids of numbers:
   a) Build a pyramid of numbers that is in balance.
      1. How many producers do you have? _____
      2. How many herbivores do you have? _____
      3. How many predators do you have? _____

   b) Build a pyramid of numbers where there are six more herbivores. What happens?

      _____
      _____
      _____

   c) Build a pyramid of numbers where there are ten more predators. What happens?

      _____
      _____
      _____

2. What producers are there in the garden?

   _____

3. What herbivores are there in the garden?

   _____

4. Who is the main predator of the living thing that you study?

   _____

5. What do you think would happen to the garden if there were too many herbivores?

   _____
   _____
   _____
   _____

Name _____ Scientist Group _____

INTERACTIONS WITH HUMANS

1. How do humans affect the living things that you study?

   Fill out this table:

Human action	Good for your living thing	Bad for your living thing	Doesn't matter to you living thing
Do Nothing			
Spray Chemicals			
Remove Plants			
Integrated Management			

2. Which human action would be best for your living thing?

   _____

3. Make a sign (in the space below) that you would use to tell third graders not to hurt the living things you study.

Name _____ Scientist Group _____

YOUR QUESTIONS

1. What are your questions about the living things that you study?

_____
_____
_____

2. What stuff do you need to collect to answer your questions?

_____
_____
_____
_____

3. What is the answer to your question?

_____
_____
_____

4. What do you think would be the coolest thing about being your kind of scientist?

_____
_____
_____

MAPS & DIRECTIONS - How do you find your way home?

Using this map of the garden do these things:

1. Fill in the directions on the compass rose.

2. Mark on the map where your habitat is.

3. Draw a route from the entrance to your habitat for someone else to follow.

4. What direction would you have to go to get to:

   The dance chimes _____

   The Tree House _____

   The bridge over the pond _____

   The railroad tracks _____

5. How far is it from the entrance to your home (habitat)?

   _____

Materials Listing of 4th Grade Activities

Connected Classrooms

Mrs. K's 4th grade – October, 1999

We will be exploring ways to use the school garden to supplement and enhance 4th grade science explorations. This will be done by:

a) Collecting 'stuff' from the garden (digital images, numerical data, drawings, ideas, plant parts, etc.)
b) Using this 'stuff' to do science
c) Using technology to support and enhance the science explorations.

General Outline:

1. **Pre-visit activities:**
   a) General Information Survey
   b) Science Information Survey
   c) Create groups and assign the types of scientists.
   d) Students will find out what the real name of their type of scientist and some things about that type of scientist
   e) Briefing on what they will be doing during their field trip to the garden
2. **Visit:**
   What is in soil?
   What plants are in the garden?
   What happens to plants when they freeze?
3. **Post-visit:**
   a) Proposed activity:
   1. Look at the images collected, devise ways to use them
   2. Connect with Dr. Norm to discuss the field trip, look at the images, ask questions, etc.)

Other ideas for post-visit activities:

1. Create a report on the answer to their question. (Use images they collected, contact Dr. Norm to get additional information/photos).
2. Create an overall field trip report
3. Write a story about the field trip using images
4. Write a summary for each type of scientist
5. Ask questions of Dr. Norm
6. Create a web page

Plant Scientist - Annual, Perennial, Maple, Spruce

Name: _____

What Plants are in the Garden?

1. Go outside and look closely at one of these types of plants:
   Maple tree / Spruce Tree / Annual in the garden / Perennial in the garden

2. Describe with words and pictures these parts of your plant:

a) Roots

b) Stem

c) Leaves

d) Flowers

e) Fruit

3. Collect whatever parts of your plants that you can find and bring them back into the lab (classroom). What should we do with them?

4. Take photos of the parts of your plant and anything else that is interesting about your plant.

4-H Children's Garden – "Talk Back"

Today you are going to be testing (for the very first time ever) the 4-H Children's Garden "Talk Back" software that we are working on.

Here is what we are going to do.

