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An outdoor education curriculum for primary grades: Kindergarten through third

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AN OUTDOOR EDUCATION CURRICULUM FOR PRIMARY GRADES: KINDERGARTEN THROUGH THIRD

A Project

Presented to the

Faculty of

California State University,

San Bernardino

In Partial Fulfillment

of the Requirements for the Degree

Master of Arts

in

Education: Environmental Education

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ABSTRACT

A sustainable environment in which the needs of the present population are met without compromising the ability of future generations to meet their own needs is not possible without patterns of conserving behavior and positive values toward the environment. Now is the time for behaviors to change and become pro-environmental and the best approach to encourage change is to concentrate on the education of children. It is imperative for teachers to expose students to environmental experiences in order to promote positive actions and to take care of the world for future generations.

Relevance in environmental studies is dependent on children's natural curiosity, on their expanding interests, and on their need for explanations about the world in all its dimensions. Through environmental studies, children will begin to see how they fit into the total pattern and what part they play in sustaining our world. Having an outdoor garden at the school will allow children the opportunity to explore and learn about their surrounding world.

This project includes a step-by-step guide to creating an outdoor garden area on school sites, instructions on how to make compost, and a collection of activities and lessons

for easy implementation in grades kindergarten through third. Background information is provided for concept development. The example site was cultivated in Phelan, a rural area located in the high desert, yet near to mountains. Thought was given to the type of plants that would grow in a seasonal environment. The lessons and activities were also designed around the changing weather.

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INTRODUCTION

As the human population of the world grows, the stress that is being placed on the earth's resources continues to increase. These resources include all elements that comprise the earth's many interwoven and connected systems, such as water, atmosphere, soil, plants, and animals. Not only are humans dependent on these vital life-supporting systems, they are also the very ones who are damaging them. Humans, being much of the cause of many of the problems that now threaten the earth's systems, must become educated caretakers of these resources if the survival of our species is to continue. Education is the key to change; change in thinking, change in the uses and abuses of the resources, and change in bringing about future actions to save the planet.

Environmental issues must be a permanent concern in our society. The decisions people make now about resource use, waste disposal, and pollution control have great impacts on our lives and those of future generations. Environmental education is necessary to give the children of today the tools required to address problems that are affecting our world environment. Thus, by teaching issues of environmental importance, the students will acquire an understanding of their impact on world resources and become

responsible consumers. This in turn will create a future citizenry that will make positive choices toward the environment.

Environmental education is learning about the earth's natural and built environments, how they function, and the relationship people have with their surroundings including attitudes, feelings, ideas, and actions. It is a student centered approach that incorporates the needs of the student within its objectives. Environmental education taught from this perspective allows children to investigate, discover, and construct meaning from their own experiences. Thus, the involvement with the environment is of prime importance; it stimulates children to communicate because they want to tell others about their experiences, it impels expression and thought because children want to interpret their experiences, and it provokes action.

Environmental education should not be taught as an isolated subject, but be interwoven across the curriculum. The objective is not to make room for a new area of study, but rather to include environmental education across the subjects, integrating it as an inherent component. Educators need not feel engulfed with adding a new curriculum with little time to implement. As environmental education is included holistically within all academic

areas, children begin to view it not as a separate discipline but rather as an underlying attitude that affects their actions toward their surroundings. In addition, environmental lessons should proceed throughout the school year and include both indoor and outdoor settings that provide a scope for study, interpretation, and investigation.

Environmental education emphasizes three principles-appreciation, awareness, and action-in order to understand and learn why the environment is important to humans and how all living things are interdependent. Through appreciation students investigate their own nearby surroundings to understand how humans depend on the environment. Through awareness the learner uses hands-on experiences to understand why plants, wildlife, and humans that share the earth depend on each other. Lastly, through action the learner discovers why our earth environment is in danger and how they can help sustain the earth using problem solving skills. Each principle is highlighted within the curriculum.

In order for the first and second principles to be achieved, naturally occurring experiences are necessary. However, many urban and inner city children are not exposed to the natural surroundings and may not be aware of the

diversity of animals and plants that our world holds. They may never have seen aquatic life or experienced the awe of watching a caterpillar metamorphosis into a beautiful butterfly. Thus, environmental education that encompasses outdoor experiences allows all children to take an active role in nature and enables them to share in something they all know about, their immediate surroundings. Only then can environmental sensitivity be achieved.

It is thus the task of the educator to structure the learning climate to include outdoor experiences. Outdoor lessons and activities that allow children to experience nature, to satisfy their curiosity, and to enjoy the delights, mysteries, and realities of our environment, can be constructed in a simple-made garden area. By studying the area, children will have the opportunities to make close observations, to share with others, to record, to relate, and to draw conclusions about their experiences. Here is a chance for all children to understand their discoveries, to interact with each other, and to learn.

Once a basis for learning has been established and shared, children can begin to gain knowledge about their surroundings. In addition, environmental concepts, issues, and concerns can be examined to help build foundations for informed and rational decisions and aid children to acquire

the information and the skills they will need to live and prosper in a global society. Environmental lessons lead to experiences that familiarize children with their natural environment so that they may see something of the nature of its parts, while also comprehending something of its patterns as a whole.

For example, children can begin with the most familiar area of study, their family. Then by encouraging them to observe that there are animal and plant families, that the family serves many functions, that families differ, change, and involve a network of relationships, they start to see and understand that all communities have characteristics that are similar to those of the family. This then develops into a concept of community that includes interactions with the environment and how each are interdependent on the other. Through such studies, children will begin to see how they fit into the total pattern and how their actions toward the environment can make a difference, together with others and individually.

To summarize, children must experience the outdoors in order for them to appreciate nature, become aware of their actions toward their surroundings, and to develop positive behaviors that help sustain our world environment. This project is designed to aid kindergarten through third grade

teachers in developing a curriculum with outdoor lessons and activities that involves the learner directly with nature, and thus producing a future population that takes care of the world environment. Our survival is dependent on it.

