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A Kindergarten Curriculum Guide in Environmental Education

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A KINDERGARTEN CURRICULUM GUIDE
IN
ENVIRONMENTAL EDUCATION

by

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INTRODUCTION

Understanding the interdependence of living and nonliving things is fundamental in environmental education. One cannot appreciate the significance of human impact on the environment, the need for maintenance of the world, ideas related to the quality of life or issues related to its improvement without first comprehending the interrelationships of the world. Environmental education focuses on the development of a citizenry which has knowledge and an attitude of responsibility toward the use of natural resources. To be environmentally conscious, one must have an awareness of the physical and biotic factors of the environment and the relationships among them. Gaining such awareness is a long-term process, and it is seldom achieved by repeated contact with the slogans and generalizations which are presently evident in the media.

Children should have experience over a period of years in which they will have opportunities to discover relationships for themselves. These experiences should be pleasant ones in the out-of-doors, as well as in the classroom. If teachers can guide children's natural curiosity and assist them in making their experiences rich and meaningful, the chances of having a responsible citizenry in the future are enhanced.

The assumptions of this project imply that concepts concerning the relationships among living organisms can be

assimilated by the child only if his experiences include exploration of his environment and the opportunity to discover these relationships himself. In order to help him progress, an interested, informed teacher who will encourage and help him is of prime importance.

Because progress needs to be started as early as possible, kindergarten age children will be the focus of this project. Here the school should use the opportunity to begin developing the environmentally aware citizen. Unfortunately, few texts and guides in environmental education have been developed for teachers working in the kindergarten. A beginning curriculum utilizing the curiosity in the children and the order of the environment is needed. This project will be an example of a way to fulfill this need.

Therefore, the purpose of this project is to develop a series of activities into a curriculum guide in environmental education for use by teachers in kindergarten. Specifically, this will be a kindergarten environmental education curriculum guide for approximately sixty students in three classes at Melrose Community School in Melrose, Putnam County, Florida.

DEFINITION OF TERMS

1. biotic: pertaining to life
2. ecology: the attempt to understand the relationships of plants and animals to their environments--where they live, how they live there, and why they live there. The study of the structure and function of nature.
3. environment: the sum of all forces or influences that affect an organism.
4. observe: to employ as many of one's senses as possible in obtaining information about a thing or an action.

REVIEW OF THE RELATED LITERATURE

Ideas are built on other ideas. They are dependent upon and evolve from what has gone before. Frequently their emergence is stimulated by the pressure of human problems. So it is with the concepts of ecology, and their implications for human survival and education.

The development of the disciplines of natural history, ecology, conservation, nature and conservation education, and modern educational philosophy are all closely related. Their basic tenets appear similar since they developed concurrently, and some of the people involved made contributions in more than one of the fields mentioned.

It is not the function of this project to present a detailed history of these related fields. However, it is intended that a brief account of a few outstanding contributions can serve to demonstrate the evolution of ideas.

Concepts of ecology have no single origin. They developed as the naturalists accumulated data and as physiologists became aware of environmental influences on the functioning of the individual organism. Theories of evolution originated with naturalists and are rooted in concepts of interaction. Charles Darwin (1809-1882), for example, was a naturalist who spent a great part of his life collecting and studying plants and animals. He developed the theory of evolution, and in 1859, published The Origin of Species (Abruscato and Hassard, 1977).

The significance of ecology is becoming more fully understood now, just as academic centers which give emphasis to this point of view are becoming more numerous. Almost one hundred years ago, the University of Chicago and Cornell University were the two centers in this country where outstanding ecological work was being done. The naturalists and teachers who influenced and stimulated these two groups of ecologists also had extensive influence on the development of nature and science education in the public schools.

As outstanding individuals are mentioned, it is important to remember that they were members of a dynamic human society. Perhaps they had the vision to see ahead of their time, but if they had not been able to apply their thinking to specific problems of their time, their ideas may have been lost. The moment, the place, and the idea merged, and the contribution became significant.

Louis Agassiz (1807-1873) came to America from Switzerland in 1846. He became professor of zoology at Harvard and in 1859 founded the Museum of Comparative Anatomy at Cambridge. He gave twelve lectures in zoology at Cornell University in 1868, the first year of Cornell's operation (Allee, 1949).

Agassiz "taught the men who in turn trained the pioneer American ecologists" (Allee, 1949, p. 33). A highpoint of his famous career was summer school at Penikese Island in 1873. Of this summer laboratory Allee says:

> Agassiz at the Penikese laboratory exerted an influence on American biology out of all proportion to the length of the short summer session in this, the last year of his life (Allee, 1949, p. 42).

Agassiz's attitudes concerning teaching and learning are indicated in the remarks he made to the students at the opening of the Penikese session. To the remark attributed to him, "Study nature, not books," he added:

> Whenever we study books we are one removed from the things that we would be better acquainted with ...
>
> Our way of studying will be somewhat different from instruction generally given in schools. I want to make it so different that it may appear that there is something left to be done in the system adapted in our public schools ...
>
> I shall never ask you to repeat what you have been told, but constantly ask what you have seen for yourself ... (Palmer, 1950, p. 6).