1. Log on to your computer
2. Start Netscape Communicator – it is the E.A.R.N. icon on your computer desktop.
3. Type the URL: **4hgarden.msu.edu/chat.html**
4. Click on- Click here to open the chat
5. Next click on your picture (at the bottom of the page) and then click on the flower in the bottom right corner.
6. Click on the scientist group that you were in when we collected stuff outside, and then click on the flower in the bottom right corner.

Now you are in the chat. The top of your screen is a regular web page and the bottom is the "Talk Back". In the "Talk Back" part of the window you will be able to "talk" to other scientists in your group (annuals with annuals, perennials with perennials, etc.) and to Dr. Norm. So, try this:

1. Play with "Talk Back" for a few minutes. See what it will do.
2. Send some messages to the other scientists in your group.
3. Send a message to Dr. Norm.

Now we move on to the real work.

1. I am going to change the web page (top of your screen). When it changes, follow the directions on that page.
2. I will change the web page again, this time to the pictures that we took with each scientist group.
    a) Look at your pictures.
    b) Send a message to the other scientists in your group telling them what picture you like best.
    c) Send Dr. Norm a question about your favorite picture (be sure to tell him which picture it is so he can look at it too).

4-H Children's Garden - "Talk Back"

11/30/99

Could you please answer these questions?

1. What scientist group were you in?

   Annual Perennial Maple Spruce

2. Have you ever used an internet chat before?

   Yes No

3. What did you like most about "Talk Back"?

_____
_____
_____
_____

4. What fun things could you make "Talk Back" do?

_____
_____
_____
_____

5. What would you like to have changed or added to "Talk Back"?

_____
_____
_____
_____

6. What are some ways you can think of to use "Talk Back" for science or something else?

_____
_____
_____
_____

7. Would you like to do more with "Talk Back"?

   Yes No

4-H Children's Garden - "Talk Back"

12/7/99

Today we are going to be using the 4-H Children's Garden "Talk Back" software again. I know you probably remember, but in case you don't, here is what you do to get to the chat site:

1. Log on to your computer
2. Start Netscape Communicator - it the E.A.R.N. icon on your computer desktop.
3. Type in this URL: **4hgarden.msu.edu/chat.html**
4. Click on - Click here to open the chat
5. Next, click on your picture (at the bottom of the page) and then click on the flower in the bottom right corner.
6. Click on the scientist group that you were in when we collected stuff outside, and then click on the flower in the bottom right corner.

Now you are in the chat. The top of your screen is a regular web page and the bottom is the "Talk Back". In the "Talk Back" part of the window you will be able to "talk" to other scientists in your group (annuals with annuals, perennials with perennials, etc.) and to Dr. Norm.

Here is what we are going to do today.

1. I will change the web page (top of your screen) to the pictures that we took with each scientist group.
   a) Look at your pictures.
   b) Send a message to the other scientists in your group telling them what picture you like best.
   c) Send Dr. Norm a question about one of your pictures (be sure to tell him which picture it is so he can look at it too).

2. Put your favorite picture in a Word document.
   a) Put the mouse on the picture you want to use
   b) Click your right mouse button
   c) Select "Save Image As"
   d) Save the image to your desktop
   e) Start Word 97 and insert the picture
   f) Make the picture smaller so it is only about 2 inches tall and wide
   g) Write a few sentences that tell what the picture is and why you took it.
   h) Print the picture and your text.

4-H Children's Garden - "Talk Back"

Here are the instructions for getting into the "Talk Back".

1. Log on to your computer.
2. Start Netscape Communicator - it is the E.A.R.N. icon on your computer desktop.
3. Type in this URL: **4hgarden.msu.edu/askdrnorm**
4. It will now ask you for your User Name and Password
   User Name = Bee Password = **** and click OK
5. Click on Dr. Norm
6. Next click on your picture (at the bottom of the page) and then click on the flower in the bottom right corner.
7. Click on your scientist group and then click on the flower in the bottom right corner.