REVIEW OF LITERATURE

One of the many tasks of educators today is to continuously find the time to teach added subjects within the school year. As a result, an important and essential curriculum that is often ignored or dropped is environmental education. It is often thought that environmental education should be taught within the science framework. However, in order to be most effective, environmental studies must be included and taught within all subjects. Furthermore, environmental education needs to be taught with a balance of indoor and outdoor activities in order to give children the personal experiences with nature needed to foster positive attitudes and behaviors toward the conservation of our planet. Further research and studies, however, are needed to expand on the relationship between attitude formation and behavior within the influence of the school setting.

Ecological Literacy

Orr paraphrased Garrett Hardin and stated, "ecological literacy...is the ability to ask 'What then?'" (Orr, 1992, p. 85). Orr went on to write that many children and adults do not have the foresight or understanding to recognize future consequences of their behaviors. If all the rain forests are destroyed, what then? He continued to explain

that ecological literacy is not being developed within the schools, thus undermining its importance and creating a populace that is ignorant of the consequences of its actions. Orr stated that "ecological literacy is driven by the sense of wonder, the sheer delight in being alive in a beautiful, mysterious, bountiful world" (p. 86). But "even a thorough knowledge of the facts of life and of the threats to it will not save us in the absence of the feelings of kinship with life" (p. 87). In order for this to be established, the innate fascination of a child must be captured and developed.

Thus, to teach environmental sustainability educators must adhere to six fundamental principles described by Orr:

> The first is the recognition that all education is environmental education....Second, environmental issues are complex and cannot be understood through a single discipline or department....Third, for inhabitants, education occurs in part as a dialogue with a place and has the characteristics of good conservation....Fourth, it follows that the way education occurs is as important as its content....Fifth, experience in the natural world is both an essential part of understanding the environment, and conducive to good thinking....Sixth, education relevant to the challenge of building a sustainable society will enhance the learner's competence with natural systems. (1992, p. 90-92)

These six principles are the keys to developing a populace that understands nature, its parts, and the interrelationship of all living things.

Ecological literacy requires a broad perspective that acknowledges "how people and societies relate to each other and to natural systems" (Orr, 1992, p. 92). However, this approach cannot be validated until society is willing to rethink its role with nature and possibly begin to change the very structure it was founded upon. "The concept of sustainability implies a radical change in the institutions and patterns that we have come to accept as normal" (Orr, 1992, p. 94). Once we develop ecological awareness, only then can we begin to change and understand the importance of environmental education as a means to ecological literacy.

Constructivism

In order to prepare children for a "world that demands specific knowledge and skills, but also attitudes and interests conducive to vision and creativity," teachers must balance the curriculum to include both "fact and skill acquisition and teaching for independent and expert thinking" (Brooks, 1990, p. 68). A constructivist approach can balance these two styles. According to Brooks "constructivists believe that knowledge is the result of individual constructions of reality. From their perspective, learning occurs through the continual creation

of rules and hypotheses to explain what is observed" (1990, p. 68).

Brooks went on to describe a contructivist model of learning that accounted for exploration and discovery as the initial step. "A teacher designs opportunities for students to experience the lesson concepts through direct encounters with material or information" (Brooks, 1990, p. 69). Next, the teacher presents the concepts using new information and ways of thinking. Finally, additional activities are given that involve the same concepts (1990, p. 69).

Brooks stressed four components of a constructivist approach to teaching. The first involves the "structuring of curriculum around primary concepts" that allows the students to explore the objectives (1990, p. 69). This kind of thinking parallels the course of expert thought. The next two elements of a constructivist approach are "the uncovering of alternative conceptions-or 'misconceptions'- and the attempt to understand the learner's point of view" (Brooks, 1990, p. 70). After the current ideas of the learner is established, the teacher must then structure the lessons so that a imbalance of ideas occur between the present notions of the learner and the desirable concepts. This in turn will generate a change in the misconceptions of the student. Finally, the fourth component of

constructivism is the idea of conflict. It is the "teacher's job to help students negotiate the frictions that inevitably arise is settings that provoke them to challenge ideas, most often their own" (Brooks, 1990, 70).

A review of the literature suggested a parallel between teaching strategies used in environmental education and constructivist methods. "Both philosophies require students to take an active role in learning and building on factual knowledge to improve investigation and critical thinking skills" (Klein & Merritt, 1994, p. 20). Effective environmental programs incorporate a constructivist method focused on real-life problems, active or hands-on learning, cooperative groups and peer interactions, and alternative methods for evaluating student progress.

An Outdoor Curriculum

Past research has indicated a weak correlation between environmental attitudes and behavior toward the environment. Nevertheless, "the correlation between an attitude toward a particular behavior and that behavior itself is relatively strong" (Shepard & Speelman, 1985-86, p. 20). In other words, there seems to be a consistency between an established outlook and the likelihood of performing a related behavior that reinforces that outlook. Thus,

educators need to adopt environmental programs that are designed to target and enhance amiable attitudes toward the earth, affirming a positive foundation to build on cognitively.

Shepard and Speelman also stated that "the correlation between attitudes and related behavior has also proved to be strong where the attitude has been formed or changed through direct experience with the object of the attitude" (1985-86, p. 20). This suggests that outdoor environmental approaches help to produce positive attitudes and thus favorable behavioral changes toward nature, where the learner can address the environment firsthand and become more aware of its intricate parts. Through observation and personal experiences, outdoor environmental education becomes meaningful to the learner.

The Shepard and Speelman study also indicated a connection between the duration of an outdoor program and positive attitude development toward the environment. They found that outdoor teaching programs that lasted for at least five days "seem to have had a more positive effect on environmental attitude development" (1985-86, p. 22) than one that lasted for a shorter time span. The longer the program, the stronger pro-environmental attitudes are

established. Subsequently, it would be reasonable to expect a year round outdoor program having the same results.

In an adjunction with the belief that outdoor education enhances pro-environmental attitudes, Wilson delineated a 12-item index that is designed "for developing, implementing, and evaluating environmental education programs for young children" (1993, p. 15). To briefly outline the index, the learning experiences of the child should be focused on direct and frequent exposure to nature equated activities. Wilson stated that "to be truly effective, nature-related opportunities must be frequent, pleasant, and memorable" (p. 16). Such programs must develop purposeful environmental lessons and activities that are conducive to the earth. Finally, Wilson (1993, p. 19) urges that all environmental programs must stem from an appreciation for nature and that educators must model pro-environmental attitudes and behaviors in order for positive change to occur.