Early in the nineteenth century in Switzerland, Heinrich Pestalozzi (1746-1826) was engaged in trying to develop an education which might change the almost hopeless condition of the common people. He felt that it was only through the education of the individual that the gains of the Swiss revolution (1799) could be insured. What Pestalozzi contributed to education throughout the world was a basic idea that education consists of guiding children into a natural and orderly unfolding of their innate capacities, plus several brief experiments to show how his idea of a "child centered" school would work. His ideas were utilized by a dozen other

men with less genius but with more sense of the practical. They carried the ideas throughout Europe and the United States. The modern school is a Pestalozzian school because its work centers upon children, is adapted to them, and encourages them to grow. If one seeks the inner secret of Pestalozzi's general theory of education, he will come closest to it in the idea of organic development. The child is an organism that unfolds according to definite, orderly laws (Cole, 1950).

The implementation of Pestalozzi's ideas was evident in the beginning of the Nature Study curriculum movement at the University of Chicago where, in the 1890's, biologists were interested in the ecological problems and educators were experimenting with new ways of teaching (Eby, 1952). In 1891, Wilbur S. Jackman, dean of the University of Chicago's College of Education, published his Nature Study for Common Schools. To the dismay of teachers, who wished to find all the answers in books, this text raised many questions for the reader, but answered few. The answers were to be found through direct observation of objects and phenomena. Although Jackman's exact methods probably are used no longer, three of the principles on which he based his work are acceptable today:

1. Use materials of the environment as they become available through the seasons and as they have seasonal significance.
2. Reject close and specialized study of dead

forms and take the children into the fields and woods that they might study all nature at work.

3. Instead of looking upon nature study as supplementary to reading and writing, let nature study itself become a demand that these subjects be taught (Eby, 1952, p. 443).

Jackman combined Agassiz's and Pestalozzi's philosophies. He not only recommended that children study things in their natural environment, but also suggested that they be studied in relation to the child himself (Eby, 1952).

Except for some individuals and universities, concern for the natural resources in the United States came very slowly. The people were only ready to listen when drastic changes in water supply and crop yields could be seen within a single lifetime. By the end of the nineteenth century, the great buffalo herds were liquidated, the end of the wood supply could be forecast, and a dust bowl was in the making (Tilden, 1967).

In the spring of 1908, President Theodore Roosevelt called a White House Conference for the purpose of considering the condition of natural resources. He invited governors, members of Congress, the Cabinet, and Justices of the Supreme Court. This White House Conference marked the first nation-wide study of the problem of depleting natural resources. Much of the President's program was blocked by a small, powerful group in Congress. However, his National Conservation Commission produced an inventory of the country's natural

resources, the national forests were expanded, and an irrigation program was initiated. Citizens began to be conservation-conscious, and research in forestry, soils, agriculture, and wildlife management was proceeding. Destructive practices, however, continued (Tilden, 1967).

When Franklin D. Roosevelt became president in 1933, an army of unemployed needed work, and the forest, soil, and water resources were in deplorable condition. There was need to stem the tide of destruction and to educate for the prevention of further destruction. The knowledge, the need, and the manpower were all present when an administration, with enough vision and public support, came into office. The outcomes included: the Civilian Conservation Corps, reforesting denuded, abandoned lands, the Tennessee Valley Authority, regional development of land, the Soil Conservation Service, farm planning to control erosion (Tilden, 1967).

The environmental education movement is passing through a series of growth stages. Here in the United States, there has been an awakening to the environmental crisis (Stapp, 1970). The 1960's involved problems in the American colleges and universities and resulted in the massive response from students that is known as "Earth Day" 1970. The Environmental Education Act, passed on October 30, 1970, provided for the establishment of an Office of Environmental Education at the federal level. The purpose of the office was to stimulate the awarding of grants to support research and to pilot projects

designed to educate the public on problems of environmental quality and ecological balance (Stapp and Liston, 1975).

Education projects funded by the United States Office of Education under Section 306 of the Elementary Secondary Education Ace (ESEA) Title III encourage schools to confront environmental problems common to all or many of the states. With monies appropriated through Title III, school districts throughout the United States are developing environmental education programs (Childress, 1978). Criteria developed by the Office of Environmental Education for model environmental programs include the following:

1. Such programs should support the concept that environmental education is defined as people-centered;
2. Such programs should support the concept that the student's immediate environment is the basis of his study, and both urban and rural environments are examined;
3. Such programs should support the concept that learning is on a discovery-inquiry, problem-solving model;
4. Such programs should support the concept that the curriculum is interdisciplinary;
5. Such programs should lead to student responsibility for some aspects of environmental control and improvement (Childress, 1978).

Congress intended that Title III money be used to

supplement the customary programs of the schools, and hopefully to stimulate innovative ways of teaching and learning. Clearly, Title III can play a role in enabling schools and the communities of which they are a part, to help teach about the environment (Bedwell, 1976). Although the Environmental Education Act is the principal authority under which schools carry out environmental programs, it was apparent to congress that the funds available under the Act were not sufficient to meet the extraordinary need. Therefore, it is appropriate that Title III be used to supplement the Environmental Education Act (Childress, 1978).

During the early 1970's, a group of community and junior college teachers came together in a consortium to teach environmental education courses, and out of this group evolved the National Association for Environmental Education. The main purpose continues to be to promote environmental education and to facilitate interaction between professional environmental educators and practitioners. Another group, the Alliance for Environmental Education, attempts to coordinate environmental educational activity and encourage communication among national organizations (Stapp and Liston, 1975).

The environmental movement is now at the international level. Beginning with the 1972 United Nations Conference on the Human Environment held in Stockholm, Sweden, global attention was focused on the plight of Spaceship Earth. Among the 26 principles agreed upon by representatives of

116 participating countries was a clear emphasis on the need to establish environmental education programs worldwide. The United Nations Educational, Scientific, and Cultural Organization (UNESCO) and the United Nations Environmental Programme (UNEP) have greatly facilitated the eventual attainment of the goal. A working conference was held in Belgrade, Yugoslavia, in 1975, with sixty-four countries participating. Various regional meetings were held around the world, including the North American Regional Seminar on Environmental Education in October, 1976. Another meeting was held in Tbilisi, U.S.S.R., in 1977, during which time strategies for implementing environmental education were discussed by the seventy participating governmental representatives. Much remains to be accomplished (Siehl, 1978).