Congratulations! You made it into "Talk Back"!

The top of your screen is a regular web page and the bottom is the "Talk Back". In the "Talk Back" part of the window you will be able to "talk" to other scientists in your group (annuals with annuals, perennials with perennials, maples with maples, and spruce with spruce) and all of you can talk to Dr. Norm.

Tuesday, February 8, 2000

Here is what we are going to do today.

1. Use the "Talk Back"
   a) Send a greeting message to your fellow scientists
   b) Send a greeting message to Dr. Norm
   c) Try "Talk Back" in Graphic mode
   d) Try "Talk Back" in Text Mode
   e) Send a message to your fellow scientists that says which mode you like best.
   f) Whisper a message to someone in your group
   g) If there is something you really like, send a message to Dr. Norm and tell him
   h) If there is something you really don't like, send a message to Dr. Norm and tell him.

2. Respond to "Headline"
   a) I will change the headline (brown bar at the top that has your group)
   b) Look at the question that is there and answer it - whisper your answer to Dr. Norm
   c) I will change the headline again - "What happens to your plant's leaves in winter weather?"

3. Look at another web site to get information
   a) I will send you to another web site
   b) Use it to find information about what happens to plant leaves in winter weather

THIS IS AS FAR AS WE WILL GET TODAY.

4. Set up your next "meeting" with Dr. Norm. He will have more information about your plants and questions for you to explore.
   a) You have to set up your next meeting without talking to Dr. Norm face to face
   b) Make sure you have written confirmation of the meeting day, time and method.

Finding information, creating a web page of answers

Tuesday, February 15, 2000

Today I need each scientist group to sit near each other because you are going to have to discuss some things and work together.

Annuals - Aerialle, Anthony, Brandon, Geni, Tyler
Perennials - Adam, Grace, Ian, Rachael, Ayse
Maples - Aaron, Molly, Nathan, Angela
Spruce - Ashley, Allison, Camille, Kara, Mike

Today you will be using "Talk Back" and Netscape Composer to do some exploring and create a web page that has what you find. I will be asking you some questions and sending you to web pages to find information. Then you will cut and paste the information into a web page that we will use later.

Here is what you need to do:

1. Log on to "Talk Back"

Question 1: (Describe winter weather)

1. I will ask you a question - You will see it in the brown bar across the top of the chat.
2. I will also change the top part of your page.
3. When you are ready to type your answer to the question do this:
   a) Scroll to the bottom of the page that is in the browser part of your screen (the top half) and click on your group's "Web Work Space"
   b) Then click on **FILE** and then **EDIT FRAME**
   c) Now you can write the answer to your question
   d) To get back to the chat page, click the button along the bottom that has the little pen and say's "4-H G....."

Question 2: (What happens to plants in the winter?)

1. I will change the question in the chat
2. I will send you to a web page to look for the answer
3. When you find the answer, highlight it on the page and then click: **EDIT** and **COPY**
4. Bring up your web page again - click the button along the bottom that has the little pen and says "Untitl...."
5. **PASTE** the answer to the question into your web page

Now save your web page:

1. Click **FILE** and then **SAVE AS**
2. Save the file to the desktop on your computer. Use the same file name as it already has.

Question 3: (What parts of your plants stay alive through the winter?)

1. I will change the question again.
2. I will send your browser window back to the 4th grade pictures page
3. Answer this question using pictures from this page
4. Put the picture or pictures into your web page
   a) When you have the picture you want, put the cursor on the picture and right mouse click
   b) Then click on **COPY IMAGE LOCATION**
   c) Bring up your web page - (click the button along the bottom that has a little pen and says "Untitl...."
   d) Paste the image into your web page
   e) Resize the image so it isn't so big
5. Go back to the chat window

Question 4: (How can you explain that parts of plants will survive below freezing temperatures?)