Also, to learn about and appreciate their surroundings, children need to be actively involved in the experiences. A program that allows for student-centered, hands-on encounters with the environment will foster pro-environmental attitudes. "Young children learn about the natural environment by experiencing it: by feeling,

listening, tasting, and smelling" (Wilson, 1993, p. 17). Furthermore, a variety of activities become important as children experience nature. Both indoor and outdoor projects must be included to strengthen and reinforce the ongoing connection that children have with their surroundings.

Iozzi also recommended that a balanced environmental program must "include outdoor experiences whenever possible," but not neglect the classroom environment (1989, p. 9). Children profit from going outdoors as well as conducting observations, experiments, and research within the classroom. According to Iozzi, benefits arise from a variety of teaching styles "that directly involve children in investigating real environmental problems and phenomena" (p. 11), so that firsthand observations and experiences may contribute to an appreciation of nature and conserving behaviors.

The outdoors provides a stimulating learning setting that is appropriate to environmental education. Still, many students are not able to experience the wonder of nature firsthand. "Factors restricting the use of the outdoors as a teaching resource" include "financing the travel; too large a class; lack of support from the administration; and few local sites of interest" (Harvey, 1990, p.10). Harvey

went on to add that "the school landscape, if planned and developed as a teaching resource, would alleviate some of these difficulties" (p. 10). Cultivating an area on school grounds would create a study area for students.

Harvey's study (1990) examined the impact of exposure to vegetation on a school site upon children ages eight to eleven. In general, it was found that the "role of the school landscape as a teaching resource" (p. 13) was significant to the students' "environmental dispositions" (p. 9). Harvey also reported that the developed school grounds were better than schools with little or no vegetation "in enhancing knowledge of botany and fostering beneficial attitudes to the environment"(p. 13).

In addition, as the children help to organize and create the natural area, they become invested in its purpose and learning becomes meaningful. The design of an area can range from "large open spaces kept as nature reserves, through plantings in the dead spaces between sports fields, to gardening in small containers on blacktop playgrounds in the inner cities" (Harvey, 1990, p. 10). Using school grounds as a means to teach children about the environment is of growing interest and a wonderful resource available to educators.

The literature supported that an extended outdoor program that combines various subjects is most effective in developing positive attitudes and behaviors toward the environment. However, it must be noted that the correlation between attitude formation and action is not strong and further study needs to be conducted in this area (Shepard & Speelman, 1985-86, p. 22). Yet, the results of the present findings have implications for the planning and developing of future outdoor sites.

An Interdisciplinary Approach

Environmental education is a topic that can be incorporated into several different subjects. The argument for infusing environmental studies is persuasive: "by incorporating environmental education throughout the total curriculum at every grade level, a more comprehensive treatment of environmental concerns can be accomplished" (Simmons, 1989, p. 15). In this approach, practical benefits are added. The teacher can easily implement environmental lessons into the normal scope of subject areas without excluding any and with little extra time being used. This holistic approach is promoted by most advocates of environmental education. Iozzi (1989) and Williams and Reynolds (1993) suggested some examples for infusing

environmental studies into language arts, music, art, mathematics, science, and social studies.

In language arts, there are numerous books "available for children at all grade and reading levels that deal with environmental themes, problems, and issues" (Iozzi, 1989, p. 6). Current events are highlighted so children are more interested in reading. In addition to specific environmental books, there is the opportunity for teachers to use almost any book for discussing environmental attitudes and behaviors. The teacher can use the students' prior experiences to build upon and questions related to the book to guide thinking. In addition, Williams and Reynolds (1993, p. 14) described a workable interdisciplinary unit whereby teachers used local environmental issues to involve students in communication and listening techniques.

Children can also write about environmental issues. Several ideas might include writing about personal feelings, animals and their habitats, plants and how they adapt to different areas, or the many futures of our planet. Furthermore, writing styles can be targeted. Children can write poems about the environment using a variety of techniques, letters to different organizations, or reports on a specific animal (Iozzi, 1989, p. 7).

Art and music can also be avenues in developing environmental concepts. For example, children can illustrate how they feel in a poor environment and then in a pleasant one. They can also draw pictures of what the future might be like if people practice conserving behaviors now. In addition, "there are many songs that deal with the environment that can be included in school music programs" (Iozzi, 1989, p. 7). If a song cannot be found, the children can write their own.

Mathematics is another area of study where environmental education can be easily used. Computation, measurement, velocity, fractions, and tables are but a few of the skills children can use during an investigation of environmental concepts. Also, science and social studies are natural subjects to incorporate outdoor lessons. For example, children can learn about polluted rivers and discuss the "political, economic, and social implications" of dumping wastes into local water sources (Williams & Reynolds, 1993, p. 14). In summary, there are many opportunities for teachers to incorporate environmental studies into the existing subject areas.

GOALS AND OBJECTIVES

This project is designed to aid elementary teachers in the implementation of environmental education with a strong focus on outdoor experiences in all types of schools. In the primary grades, the world with which the child is familiar is used by the teacher as a basis for the development of values, attitudes, concepts, and skills. Children learn by doing and becoming familiar with the unknown. It is anticipated that by the end of the primary years, a child will have been exposed to many concepts and issues which deal with the environment. It is far better for these experiences to occur as naturally as possible in order for the child to gain meaning and understanding from firsthand contacts.

The overall goal of this project was to help educators, in grades kindergarten through third, make these first contacts real and significant, thus promoting positive attitudes and behaviors toward the environment that is practiced throughout life. Therefore, the purposes of this project were to:

1. Develop a guide for K-3 educators that would enable them to create an outdoor garden area on school grounds.
2. Provide instruction on how to make compost.

3. Conduct extensive lessons and activities focused on environmental concepts, and extended ideas that relate to the seasons, and provides outdoor experiences.

4. Acquire background information on concepts.

5. Utilize children's literature within the classroom and relate it to the concepts covered.

DEFINITION OF TERMS

Ecological Literacy - The knowledge and understanding of the total environment including nature, culture, people, ideas, and feelings, and the interrelationship between humans and natural systems.