The importance of the almost infinite number and kinds of interrelationships among living things and living and nonliving things to the survival of living things is summarized in this statement by W. C. Allee:

> The probability of survival of individual living things, or of populations, increases with the degree with which they harmoniously adjust themselves to each other and their environment. This principle is basic to the concept of the balance of nature, orders the subject matter of ecology and evolution, underlies organismic and developmental biology and is the foundation for all sociology (Allee, 1949, p. 729).

CURRICULUM PROJECT

PROCEDURES

A kindergarten environmental education curriculum guide is to be developed for use in Melrose Community School, Melrose, Putnam County, Florida during the 1979-1980 school year. This is a rural, Title I school with three hundred and seventy students (approximately 55% white and 45% black) in grades kindergarten through five. The kindergarten has sixty students in three classes of twenty each.

The needs of these children have been determined by the acceptance of the following assumptions:

1. The function of education is to increase the chances for human survival.
2. Man's chances of survival increase as he gains knowledge of natural forces and learns to work in harmony with them.
3. The school has an obligation to educate children toward these understandings.
4. In planning educative experiences for children, teachers must consider the nature of the child and the way children learn.
5. Kindergarten students need concrete experiences with the guidance of a teacher who will challenge, lead and interest them to inquire into their surroundings.
6. This kind of guidance demands an environment rich in potential experiences with natural phenomena, an

environment so accepting that children can develop skills by engaging in their use.

7. Children do not yet know enough about their environment.

The assumptions outlined above will be used to develop the environmental education curriculum guide. This guide will suggest ways of improving the classroom environment and utilizing the outdoor environment of the school campus. It will contain a series of activities to be incorporated into the existing kindergarten curriculum. These activities will be presented seasonally in order to take maximum advantage of the changes evident in the out-of-doors. Through the use of these activities the students will:

1. Become familiar with the natural environment.
2. Observe the relationships between the living and nonliving in nature.
3. Observe the relationships between the living things in nature.
4. See patterns, order, sequence and reason in nature.

The activities will be evaluated by discussion, art, language experience charts, and teacher observation. The structure of this curriculum guide will be arranged in a spiral fashion; that is, the concepts introduced early in the academic year are expanded throughout the year.

The constraints of time dictated the means used to evaluate this curriculum. Feedback from experts in the

field of Early Childhood Education was sought. Four professional educators who have devoted their adult lives to the education of young children agreed to the task. Their qualifications are outstanding. One has her specialist degree in Early Childhood Education, has spent years writing, teaching at the university level, and now is teaching in kindergarten. The other three are certified early childhood educators who are actively teaching in that area.

These experts were each given the curriculum to read and the questionnaire to fill out (see appendix). Their major criticism was in the area of evaluation. They realized that some of the activities did not have clear evaluative techniques. Another criticism was in the section, Bringing Life to the Classroom. They felt the concepts to be taught were not extensive enough. One of the evaluators questioned if one of the objectives was being met. Utilizing the advise of these four teachers, modifications were made. These modifications included a means to evaluate each activity, five concepts were added to the animal section and six concepts were added to the plant section, and one of the objectives was clarified by rewriting.

Evaluating the curriculum by means of expert feedback proved quite effective. They were direct, impartially critical, and helpful in their criticisms. Overall, they were impressed with the curriculum and felt it would be both useful and usable in the classroom.

INTRODUCTION

Environmental education is an attempt to sensitize the individual to his environment. To accomplish this, the student must use every sense he possesses to experience his surroundings. Unlike other approaches where emphasis is on collecting and identifying, here understanding and awareness are the goals.

Ideally, environmental education develops a way of looking at things; a way of thinking of the commonplace as well as the unusual; a way of feeling the climate of one's surroundings. The concept is elusive. It is an overall dynamic and committed program which invites participation and emphasizes doing and creating. It is light and shadow, texture and vantage point. It is a quiet time when we are linked together with nature; a time when we come to grips with ourselves as a small part of an immense world. It is a beginning, not an end.

The goal of these activities is not to cover distance, but to uncover feelings; to instill a natural openness for intuitive and reflective growth; to develop a heart that watches and receives. The nature of life is nature. Bodies grow. They need light and air and water and soil just like the trees. And like plants, bodies thrive with space and attention. It is important for a young person to see the exquisite lines, the interrelatedness, the formidability yet fragility of all life; to see the pattern, the delicate

harmony, and the balance of all living things. If a teacher can create a sense of excitement, and wonder, and love of life, they will have enriched life forever. These activities are geared toward this goal. Hopefully, they will get the teacher thinking, for good teachers do not just teach; they create a variety of learning situations.

INSTRUCTIONAL PACKAGE

LIFE OUTSIDE THE CLASSROOM

MANY THINGS MAKE UP YOUR ENVIRONMENT.

Take a walk around the school. Look around. Listen, smell, touch things. Taste. Talk about things observed. What things did you like? What things would you change?

OUR ENVIRONMENT HAS LIVING THINGS IN IT.

Discuss with students the characteristics of living things. Living things can grow and change. They can make more living things. They can die. Go for a walk. Find living things. Show five living things to a friend.