1. Add your thought to your web page.

Printing your web page

Often is it useful to print your web page so you have a paper copy.
Then you can:

- Edit
- See what is missing
- Decide what questions you have for Dr. Norm
- Show it to others

I will change your browser window so that it shows your current web page.

1. When your browser window changes, do these things:
   a) Look at the information that is there
   b) Try the links and look at the pictures

2. Now print your web page
   a) Click on **FILE**
   b) Click on **Print Frame (Page)**

3. Now use the paper copy of your web page to:
   - Edit what is there
   - Figure out what information is missing
   - Think of questions that you need to ask Dr. Norm

Next week you will connect up with Dr. Norm while he is in his office and you can ask your questions.

Scientist Groups:

Annuals - Aerialle, Anthony, Brandon, Geni, Tyler
Perennials - Adam, Grace, Ian, Rachael, Ayse
Maples - Aaron, Molly, Nathan, Angela
Spruce - Ashley, Allison, Camille, Kara, Mike

Plant Explorations - April 18, 2000
Creating web pages of useful plant information.

Today we are going to work on creating web pages again. I would like you to work in your scientist groups, and make up two groups of each kind of scientist. One group will work on Spring and Summer and the other group will work on Autumn and Winter.

1. Log on to the computer.
2. Start Netscape Navigator - click on the E.A.R.N. icon on your computer.

You are going to be working with two programs at the same time. So do this:

- Connect to this URL: http://www.msu.edu/~lownds/wcliff/4th.html
- You will use this web site to collect images that you will ass to your information page
- Pick out pictures that you want to add to your information page

Next minimize the window you are working in and start another Netscape Navigator 3:

1. Go to this URL: http://www.msu.edu/~lownds.wcliff/plants.html
2. Go to the bottom of the page and select your scientist group
3. When you get to your Plant Information page:
   Click on **FILE**
   Then click on **EDIT PAGE**
   Now fill in the table with information for each season

(Plant Group)	SPRING	SUMMER	AUTUMN	WINTER
ROOTS				
STEM				
LEAVES				
FLOWERS				
FRUIT				
SEEDS				

4. To add links to pictures.
   - Click on the Netscape - Garden Photos button along the bottom
   - Look at the pictures
   - When you find one you want to include, click in the **LOCATION WINDOW** (this should highlight the picture URL), then click on **EDIT**, then **COPY**.
   - Go back to your plant information page (click the button along the bottom that has a pen and says Untitled
   - In your information table, highlight the text that you want to link your picture to
   - Click on **LINK**
   - Make sure your cursor is in the **LINK TO PAGE OR LOCATION SPACE**
   - Then press **CONTROL** and **V** at the same time (this will paste the picture location)
   - Press **RETURN** - now you have created a link to that picture

5. Are there also drawings or other things that you would like to include on your information page? If yes, write down what they are and if they are drawings, you can start to draw them.

6. When you have put all the information in:
   - Click on **FILE**
   - Then click on **SAVE AS**
   - Save the tile to the **DESKTOP** with the file name it already has.

APPENDIX F

APPENDIX F: UCRIHS APPROVAL

MICHIGAN STATE
UNIVERSITY

April 28, 2000

TO: Norman LOWNDS
A42 Plant & Soil Sciences

RE: **IRB# 00-213** CATEGORY:1-A, B, C

APPROVAL DATE: April 28, 2000

TITLE: A MODEL SYSTEM LINKING FORMAL AND INFORMAL EDUCATION: FIELD TRIPS, CURRICULUM STANDARDS AND THE 4-H CHILDREN'S GARDEN AT MICHIGAN STATE UNIVERSITY

The University Committee on Research Involving Human Subjects' (UCRIHS) review of this project is complete and I am pleased to advise that the rights and welfare of the human subjects appear to be adequately protected and methods to obtain informed consent are appropriate. Therefore, the **UCRIHS approved this project.**