Environmental Education - The interdisciplinary process of developing a citizenry that is knowledgeable about the total environment, including both its natural and built aspects, that has the capacity and commitment to engage in inquiry, problem-solving, decision making, and action that will assure environmental quality (D. Stoner , personal communication, October, 1994).

Environmental Sensitivity - Having an empathetic view of the environment and of its problems and issues.

Environmental Sustainability - A view that if people work with nature to manage earth's resources, the capacity of the environment to cleanse and renew itself by natural processes will not be overloaded and do irreparable environmental damage (Miller, 1995, p. A38).

Pro-environmental - Showing positive and favorable attitudes and behaviors toward the environment.

DESIGN OF PROJECT

This project originated out of necessity to expand the environmental program used at our school site. The existing program was a combination of mini lessons obtained from different sources, over-used activities, and science related lessons. There was no continuity between grade levels and only a few teachers incorporated an environmental focus within their curriculum. As a result, we surveyed the staff at our school and found that many teachers were receptive to adding an environmental component within their subjects, as long as it did not take a lot of planning or time.

As the design of the project commenced, we noticed a lack of outdoor activities used. The most common reasons given were the weather and the lack of a natural, yet contained space for learning. Thus, our project turned in a new direction and we focused on developing an outdoor garden area to be used for part of the year, and a greenhouse for the winter months.

Many of the lessons were created and extended upon from proven activities passed along and shared from teacher to teacher. In addition, several of the ideas stemmed from published curriculum already used by educators. Ideas were also brainstormed, tried, and chosen. Most, if not all, activities included have been reviewed and used by teachers

within our school. Each lesson was shaped with added input after implementing within the learning setting.

After much time, we realized that the task we set out to achieve was overwhelming. Thus, based on our grade level experiences, we decided to modify our project to incorporate the primary grades only (kindergarten - third). In addition, other limitations may include available space and obtaining the necessary materials. Yet, suggestions have been made that target the issue of limited space and most of the materials can be found around the classroom or home.

Specific criteria was used in selecting and developing the lessons and activities included in this project and the students' needs were our priority. Objectives for the students are as follows:

1. Developing attitudes, interests, and aesthetic awareness.
2. Undertaking of observations, explorations, and investigations in real life experiences; coming to a personal understanding of human impact on the environment.
3. Manipulating hands-on activities in a meaningful context.
4. Developing basic concepts and critical thinking skills.
5. Posing questions and sharing in the discovery of their answers.

6. Acquiring knowledge and understanding of environmental concepts, including problems facing the planet and actions to take in resolving these problems.
7. Expanding communication and cooperative learning skills through guided explorations.
8. Appreciating patterns and relationships.
9. Interpreting findings critically.
10. Developing awareness of the surrounding and a sensitivity toward all living things.
11. Promoting pro-environmental attitudes and behaviors toward the environment.
12. Internalizing the strategies, skills, and benefits of self-directed learning.

IMPLICATIONS FOR EDUCATORS

Commentary

> In the year 2030, a young boy enters the long circular tube located inside his home. He presses a yellow button labeled "school" and disappears. Within moments, the boy is scurrying to his desk to get ready for the day's lesson. He is unable to step outside of buildings and into the natural environment due to the toxic wastes that encompass his surroundings.

It is important to realize that this scenario is only one way to view the future. Unfortunately, it is a realistic scene that may become the present. Our world environment is at risk of becoming a place too dangerous to live in, as air, water, and land pollution is increasing at a rate faster than natural systems can restore them. Environmental education is the tool used to gain environmental literacy. Environmental education is not easily defined and depending on the source of the definition there could be several variations. However, for the purpose of this project, environmental education is defined as an interdisciplinary approach "aimed at producing a citizenry that is knowledgeable concerning the biophysical environment and its associated problems, aware of how to help solve these problems, and motivated to work toward their solution" (Stapp et al., 1969, p. 31).

Although the family is the primary source of socialization values and formation, schools play an

important role in shaping children's values about the world around them. Environmental education is actively taught to many school children in the United States. In today's world it is important to promote pro-environmental attitudes, beliefs, and values that transfer into positive actions toward the environment with emphasis on conserving resources and reducing wastes. Many researchers believe "that the primary goal of environmental education should be to encourage people to engage in more pro-environmental behaviors" (Leeming, Dwyer, Porter, & Cobern, 1993, p. 8). Thus, children must be given the opportunity to learn and demonstrate positive actions toward our environment. In addition, children need to feel connected with the environment and that their actions are important.

In every classroom there is a climate that allows it and the participants to work together in accomplishing certain goals. Traditionally, education was based on a linear, or mechanistic, perspective that focused on teacher directed curriculum. Its main emphasis was the transmission of knowledge through set objectives and step-by-step lessons. In general, education today is reflective of this model. The teacher is in control of the lessons and what information is learned. However, a new approach to teaching has emerged within the field that stresses a holistic

perspective and organizes lessons around students' needs. Within the schools, environmental education can be taught from both positions (S. Crowell, personal communication, Spring, 1996).

Environmental education, as viewed from a mechanistic model, is based on certain assumptions that allow it to work. Lessons are designed around the curriculum to guide the experiences of the students and this is usually concentrated within the sciences. An environmental lesson planned in this manner is teacher controlled with specific outcomes and behaviors preestablished. Direct instruction is the main method of teaching that allows the teacher to convey the needed information to the students using a set format and concentrating on one aspect of the curriculum at a time (S. Crowell, personal communication, Spring, 1996).

This method works well for certain objectives and lessons, and not others. For example, if students were being taught a lesson on conserving water they would first be given a pretest to determine their level of knowledge on the subject. Next, the teacher would set the stage for the activities getting the students interested and excited. Then the teacher would explain to them what they will be studying and why it is important. The lessons on conserving water would then be taught and a final post test would be

administered to assess if the needed information was acquired.

This type of lesson does not allow the students to investigate the subject or think about its relevance to their lives; it only communicates objective information to them. Therefore, the children learn what the teacher views is important and do not have the opportunity to experience the issues firsthand. The lessons are broken down into smaller parts that are isolated and taught by using worksheets and other pre-made materials. Progress of the material is made by mastering one concept and then moving onto a new set of objectives. The children do not use the information in their own lives but only within the classroom setting, and their experiences of the issues are not used within the activities. Also, the environmental focus is on managing natural resources. A stewardship position is taken where humans are viewed as having sole responsibility toward nature by controlling its fate.