OUR ENVIRONMENT HAS NON-LIVING THINGS IN IT.

Discuss with students the characteristics of non-living things. Non-living things do not grow nor reproduce. Non-living things do change. Go for a walk. Look for non-living things. Make a crayon rubbing of a non-living thing.

PEOPLE CAN CHANGE OUR ENVIRONMENT.

Go outside and lie down on your back under a tree. Describe the following:

Branches moving.

Noises of the wind in the branches and leaves.

Clouds as they show through the branches and leaves. Return to class and list as many ways as you can that man might change what you heard and saw. Discuss ways we can prevent others from destroying what you like about what you saw.

THE ENVIRONMENT CAN BE ALTERED.

Take students outside to a large shade tree where there is grass. Have students lie down on their backs with you around the trunk of the tree. Everyone's feet should touch the trunk with heads away from trunk.

1. Have students describe shapes above them.
2. Tell students they are part of the tree and ask how they feel about a bird building a nest in their branches.
3. A squirrel moves into the tree and the tree and roots must react to this.
4. There is the sound of a chain saw. What are the roots feeling?
5. The tree has been cut down and its wood is to be used for: school, hospital, church, fireplace. What are their feelings?

THE ENVIRONMENT IS INTERRELATED.

Discuss life requirements of plants: sunlight, water, air and soil. Have students take a survey of the areas on campus where plants do not grow. Determine which of the major requirements for plant life is missing. (Bare ground on paths or playground sites can be related to soil compaction which reduces the necessary amounts of air in the soil. Stress the importance of burrowing organisms and plant roots to loosen and aerate such soils.

Activity to prove need for aeration of soil: Take one

shovel of soil from a bare path. (Be sure to fill the hole with soil from another area.) Break soil apart, crumble, place in wooden box, water, place in sun or bright window. Expect to see many little weeds emerge. Why didn't these seeds sprout while in the pathway? Why don't seeds sprout in heavily shaded areas?

PLANTS HAVE A FRAGRANCE.

Lead your class to the most natural area you have on campus. Instruct children to smell as many flowers, plants, vines, and trees as they can. Ask them to choose the fragrance they like the most and the fragrance they like the least. Demonstrate the proper method of smelling a leaf before beginning this activity. Rub the leaf between the thumb and forefinger to release the fragrance of the plant. Bend your head down to the plant to smell. Do not break off the plant and lift it to your nose. Emphasize respect for living things. Teach children to recognize poison ivy before they disperse on their own.

PLANTS PRODUCE LIKE PLANTS.

Examine a mature tree on your school grounds and compare this adult tree with a young sprout or seedling of the same species. Sprouts will naturally be found growing beneath or nearby the mature tree. Ask students to discuss:

How the juvenile specimen is similar to the mature tree?

How the sprout is unlike the mature tree?

Relate this to their own growth, resemblance to their parents, and genetics in general.

SOME PLANTS HAVE SEEDS.

Have students search the weedy areas for six different kinds of seeds. They return and display the seeds, with the teacher leading the discussion on what seeds are and how each type is dispersed. (hitch-hiking, spiny seeds, wind-dispersed feathery or wing seeds, bird-scattered smooth seeds, etc.)

THERE ARE DIFFERENT KINDS OF PLANTS.

Have students collect a variety of plants (weeds, ferns, leaves, grasses, etc.). Each species is carefully sealed on file cards with clear contact paper. Name of plant and place collected should be added. The cards can be placed around the wall, or serve as flash cards to familiarize students with local flora. Care should be taken to avoid bubbles of trapped air beneath the contact paper. These specimens should last for several years.

THE ENVIRONMENT IS INTERRELATED.

Have students go outside and identify different objects and have interaction among these objects. Students can pick some natural things, then through discussion compose a list of other things that interact with this chosen object. Example: tree -- sun, air, water, soil, birds, insects, man.

EACH NATURAL OBJECT HAS ITS OWN CHARACTERISTICS.

Have each student collect one thing from the campus. These things should be rocks, leaves, seeds, etc. Whenever possible, the object should be something the student has never seen before on the school grounds. Each child should hold his object for the others to see, then the rest of the class should tell what they know about it.

NATURE IS ABOUNDING IN DIFFERENT TEXTURES.

Hold a short discussion concerning textures. Then take your class outside and have them identify different types of tree bark, grass, weeds, sand, different soils, leaves, etc. By getting as close as possible to these items and blocking out extraneous materials, the texture becomes an art form. Have students lay paper over the texture, then rub with the side of a crayon or colored chalk. It is interesting to put the designs around the room and have the rest of the class guess what the texture is from.

Have students collect dried seeds, sticks, moss, and other natural materials from around the school campus. Glue materials onto construction paper to produce a collage.

Have students collect leaves, twigs, and any other natural objects from campus. Construct mobiles from these natural objects. The leaves should be pressed dried before used. The mobiles can be hung throughout the school.

Have class draw a large tree on poster board or large paper. Have students collect leaves and/or other objects found in trees from the campus and glue them onto the tree.

Make a leaf of clay. Ingredients for clay:

1 cup salt

2 cups flour

½ cup water

2 tablespoons oil

Stir salt, flour, water and oil until well mixed. Roll out clay to a flat shap and press leaf, vein side down, onto clay. Remove leaf carefully and place clay in a slow, 250° oven for several hours. After clay leaf has dried, it can be coated with clear shellac. If you wish to hang, insert screw eye or paperclip before baking.

LEAVES CHANGE COLOR IN AUTUMN.