RENEWALS: UCRIHS approval is valid for one calendar year, beginning with the approval date shown above. Projects continuing beyond one year must be renewed with the green renewal form. A maximum of four such expedited renewals possible. Investigators wishing to continue a project beyond that time need to submit it again for a complete review.
REVISIONS: UCRIHS must review any changes in procedures involving human subjects, prior to initiation of the change. If this is done at the time of renewal, please use the green renewal form. To revise an approved protocol at any other time during the year, send your written request to the UCRIHS Chair, requesting revised approval and referencing the project's IRB# and title. Include in your request a description of the change and any revised instruments, consent forms or advertisements that are applicable.
PROBLEMS/CHANGES: Should either of the following arise during the course of the work, notify UCRIHS promptly: 1) problems (unexpected side effects, complaints, etc.) involving human subjects or 2) changes in the research environment or new information indicating greater risk to the human subjects than existed when the protocol was previously reviewed and approved.

If we can be of further assistance, please contact us at 517 355-2180 or via email: UCRIHS@pilot.msu.edu. Please note that all UCRIHS forms are located on the web: http://www.msu.edu/unit/vprgs/UCRIHS/

Sincerely,

David E. Wright

David E. Wright, Ph.D.

DEW: bd

cc: Stacy Messenger
3040 Staten Ave., Apt. 2
Lansing, MI 48910

OFFICE OF
RESEARCH AND GRADUATE STUDIES
University Committee on Research Involving Human Subjects
Michigan State University
246 Administration Building
East Lansing, Michigan
48824-1046
517/355-2180
FAX: 517/353-2976
Web: www.msu.edu/user/ucrihs
E-Mail: ucrihs@msu.edu

REFERENCES

American Association for the Advancement of Science. (AAAS) (1993). *Benchmarks for Science Literacy: Project 2061*, New York, NY: Oxford University Press.

American Association for the Advancement of Science. (AAAS) (1989). *Science and Math in the Schools*. New York, NY: Oxford University Press.

American Association for the Advancement of Science. (AAAS) (1982). New York, NY: Oxford University Press.

Brandwein, Paul F. (1962). *The Teaching of Science: Elements in a Strategy for Teaching Science in the Elementary School*. Cambridge, MA: Harvard University Press.

Buckingham, D. (1993). *Towards New Literacies*. *The English and Media Magazine*, Summer: 23.

Bunting, T.E. & Cousins, L.R. (undated). *Children's Environmental Response Inventory*. Unpublished Instrument.

Castle, Ann M. (1996). MA Thesis. *Children's Exposure to the Natural Environment and Their Environmental Attitudes (An Exploratory Study)*. East Lansing, MI: Master of Arts in Family Ecology, Michigan State University.

Charp, Sylvia. (1987). Computer Use in Education. Trends, Challenges and Opportunities. In Blagovest Sendov and Ivan Stanchev (Eds.), *Children in the Information Age: Opportunities for Creativity, Innovation and New Activities*. Oxford: Pergamon Press.

Cohen, S. (1992). Promoting Ecological Awareness in Children. *Childhood Education* 68: 358-360.

Dierking, Lynn D. and Falk, John H. (1998). Audience and Accessibility. In Selma Thomas and Ann Mintz (Eds.), *The Virtual and The Real: Media in the Museum*. Washington, DC: American Association of Museums.

Gair, Nicholas P. (1997). *Outdoor Education – Theory and Practice*. Issues in Education Series. London: Cassell.

Haugland, Susan W. and Wright, June L. (1997). *Young Children and Technology: A World of Discovery*. Needham Heights, MA: A Viacom Company

Healy, Jane M. (1990). *Endangered Minds: Why Our Children Don't Think* New York, NY: Simon and Schuster.

Hemenway, H.D. (1906). *Hints and Helps for Young Gardeners.* Hartford, CT: Published by the Author.

Heppell, S. (1995). Weaned on the screen, *Getting Wired: Part 2, Sunday Times*, 7th. May.