In contrast to this linear and sequential model of education is the holistic paradigm. Environmental education taught holistically takes on a new set of beliefs. Within this framework is the assumption that children learn from their experiences and that the curriculum is organized around these experiences. The lessons are designed to

include the students in meaningful activities that they can use in their everyday lives. Instead of the teacher controlling what information the students will learn by the end of the lesson, the children are in control of the data. In other words, there is a set curriculum that must be addressed but the direction it takes depends on the students and their experiences, interests, and abilities (S. Crowell, personal communication, Spring, 1996).

For example, in a water conservation lesson the goal may be to understand the need to save water in our daily lives. The students can participate in experiments that record the amount of water their families use at home currently, and then the amount of water they use after practicing water conservation behaviors. By relating water conservation to their own experience children learn the material more thoroughly and they become invested in the issue.

In addition, environmental education is a curriculum used to encourage positive environmental attitudes and behaviors. However, past studies have indicated that "awareness does not lead to behavior in the environmental dimension" (Hungerford & Volk, 1990, p. 17). Thus, the focus of environmental instruction and the key to bring about behavior change is to direct education toward issues

that involve the learner firsthand. Thus, as children become involved in issues concerning the environment, and they begin to develop positive attitudes toward the environment, they will in turn exhibit pro-environmental behaviors.

Furthermore, De Young stated that self-discovery is an important tool that "involves people undergoing a deep personal change about a certain environmental issue whereby they gain insight or understanding far beyond simple awareness" (1993, p. 488). Children who have direct experience with an environmental issue will be able to gain a deeper understanding of that issue. Hungerford and Volk also emphasized that if the goal of environmental education is to change behavior, "instruction must go beyond an 'awareness' or 'knowledge' of issues. Students must be given the opportunity to develop the sense of 'ownership' and 'empowerment' so that they are fully invested in an environmental sense and prompted to become responsible, active citizens" (1990, p. 17).

Holistic teaching also highlights relational properties. Environmental education by nature teaches people that the living world is interdependent and that everything is connected or related to something else. The holistic paradigm helps children to see that their actions

can affect the environment by focusing on critical thinking, problem solving, and inquiry skills. Children learn the new ideas and concepts when it relates to them personally and they use it in varied ways, integrating it to their own backgrounds (S. Crowell, personal communication, Spring, 1996).

The holistic model also emphasis recurrence. The living world is made up of events and patterns that repeat themselves. As environmental issues are taught from a holistic viewpoint, children begin to understand recurrence and the whole picture of how the world works. Holistic teaching should also emphasis an interdisciplinary approach by incorporating a variety of environmental topics into other curriculum areas, such as science, social studies, math, art, music, and language arts. This would allow children to be exposed to environmental concepts in a variety of settings and situations. Students would be able to understand the relationships of issues and how things are connected. Patterns will start to emerge as children engage in interdisciplinary activities (S. Crowell, personal communication, Spring, 1996).

In addition, environmental education should expose children to issues and concerns at an early age. This will increase the probability that the positive behaviors will be

learned and that pro-environmental behaviors will be practiced. In order for children to feel that their actions are important, they must be personally involved in the issue. Environmental education taught holistically is aimed at getting children involved firsthand with the environment. Starting in kindergarten, children can be exposed to their surroundings and important environmental issues by going on nature walks, planting and caring for a garden, starting a recycling center within their classroom, and conserving resources. Each concept would be expanded in subsequent grades and exponential learning would occur.

As children move up in grades, they can be further exposed to environmental issues and concerns in greater depth. Previous concepts can be built upon as children gain a better understanding about the world's resources and the impact that humans have on managing their environment. They will begin to grasp the patterns of the living world and how humans have influenced and changed them.

As environmental issues are addressed in each subject area and each grade, students will constantly be reinforced about their importance, and thus positive attitudes toward the environment will result. Reinforcement also allows children the opportunity to get involved with issues and

understand the nature of environmental concerns, therefore leading to positive and constructive behaviors.

Environmental education taught from a holistic perspective transfers the responsibility of learning from the teacher to the student and as a result, multiple possibilities of a lesson can lead to change and new ways of thinking. The children begin to process the information and the potential of learning becomes broader. The method of teaching now involves many different techniques that include the students by incorporating cooperative groups, experiments, and discovery learning into daily lessons. Children become active participants in the learning process as they share experiences and language and learn how to think about the issues. Environmental education becomes meaningful and purposeful for the students.

Accordingly, education is the means of promoting pro-environmental behavior in children and the public. As environmental concerns increase and people are looking for answers to the "problematic interactions between the quality of life and the quality of the environment for the planet's inhabitants" (Ramsey, Hungerford, & Volk, 1992, p. 35), education must address the crucial goal of teaching and promoting pro-environmental behaviors. In addition, "because education is the vehicle through which society

prepares its citizens to carry out their responsibilities, education must be environmental" (Ramsey, et al., 1992, p. 35).

Environmental education is an instrument that can be used to involve children, and adults, in issues and concerns that are affecting our world. Subsequently, people begin to change their attitudes and behaviors toward the environment, and have a positive effect on the earth's systems. As people develop positive attitudes toward nature they begin to view their relationship with the environment in a new way. They will begin to view nature and humans as one. Environmental education is a means to teach children that they are the agents of change, and it empowers them to take ownership of their actions.

Environmental education must be taught within the schools in order for children to make informed decisions about the care of our environment and to have a positive impact on our future. Children must be involved in improving our world environment, starting today. In addition, environmental education must be incorporated into the entire education process and thus producing a citizenry that fully sees itself as a continuous part of the environment. "Environmental education needs to break down the environmental myths of today and start showing the

individual connections to today's environmental problems"(Gigliotti, 1990, p. 12). Teaching environmental issues and concepts within the classroom will help students "learn what they can and should do to improve the environment and create a desire in each person to take the correct actions" (p. 12).

In summary, it is highly important that educators recognize the benefits of environmental education in shaping the attitudes and behaviors of the leaders of tomorrow to be more positive and pro-environmental. Our world environment depends on people who are sensitive, caring, knowledgeable, and willing to make a difference. Consequently, teachers need to implement environmental lessons and activities within the classroom.