Start to collect leaves in the autumn when they begin falling from the trees. Select perfect leaves with bright colors. Cut up newspaper and place each leaf between a sheet of paper. Place a heavy object on top. Do not disturb for one week. When leaves are dry and flat, place a piece of cloth on your ironing board. Cut strips of waxed paper. Place one under and one on top of leaves. Press with a warm iron. Repeat, using fresh waxed paper until all the leaves are coated. Collect some sticks from the campus and make colorful mobiles with these leaves.

THERE ARE SOUNDS IN OUR ENVIRONMENT.

To help students develop listening ability, take your class outside and record all the sounds they hear in five minutes. Each child draws a picture of one of the sounds heard. Make a bulletin board with the title "Sounds of the School Grounds."

NATURE HAS USABLE COLORS.

To explore the natural pigments, give each child one sheet of white paper. A clipboard or a piece of cardboard may be used to back the paper. Allow children fifteen or twenty minutes on a limited area of the campus to compose and "paint" a picture using found bits of charcoal, leaves, flowers, berries, clay, or muck. Display pictures.

NATURE IS INTERRELATED.

Take a labeled walk. Before the walk, find examples of ecological relationships such as: the home of a social insect, a plant that is dependent on another plant, a plant that is beneficial to man, a plant that is detrimental to man, evidence that an animal had been there, evidence that people had been there, etc. Mark these places. Ask the children why they think each place was chosen. Discuss.

LIVING THINGS RESPOND TO THEIR ENVIRONMENT.

PLANTS CHANGE WITH THE SEASONS.

On a sunny day in September begin this lesson by reading the following riddle:

Can you guess? What starts from something smaller than a bee, and soon gets bigger than you and me? What's bare in the winter and bright in the fall and makes shade in the summer, for one and all? What do boys like to climb, and girls do too? And gives many good things to me and you? A tree of course.

Take a walk around the campus and "adopt" a tree. Note: the students perceive this tree as being theirs and they will study it all year long. Visit the tree often during the course of the school year and make observations. The teacher should keep a chart and record changes in the tree that can be observed. Perhaps take pictures as the seasons change.

BRINGING LIFE TO THE CLASSROOM

ANIMALS

Many young children seldom have desirable contact with animals except, perhaps, with a family pet. Unfortunately, some children have undesirable, even frightening, contacts with animals such as rats and cockroaches. It seems important that children be provided with opportunities to learn about animals firsthand.

Among the concepts children may develop as a result of firsthand experiences with animals are:

Animals change as they grow.

There are many different kinds of animals.

There are likenesses and differences among animals.

Animals need food.

Animals have different environments.

Animals have different ways of moving about.

When animals are in people's care, they depend on people to provide them with proper food and shelter, and to keep them clean.

It is suggested that experiences with animals be continuous throughout the year. At least one kind of animal should be available for observation at all times. In addition, children should be taken on short excursions to become acquainted with animals in outdoor seetings.

Guinea Pigs

Cages for small mammals may be made by first making a

frame, 24 inches x 16 inches x 12 inches, from narrow strips of wood. The sides, not the top or bottom, of the frame should be covered with screening or hardware cloth. No top is needed since guinea pigs are not climbers. The lack of a bottom will allow for easier cleaning of the cage.

The cage should be set on the sheet of plastic sheeting, or plastic table cloth, that is covered with several layers of newspapers. Each day, the newspapers should be discarded and fresh ones supplied. Obtain a water bottle and food hopper from a pet store. Feed the guinea commercial guinea pig food supplemented with fresh carrot, lettuce, or other fresh greens.

Two or three children at a time can help clean the cage and feed the guinea pigs each day. Feeding can be great fun since these little mammals whistle and squeal, especially at mealtime. Teach children to be very gentle with little animals.

Chicks

Prepare a brooder for the chicks by removing the top and bottom from a box (24" x 20" x 8") and placing it on some plastic sheeting. Cover the sheeting inside the box with newspapers. Chick feed, purchased at a feed store, should be placed in a dish and water in another dish. If the temperature in the room drops below 75°, arrange a gooseneck lamp so that the bulb heats the inside of the brooder. The newspapers should be changed daily. This size box will accommodate about six chicks. They can remain

there for about three weeks. Then they should be donated to a local farm.

Spiders

Look for spiders in shrubs, in the cracks of tree trunks, on window panes, in the fields and woods. Give spiders a large container so they will have room to build their webs. The container should be closed with a screen top, or one that admits air. Except for jumping spiders, they can be confined by means of a wide moat of water, such as a large baking pan with a flowerpot filled with soil in the center. In this, two sticks can be anchored about 4 to 6 inches apart. In this kind of container a spider may build its web and the process watched.

Throw a fly into the web and observe how the spider shrouds it with silk. Later, if the spider is hungry, it will insert its mouthparts into the bundled-up fly. Discuss with students how they think the spider is a useful animal.

Earthworms

Turn over a shovelfull of dirt in a damp spot under a tree, or in a garden. The younger, smaller earthworms will be near the surface and the larger ones may be as deep as a yard underground. Keep the worms in a large container made of some material that can be wet. Perhaps a plastic dishpan. Fill container about 4 inches deep with soil mixed with peat.

Keep this well watered but not waterlogged. Feed with grass cuttings, corn meal or bits of food. Place this on top of the soil and cover with a fresh layer of soil every few days. From time to time dump the contents of the worm's container on a large sheet of paper to observe worms, to handle them, and to find cocoons and young worms. Discuss with the students how the earthworm is helpful to the soil. Have them draw a picture of the earthworm.