Horton, Robert L. and Hutchinson, Suzanne. (1997). *Nurturing Science Literacy Among Youth Through Experientially Based Curriculum Materials.* Columbus, OH: National Network for Science and Technology.

Jurenka, Nancy Allen and Blass, Roseanne J. (1996). *Beyond the Bean Seed – Gardening Activities for Grades K – 6.* Englewood, CO: Teacher Ideas Press – A Division of Libraries Unlimited, Inc.

Lankford, Mary D. (1992). *Successful Field Trips.* Santa Barbara, CA: ABC-CLIO

Lovejoy, Sharon. (1991). *Sunflowers Houses: Garden Discoveries for Children of All Ages.* Loveland, CO: Interweave Press, Inc.

Lownds, Norman and the Comm Tech Lab. (1999). *Plant Problems* CD-ROM. East Lansing, MI: Michigan State University. http://4hgarden.msu.edu/

Lownds, Norman and the Comm Tech Lab. (2000). *Talk Back Chat Program.* East Lansing, MI: Michigan State University. http://4hgarden.msu.edu/askdrnorm

Michigan Department of Education. (1996). *Michigan Curriculum Framework.* Lansing, MI: Michigan Department of Education. http://cdp.mde.state.mi.us/MCF/

Mintz, Ann. (1998). Media and Museums: A Museum Perspective. In Selma Thomas and Ann Mintz (Eds.), *The Virtual and The Real: Media in the Museum.* Washington, DC: American Association of Museums.

Morrissey, Kristine and Worts, Douglas. (1998). A Place for the Muses? Negotiating the Role of Technology in Museums. In Selma Thomas and Ann Mintz (Eds.), *The Virtual and The Real: Media in the Museum.* Washington, DC: American Association of Museums.

Nabhan, Gary Paul and Trimble, Stephen. (1994). *The Geography of Childhood – Why Children Need Wild Places.* Boston, MA: Beacon Press.

National Science Resources Center. (NSRC) (1997). *Science for All Children.* Washington, DC: National Academy Press.

Perlin, Ruth R. (1998). Media, Art Museums, and Distant Audiences. In Selma Thomas and Ann Mintz (Eds.), *The Virtual and The Real: Media in the Museum.* Washington, DC: American Association of Museums.

Pettus, A. (1974). Environmental Education and Environmental Attitudes. *Journal of Environmental Education* 4: 48-51.

Rizza, Peter J., Jr. (1981). Computer-Based Education (CBE): Tomorrow's Traditional System. In The Journal of Children in Contemporary Society Series - Mary Frank (Ed.), *Young Children in a Computerized Environment.* New York: The Haworth Press.

Sanger, Jack, et. al. (1997). *Young Children, Videos and Computer Games.* Washington, DC: The Falmer Press.

Smith, Paula. (1981). The Impact of Computerization on Children's Toys and Games. In The Journal of Children in Contemporary Society Series - Mary Frank (Ed.), *Young Children in a Computerized Environment.* New York: The Haworth Press.

Snyder, I. (1994). Writing with Word Processors: The Computer's Influence on the Classroom Context. *Journal of Curriculum Studies*, 26(2): 143-62.

Surbrook, Nancy Anne. (1997). MA Thesis. *Children's Exposure to the Natural Environment and Their Environmental Attitudes (An Exploratory Study).* East Lansing, MI: Master of Arts in Family Ecology, Michigan State University.

Taba, H. (1962). *Curriculum Development: Theory and Practice.* New York: Harcourt, Brace.

U. S. Bureau of Education. (1915). *School Home-Gardening Circular 2.* Department of the Interior, Washington, D.C.

Whiren, Alice Phipps. (1995). Planning a Garden from a Child's Perspective. *Children's Environments*, 12(2): 250-255.

Wilson, Lucy Langdon Williams. (1898). *Nature Study in Elementary Schools – A Manual for Teachers.* New York, NY: The Macmillian Company.