However, with so many subjects to be covered as is, it is essential to incorporate environmental studies across the curriculum. Children will learn from experiencing concepts and issues in almost every subject and relating it to their own lives. In addition, to be most effective, environmental education needs to have a balance of indoor as well as outdoor activities for children to experience a variety learning settings and styles.

One of the key components of environmental education is to experience the outdoors firsthand. However, many

children do not have the opportunity to participate in field trips to natural areas and are unable to encounter them directly. Thus, an outdoor curriculum that allows children access to meaningful and real experience is needed. An outdoor garden area enables children to have direct involvement with the natural environment. Hence, teachers and children would have access every day and throughout the year to explore and learn about the environment through outdoor lessons. Students' interests in preserving and finding new ways to conserve nature should be increased as concepts and issues are studied.

Environmental education is aimed at helping students acquire a set of values concerning the maintenance and improvement of our world, as well as fostering a sense of responsibility, motivation, commitment, and positive feelings toward its survival. Wherefore, any and all contributions to this task are beneficial, significant and highly embraced. As educators begin to adopt pro-environmental lessons, it is recommended they start with easy to follow activities. Once comfortable and confident with environmental concepts and issues, lessons can be built upon and expanded to meet teachers' individual learning philosophies and teaching styles.

As educators share the wonders of their surroundings frequently, their students will be introduced to a world of beauty; by modeling a respect and appreciation of all life, teachers will instill feelings of concern for the environment in their students. Thus, as their sensitivity for the environment grows, children begin to develop life skills for promoting a sustainable world.

Appendix A
Setting Up a Garden

The first step in setting up a garden site is to look for a good location. Some aspects to consider are:

-sunlight (Full sun is best.)

-soil condition (What is the land presently used for?)

-watering facilities (Running water is preferred to carrying it in watering containers.)

-protection from vandalism.

The next step is to convince your principal and your school's parent-teacher association that this is a worthwhile project and deserves allocation of funds. You will need some donations to begin your project.

Some basic things you will need are: garden tools including rakes, hoes, shovels, trowels; a hose and sprinkler; soil additives such as fertilizer or compost; and seeds. The major expense for most garden programs is purchasing tools. If tools are of good quality and receive good care, they will last a long time and save you money in the long run.

The third step should begin sometime before spring. Use fall and winter to enrich the soil. Teach your students to make compost and work it into the soil periodically. Put in other additives recommended by a nursery in your area.

When it is time to start planning what you are going

Appendix A
Setting Up a Garden

to plant, the nursery is a good place to get advice as to what will do well in your area and growing conditions, how and when to plant, and how to care for your plants. Other good sources for information on what and when to plant are books such as Down-To-Earth Gardening Know-how For the '90s, (Raymond, 1992), and the backs of seed packets.

When choosing your seeds, be sure and check how long it will be before harvest so that students are able to reap what they have sown. There are many vegetables that can be harvested in a short period of time. Radishes and some lettuces can be harvested in 25 to 30 days. Crops such as squash, tomatoes, and corn must be watered over the summer for a fall harvest at the beginning of the next school year.

We were very fortunate as there was a vacant section of land on our school campus where there had once been portable classrooms. It already had walkways that separated 4 feet by 8 feet "garden plots" where the classrooms had been. There was even a chain-linked fence around it.

We gave out some sample lessons to teachers who were willing to commit to planting and taking care of a garden in the spring. The first year the garden was tended mostly by second graders. The teachers learned as they went.

Appendix A
Setting Up a Garden

Our school is in a rural area so many parents got involved. Before we knew it, our principal told us that the PTA had raised money to build a greenhouse in the garden area so we could garden all year long. Our plant manager then designed and built a greenhouse. It wasn't ready to use until last spring, when it was actually too hot for the air conditioner. We lost a lot of plants until we realized we needed a better way to cool it down. Our custodians then installed a sprinkling/misting system in the greenhouse so teachers can now use it without worry.

Our school is not on a year around schedule, so arrangements had to be made for the care and watering of the garden over the summer. Summer school students cared for the garden during part of this period. Custodians took over watering for the remainder of the summer in exchange for all the vegetables they could eat.

In the fall the PTA bought us worms from a worm farm. Along with the worms came a whole new set of problems. Talk about opening a can of worms! The worms were escaping from their container into the classroom. Flies also began to hatch. Worms and flies were everywhere! The worm farms had to be moved outside.

Appendix A
Setting Up a Garden

There is always something going on in the garden. In the summer it is constantly producing. Giant sunflowers tower over the fence while hundreds of tomatoes ripen beneath them. In the fall, children harvest the vegetables and save the seeds to plant in the spring. We even had pumpkins for Halloween!

Part of the garden is now being used to make compost. Some bulbs have been planted to surprise everyone in the spring. Teachers are now beginning to use the garden area for teaching other outdoor concepts such as erosion and geology. It is indeed a very valuable part of our school.

Appendix B
Composting

Compost allows students to see that "waste" may really be "nutrients in disguise." Composting is a timeless tradition of honoring the earth. It is based on the scientific principle that nothing ever really disappears. It just changes shape and takes on new forms. Compost is created through the action of microbes that grow when mixed organic refuse receives sufficient air and water.

Begin making compost by building a simple wire-mesh cage. Take a strip of wire mesh two or three feet wide and nine feet long. Fasten the ends together to form a circular cage. Place a two to six inch layer of coarse material such as brown leaves, hay or weeds in the bottom. Next sprinkle a large handful of an activator rich in nitrogen and protein such as alfalfa meal, bone meal, "Litter Green" kitty litter, or dry dogfood.

Continue building your compost pile by adding layers of green and brown waste and an activator. Moisten the pile thoroughly, but do not oversoak. Compact the outer edges of your pile, but the center must remain loose to allow air to enter. If the pile is made correctly, the temperature in the center will reach 140 to 150 degrees Fahrenheit.

In about one or two weeks, turn the pile, mixing the materials together. Move the dry, outside material to the

Appendix B
Composting

center. Moisten the pile again if it is too dry. The heating process will begin again. Compost is ready to use when it stops heating in about four to five weeks.