Crickets

Crickets may be obtained either by catching some in fields or buying them at a fishbait store. Provide crickets with a large terrarium with a screen cover. A styrofoam cooler may also be used. Place about 4 inches of dry soil in the bottom of the container. Since crickets need dry soil but females will only lay their eggs in moist soil, bury a small bowl in the soil so that its top edge is level with the top of the soil. Fill the bowl with soil and keep it moist. The female crickets will use this bowl as the place in which to lay eggs. Scatter pieces of shredded paper and short lengths of cardboard tubes on top of the soil for the crickets to have little hiding places. The basic food should be a dry cereal such as oatmeal. Every now and then place a piece of apple, potato, or carrot for them. Also a dish with some damp paper toweling is good. Cricket eggs hatch into nymphs which look like small adult crickets except

without wings. The nymphs become adults in less than eight weeks. Have students discuss the life cycle of the cricket. Draw each stage.

Ants

Follow an ant trail until you come upon a hole in the ground or other evidence of an ant colony. When obtaining the ants, the queen ant must be included or else the colony will soon die out. She is distinguished by being much larger than the other ants.

Ant farms may be purchased. These are composed of two panes of glass securely fastened in a frame which is attached to a base. The space between the two panes is filled with soil. An opening with a cover for the insertion of food is located at the top. It is not necessary to buy a commercial product. An ant farm can be made by placing a shallow baking pan inside a larger one. This larger outer pan is kept filled with water to prevent ants from escaping. A pane of glass is placed over the inner pan. The inner pan is filled with soil and a shovelful of ants added. It is essential to keep a dark covering over the ant colony at all times except when observing. Otherwise the ants will burrow down and become inactive.

Ants go through a complete metamorphosis: egg, larvae, pupae, adult. Have students discuss and draw the different stages of development.

Butterflies and Moths

A small two gallon aquarium, a large plastic container, or a gallon jar may be used for a cage. It must be covered securely with screening or cheesecloth. About ½ inch of gravel should be placed in the bottom. Then the gravel should be covered with about an inch of garden soil. Grass seed or bird seed is then sprinkled on the soil and allowed to grow to about one inch before introducing the insects. Sprinkle the soil with water every day. Place a small branch and some twigs upright in the soil.

It will be necessary to determine the kind of caterpillar that is to be kept in the cage in order to provide proper food. Caterpillars need a constant supply of fresh leaves. These may be picked daily and placed in the cage after removing any wilted leaves. Or insert the stem ends of leaves in a bottle about ¼ filled with water and plug the opening with cotton. When the bottle is placed on its side, the caterpillars can reach the leaves easily.

The cage may be stocked with cocoons of moths or chrysalises of butterflies at the outset. This avoids the caterpillar food problem. If you collect the cocoons or chrysalises, do not attempt to detach them from branches or stems. Cut off a portion of the branch and place it in the cage. Leave the cocoon or chrysalis otherwise undisturbed. If cocoons or chrysalises are ordered from a supply house, attach them to a small branch by winding thread around them

and the branch. Moth and butterflies will feed on a thick solution of sugar and water. Unless the insect emerges during very cold weather, it should be set free.

Guppies

The aquarium will need a water heater, an air pump, a filter, and a thermometer. Since baby guppies are born alive, they will need plenty of plants to hide and keep safe in. If the female guppy is pregnant, you will need a "nursery trap" to keep her in until she gives birth. The tiny babies will leave the trap and swim to safety among the plants. They will need to be fed brine shrimp or special food for the first few weeks. Students will make a language chart about the birth of the babies or draw them.

Tadpoles

In the spring, take a walk to nearby stream, pond, or lake. Look along the edge for something that looks like strands of clear jelly with dark spots. These are fertilized frog eggs. Scoop up about a cup of these eggs, along with some of the plants and green scum that is in the water. Put them into an aquarium whose water has aged at least two weeks. Put a glass cover or plastic cover over the aquarium. The eggs should hatch into tadpoles in about six days. Getting the tadpoles to grow into adult frogs indoors is hard to do and will take a few months. If you want to try, follow the steps below. If not, return the tadpoles to the

place where you got the eggs.

From tadpoles to frogs:

1. To give the tadpoles an environment that will let them grow into frogs, you will need very few tadpoles. After six tadpoles have appeared, remove the remaining eggs and return them to pond or stream.
2. Buy some fresh-water fish food at a pet store. Add a pinch of it to the water each day.
3. If any of the tadpoles die, remove them from the water as soon as possible.
4. If after a month or two you have more than two tadpoles left, return any extras to the pond.
5. Your two tadpoles are well on the way to becoming frogs. Since the frogs will be air breathers, they will need an environment that has a place for them to stay when they are not in the water. Add rocks to the aquarium until you have one part of the tank that is above water level. Have children compose language charts and drawings of the life cycle of the frog.

PLANTS

An outdoor environment can be brought indoors with plants. By caring for the plants, observing their changes, a child will become involved in this natural phenomena. Many plants, some from seeds, some from cuttings, some from roots, can be enjoyed indoors.

The experiences that follow are not intended for

passive observers. Rather, they provide for a "hands-on" approach, encouraging children to touch, to smell, to measure, to compare — in short, to develop concepts about plant and parts of plants through active experiencing. The concepts to be developed are:

Seeds grow into plants.

There are many kinds of plants.

Flowers are part of plants.

New plants grow from parts of plants.

Plants need light.

Plants need water.

Some plants can grow from roots.

Some plants can grow from their stem.

Some plants can climb.

Plants can make the indoors a more interesting place.

When plants are indoors they depend on people to care for them.

The getting started is often the most fun. The seed bed can be almost anything the children decide on: empty milk cartons, coffee cans, aluminum foil loaf pans, margarine dishes. Whatever is decided upon, punch holes in the bottom for excess water drainage. Use premixed potting soil and fill within one-half inch of the top. Water until it is completely damp. Plant seeds, put in light, but not direct sunlight, cover with plastic wrap, and watch for new life to appear. Remove plastic wrap and observe growth. Try to have many plants growing in the classroom. This will

enhance the environment and the learning.

Morning Glory Vine

Morning glory vines may be started anytime. Soak 8 to 10 seeds in a cup of lukewarm water for 24 hours before planting. Place small stones in bottom of flower pot. Fill pot with soil up to one inch from top. Place soaked seeds in pot. Cover seeds with ½ inch more soil. Press soil down firmly. Set pot in pan of water. When dirt at top of pot feels damp, remove from water. Fasten plastic wrap over top with rubber band. Do not place in direct sunlight. Remove covering when seeds sprout. Set in sunny window. When plants have formed second set of leaves it is time to thin them. Using scissors, cut off all but the two strongest-looking plants. When plants are about 6 or 8 inches tall give them strings to climb on. Keep the plants watered everyday or so, and before you know it you will have flowers in bloom. Have students notice how the vine climbs the string. Have the class keep a graph of how high the plant grows.

Avocado

Bring an avocado to school to share with children. Remove seed, then insert three toothpicks around the waist of the seed. Place it pointed-end up in a glass of water and suspend it from rim by toothpicks. Add a few pebbles of charcoal to water to keep water fresher. Avocado seeds

can take from a few days to over a month to germinate. When the shoot is 3 or 4 inches tall, it can be potted. Set in a light window. Chart its growth weekly.

Buy seeds that will grow indoors. Follow package directions.

Finding Seeds

On walks on the school campus keep a lookout for seeds. Bring these back to the classroom for planting. Discuss the needs of these seeds in order to grow. Plant them.

Seeds in Fruits and Vegetables

Have children bring from home fruits and vegetables. Example fruits: orange, lemon, line, grapefruit, peach, mango, melon, grape, apple, cherry
Example vegetables: peas in pods, green beans, squash, green pepper, cucumbers. Explore the fruit or vegetable together. Find the seeds. Wash thoroughly. Stratify or plant immediately. Discuss what these seeds need to grow. With at least two of each kind of seed, experiment with light vs. no light, water vs. no water, warmth vs. refrigeration. Discuss results.

A Garden in a Nutshell

Fill walnut shell with potting soil. Sprinkle with rye grass seed. Water. Place in light window. Discuss why seeds grow. (Have control garden: one with no water, and one with water and no soil.) Discuss results.

ROOT CROPS

Sweet Potato

Select an old, firm, plump sweet potato that has some sprouts. With fatter part up, place sweet potato half in and half out of the jar. Use toothpicks to hold it if necessary. Fill jar with water so it just touches the end of tuber. Set jar in a cool, dark place for ten days. Bring the jar into warm, light place. Add water as necessary to keep water level up. When vine is fairly young and shoots are no more than 2 or 3 inches long, remove all but 3 or 4 of the strongest. Discuss what students did to help plant grow.

Beet, Carrot, Parsnip

Cut back green tops of vegetables to within an inch of the root. Cut the root itself back to two or three inches. Place the vegetable in a bowl. Put pebbles around them to keep the roots firmly in place. Pour in water to cover the roots but not the tops. Set the bowl in a light window. See that the water level stays up. Discuss with students what they did to help plants grow.

Hanging Vegetable Roots

Turnips, beets and rutabagas are best. Choose the fattest to be found. Hollow out the pointed end.
three toothpicks around the sides. Tie heavy cord to each toothpick end and kno together at the top. Now the vegetable

can be suspended as its own hanging basket. The hollow must be kept filled with water. Fill at least twice a day. Have one root that is not watered. Discuss difference. Ask for whys.

A Plant from a Top

Bring in a pineapple to share with the children. Twist off the top part, that is, the stem and the leaves. Remove the lower leaves, exposing $1\frac{1}{2}$ inches to 2 inches. Place the top in a small glass and fill with water up to the lowest remaining leaves. Add water to maintain this level. When glass is about half filled with roots, transplant into a peat moss filled flowerpot. To induce blooming, put plant in a large plastic bag, add a ripe apple, and twist the bag closed. Do not disturb for five days, then remove and resume normal care. Within $2\frac{1}{2}$ to 3 months the pineapple will be flowering. From the flowering will come a small pineapple. Draw a picture of the plant with the flowers.

Growing Vines in Water

Vines grow best in water if they are in a glass container rather than in one which you cannot see through. Look for interesting and unusual-shaped pitchers, bottles and jars in clear or colored glass. The children might bring in empty mustard jars, perfume, olive oil, or salad dressing bottles. Have them search.

Vines that grow well are ivy, philodendron, wandering

jew. Take off tip-end branches or "sips," 6 to 12 inches long from a healthy plant. Cut slip off with a sharp knife, making a diagonal cut just below a leaf. Remove three or four of the lower leaves. Fill glass jar with water. Place cut end of the slip in the jar. See that no leaves are in the water. Set the jar in a light window. A north, east or west window is best. None of these plants like the hot sun. Add water as needed. Have students notice what happens to immersed stems. Discuss why the roots are forming. Look at roots with magnifying glass. Draw pictures of them.