Appendix C
Nature Table

Bring the out-of-doors into your classroom. Use an old table, or one you are not using, to make a nature table.

1. Cover your table with two thicknesses of garbage bags: Build an edge around your table to hold two or three inches of topsoil or peatmoss.

2. Place specimens such as moss, tiny plants, leaves, and bark and arrange them in a pleasing manner.

3. Water well with a fine spray and pat in a handful of grass seed.

4. Cover with a sheet of clear plastic and watch!

Appendix D
Outdoor Lessons
Introduction

These lessons have been created for the purpose of giving primary students the opportunity to experience their environment first hand. The lessons have been organized into the seasons during which they should be taught. I began with summer because traditional school sessions begin in early September which is still summer. However, The lessons may begin in any season as gardening is a continuing cycle.

Each season includes activities that can be taught whether or not you have an established garden area. Most campuses have areas where there are flowers, trees, and grass growing. Birds and insects may be observed as well as other flora and fauna. Walks through nearby neighboorhoods can provide children with outdoor experiences in observation. The whole idea is to get them outside!

Many of the lessons include several centers through which groups of six to eight students rotate. These centers require adult supervision. Enlist helpers such as parent volunteers, classified employees, or older students. If you choose, each center could be treated as a separate lesson and may be taught as such.

Summer
Exploring the Garden

Grade Level: K-1

Duration: 60 minutes

Objective: Students begin to develop ideas about how plant needs and garden care are related. Students practice observation skills by looking at living and nonliving things that occur naturally out of doors.

Curriculum Arts: Science, Social Studies, Language Arts, Visual Arts

Background: Developing and practicing observation skills can significantly enhance learning by allowing children to become aware of and to restructure their own ideas. They will not easily abandon their prior beliefs in favor of new information. They will first call on their preconceived knowledge to interpret an event or solve a problem, rather than rely on any formal instruction they have received.

Materials:
Magnifying glasses
Butcher paper
Tagboard
Clipboards or pads of paper
Baggies
Construction paper
Glue
Masking tape

Preparation: Schedule help from aides, volunteers, or older students to accompany your students on a tour of the garden site.

Set up viewing centers in the classroom. Put magnifying glasses and trays for displaying garden samples at each center.

Summer
Exploring the Garden

Procedure:

Indoors

Share ideas about gardens and how people take care of them. Write students' ideas on butcher paper.
What do you know about gardens? What is in a garden? What do people do in gardens? What do gardens give us? What would you like to do in our garden?
Assign a small group to each helper.
Give each helper a clipboard or pad of paper for recording children's ideas.
Give each student a baggie for collecting small objects.

Outdoors

Lead the class to the garden sites. Show students the garden paths and ask why they are important. Record ideas. Show students their garden. Is anything living here now? How could we grow a plant here? Record all ideas.
Allow children to wander in the garden collecting small objects such as seeds, flowers, fruits, leaves, rocks, twigs, etc. in baggies to take back to the classroom to be placed in viewing centers.

Indoors

Demonstrate to students how to use a magnifying glass without damaging it.
Empty the children's baggies of garden samples on to trays at the various viewing centers.

Allow groups of students to rotate through the centers looking at the various objects at each center.

Make a loose-fitting bracelet out of masking tape, Sticky side out, for each student.
Have partners take turns sticking bits of garden samples on each other's bracelets to make "Nature Bracelets."

Summer
Exploring the Garden

Assessment: Observe students. Are students maintaining an interest in looking at the objects? Are students sharing the magnifying glasses and objects? Are students sharing their observations?
Ask students to recall the ideas they had during their visit to the garden. Use notes taken by helpers to help them remember. List their ideas on tagboard.

Extension: Make a class book of "Garden Ideas" illustrated by students.

Put construction paper and glue bottles at each center and allow students to use the garden specimens to create original works of art.

Summer
Sensing the Garden

Grade level: 1-2

Duration: 45 minutes

Objectives: Students experience the garden through their senses of sight, smell, hearing, and touch.

Students use their sense of sight to observe their environment.

Curriculum areas: Science, Language Arts, Visual Arts, Math

Background: This activity introduces students to learning outside the classroom. Almost every color in your classroom can be found in nature. Green and brown are most common. Students will see green leaves and stems, unripe fruits and vegetables, and insects. They will see brown soil, tree trunks, dead leaves and spiders. They may see other colors in flowers, vegetables, fruits, rocks and leaves. Students may touch several plants to experience different textures. They can pick up some soil to feel the texture and temperature; smell the soil and then compare it to the scent of various flowers and leaves; listen to the birds singing and insects buzzing around; and taste the juicy sweetness of a just picked tomato or lettuce leaf.

Materials: Crayons (colors to be observed in nature)
Lapboards
8 1/2 x 11 inch white construction paper folded into fourths

Preparation: Fold white construction into fourths (one for each pair of students).
Label each paper with the name of the assigned color.
Schedule two or three helpers (parents, associates, older students).

Procedure:

Indoors

Summer
Sensing the Garden

Hold up an object and ask students to describe it. (What color is it?).
Ask students to look around the room and tell what colors they see.
What sense do we use to find colors? (Sight).
What colors do you think we could find outside?
Assign partners.
Give each pair a lapboard, a piece of construction paper folded into fourths, and a crayon that is their assigned color.
Explain to the children that you are going to take them outside where they are to look for objects in nature that match the color you have assigned them. Try to keep their color a secret from the other children.

Outdoors

Look at the garden. What do you think lives here? What can you see?
Encourage students to use their senses to smell flowers, listen for bird and insect noises and touch plants and soil.
Show the students their boundaries and assign 2 or 3 pairs of students to each volunteer.
Tell each pair of students that they are to look for things that match their crayons and take turns drawing pictures of them (two pictures per student). Encourage them to try and print the name of each object under its picture. Ask volunteers to wander around, talking to students and helping them to spell.
When everyone is finished, go back to the classroom.

Indoors

Ask each pair of students to name one thing they found and have the rest of the class try and guess their color.
Display the pictures in the Science Center.

Assessment: What kinds of objects did you observe? Were they living or non-living?

Summer
Sensing the Garden

What senses did you use?
What did you learn about colors in nature?