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APPENDIX

RATIONALE FOR QUESTIONNAIRE

Questions 1, 2, 3

Every curriculum must have objectives, procedures and a way of evaluating the learning. Objectives establish the important learning outcomes for the course, procedures give a way to meet these objectives, and the evaluation indicates if the objectives were met.

Questions 4 and 7

Since this is an environmental education curriculum, it must be judged on its subject matter. It is in the field of science and should use the scientific processes.

Questions 5 and 9

Five year olds are in a developmental stage that learns but with concrete and "doing" activities. Five year olds are usually nonreaders and must have evaluations through the use of oral language, art, or other physical/manipulative activities.

Question 6

The learner is important as an individual, and must be considered in any curriculum. Psychological and physiological differences are inherent in any group of two or more. Good instructional practice must consider these.

Question 8

Convergent and divergent activities compliment each

other, and make the curriculum more meaningful as well as interesting. Convergent activities establish the cognitive base of knowledge that is necessary for deeper understandings to emerge. Divergent activities lend themselves the development of the individual as a life-long learner.

Lorena Davis

QUESTIONAIRE TO ELICIT EXPERT FEEDBACK

Because of your expertise in the field of Early Childhood Education, your evaluation of this curriculum project is being sought. Would you read the curriculum and rate each criterion on a scale of one to six? One indicates no evidence that criterion was met, and six indicates criterion was met to a high degree.

If you have any suggestions for modification and/or improvement, please give them.

1. Objectives are clearly stated.

   6

2. Procedures are consistant with objectives.

   6

3. Evaluative criteria are included.

   4

4. Concepts are representative of important learnings in environmental education.

   6

5. Activities are developmentally appropriate for five year olds.

   a) Activities are largely concrete rather than abstract.

   6 very good

   b) Activities engage the child in "doing".

   6 good

6. Activities are appropiate for the range in abilities of five year olds.

6

7. Activities involve varied scientific processes (e.g., observation, comparison, hypothesis testing, etc.).

6 excellent

8. Activities elicit divergent as well as convergent thinking.

6

9. Evaluative techniques are appropiate for five year olds.

4

COMMENTS:

QUESTIONAIRE TO ELICIT EXPERT FEEDBACK

Because of your expertise in the field of Early Childhood Education, your evaluation of this curriculum project is being sought. Would you read the curriculum and rate each criterion on a scale of one to six? One indicates no evidence that criterion was met, and six indicates criterion was met to a high degree.

If you have any suggestions for modification and/or improvement, please give them.

1. Objectives are clearly stated.

   6

2. Procedures are consistant with objectives.

   6

3. Evaluative criteria are included.

   6

4. Concepts are representative of important [illegible] environmental education.

   6

5. Activities are developmentally appropriate [illegible] year olds.

   a) Activities are largely concrete [illegible]

   6

   b) Activities engage the child in "doing".

   6

6. Activities are appropiate for the range in abilities of five year olds.

6

7. Activities involve varied scientific processes (e.g., observation, comparison, hypothesis testing, etc.).

6

8. Activities elicit divergent as well as convergent thinking.

6

9. Evaluative techniques are appropiate for five year olds.

6

COMMENTS:

Excellent curriculum activities for kindergarten children. Shows much forethought and knowledge of the needs of the children at Melrose School.

A project that would be advantageous and relative to any classroom in Florida!

A truly superb undertaking, and done with finesse and professionalism.

Diane C. Swan

QUESTIONAIRE TO ELICIT EXPERT FEEDBACK

Because of your expertise in the field of Early Childhood Education, your evaluation of this curriculum project is being sought. Would you read the curriculum and rate each criterion on a scale of one to six? One indicates no evidence that criterion was met, and six indicates criterion was met to a high degree.

If you have any suggestions for modification and/or improvement, please give them.

1. Objectives are clearly stated.

6

2. Procedures are consistant with objectives.

3

3. Evaluative criteria are included.

4

4. Concepts are representative of important learnings in environmental education.

6

5. Activities are developmentally appropriate for 4-7 year olds.

a) Activities are largely achievable within this range.

6

b) Activities engage the child in "doing"

6

6. Activities are appropiate for the range in abilities of five year olds.

6

7. Activities involve varied scientific processes (e.g., observation, comparison, hypothesis testing, etc.).

5

8. Activities elicit divergent as well as convergent thinking.

6

9. Evaluative techniques are appropiate for five year olds.

6

COMMENTS:

Marjorie Hippele
by Linda Frankel

QUESTIONAIRE TO ELICIT EXPERT FEEDBACK

Because of your expertise in the field of Early Childhood Education, your evaluation of this curriculum project is being sought. Would you read the curriculum and rate each criterion on a scale of one to six? One indicates no evidence that criterion was met, and six indicates criterion was met to a high degree.

If you have any suggestions for modification and/or improvement, please give them.

1. Objectives are clearly stated.
   5

2. Procedures are consistant with objectives.
   5

3. Evaluative criteria are included.
   4 - Some activities need more evaluation.

4. Concepts are representative of important [illegible] in environmental education.
   6

5. Activities are developmentally appropriate [illegible] year olds.

   a) Activities are largely concrete [illegible]
      6

   b) Activities engage the child in "doing".
      6

6. Activities are appropiate for the range in abilities of five year olds.

5

7. Activities involve varied scientific processes (e.g., observation, comparison, hypothesis testing, etc.).

5

8. Activities elicit divergent as well as convergent thinking.

6

9. Evaluative techniques are appropiate for five year olds.

5 - Techniques are appropriate. Be more specific for the evaluation of each activity.

COMMENTS:

Overall good project! Needs more work in the area of evaluation.

Jane Dooley