Extension: Make a class book. Let each student illustrate a page with the sentence frame "I saw a _____ _____."
color object

Summer
Examining Plants

Grade Level: 2-3

Duration: 60 minutes

Objectives: Students will investigate the parts of plants.
Students will observe plants growing and changing.

Curriculum Areas: Science, Social Studies, Language Arts
Visual Arts, Math

Background: Plants are living organisms that grow and change and reproduce their own kind. They need air, soil, water, light and space to grow.

Water is essential to all life on earth. water and minerals are taken from the soil through the roots of a plant. It goes up the stem and is carried to the rest of the plant.

Plants absorb sunlight through the leaves where a process called photosynthesis takes place. During this process green plants take in carbon dioxide from the air and use it, along with minerals from the soil, to convert light energy into food for the plant.

As the plant grows, it produces flowers and fruit which eventually go to seeds which may be planted in order to grow new plants.

Materials:
8 flowers
Magnifying glasses
1- 8in. x 10in. piece of clear contact
Construction paper
White paper
3 jars
3 colors of food coloring
3 stalks of celery
8 leaves
Crayons

Summer
Examining Plants

Observation papers (Included with this lesson
Several plants with different root systems: dandelion, carrot, radish, sweet potato, grass, etc.)

Preparation:

Duplicate observation papers included with this lesson.
Assign each of four adult helpers to lead a group of six to eight students in a study of either flowers, stems, leaves, or roots. Set up four centers in the classroom for examination of plant parts.
Designate an area outdoors for each of four groups.
Inform each adult helper which plants are to be gently dug up and brought into the classroom.

Procedure:

Indoors

Divide students into three groups: flowers, leaves, and roots.
Explain that each group is going to examine an assigned plant part.

Outdoors

Each adult group leader will guide a group of students to a predesignated area the garden. Students will be encouraged to look closely and touch plants paying special attention to their assigned part. The adult group leader will gently dig up one or two plants to bring back to the classroom for further examination.

Indoors

Each group go to their assigned center to further examine their plant part with magnifying glasses. Each group then does an activity that correlates with the plant part that group has been examining.

Summer
Examining Plants

Center 1: Flowers
Have each student choose a flower. Then have each student fill out an observation sheet including a drawing of the flower, its measurements, colors, number of petals, what it smells like, what it feels like, and what it does for the plant.

Center 2: Leaves
Have each student choose a leaf. Then have each student complete an observation sheet including a drawing of the leaf, its measurements, color, what it smells like, what it feels like, and what leaves do for the plant.

Center 3: Roots
Have each student choose a root. Then have each student complete an observation sheet including a drawing of the root, its measurements, color, whether or not it is edible, and what roots do for the plant.

Assessment: Each group should give a presentation of its findings to the class.

Extensions: Fill three jars half full of water.
Have students put a different color of food coloring in each jar.
Place one stalk of celery, leaves up, in each jar.
Ask students what they think will happen and have them record their responses on their observation sheet.
Leave overnight.
Students record the results the next morning.

Give each student a rectangle of clear contact paper and a flower. Ask the students take their flower apart to look at its parts, let them arrange the flower parts into a

design on one half of the contact paper. Then fold the other half over the design and make a construction paper frame.

Make leaf rubbings.
Give students white paper and crayons to make leaf rubbings by putting the leaves under the paper and coloring the paper over them.

Summer
Examining Plants

Observation sheets

My Flower

Picture:

Colors: _____

Smells like_____

Feels like_____

Number of pedals:_____

What are flowers for?_____

_____

_____

My Leaf

Picture:

Color:_____

Measurements:_____wide

_____long

Smells like_____

Feels like_____

What are leaves for?_____

_____

Summer
Examining Plants

Observation Sheets

My Root

Picture:

Color:_____

Measurements:_____wide

_____long

Is it edible?_____

What are roots for?_____

_____

_____

Stem Experiment

What kind of stems?_____

Draw a picture of your experiment.

What did you do?_____

_____

What do you think will happen?_____

_____

What happened?_____

Fall
Exploring Soil

Grade Level: K-1

Duration: 90 minutes

Objectives: Students explore the composition of soil.
Students explore the properties of three types of soil.
Students discover how water changes soil.
Students explore textures, fluidity and saturation.

Curriculum Areas: Science, Math, Language Arts, Music, Visual Arts

Background: Seasons of freezing and thawing, heating and cooling splinter rock formations. Over time, water, wind, ice, and plant roots wear, grind, and split rock fragments into small particles. Soil bacteria, fungi, and worms break down dead plant and animal material, adding organic matter to make soil.

The organic portion of soil is made up of different sized particles. Sand grains are the largest--up to 2 mm in size. Next smaller are silt particles. The smallest, seen only under a microscope, are clay particles. Soils are mixtures of these organic particles and materials in different proportions.

Water fills the air spaces between soil particles and holds them together. When dry, minute soil particles separate from each other and can be stirred up as dust. As soil is moistened, the particles cling together. Add more water and the soil becomes stickier, until it is mud. When all the spaces between the soil particles are filled, the soil is saturated. The water settles on top in puddles or runs off.

Fall
Exploring Soil

The amount of water a soil holds depends on its particle size. Sand drains quickly as it is made up of large, loosely spaced particles. Clay holds the most water, is the stickiest when wet, and the dustiest when dry, because its particles are the smallest in size and closely packed together.

Preparation:

Schedule 3 or 4 helpers (parents, aides, older students)
Practice singing "Dirt Made My Lunch" (Arranged and copyright 1985 Banana Slug String Band Slug Music)
Set up 4 centers in the garden.

Materials:

Center 1: Digging Holes
- Trowels
- Strainers
- Tweezers
- Magnifying glasses
- Small boxes or plastic containers

Center 2: Soil Sift
- Tubs of sand, garden soil, and clay-like or gravel-like soil
- Magnifying glasses
- Colanders
- Strainers
- Funnels
- Strawberry baskets
- Plastic containers
- Marigold seeds
- 12 plastic cups
- Masking tape and marker

Center 3: Soil Soup (Teacher directed)
- 2 buckets of water
- 16-ounce plastic food containers
- Tablespoons
- Stirring sticks
- Measuring cups
- Poster board titled "Soil Soup"
- Felt pen
- Soil

Fall
Exploring Soil

Center 4: Mud Pies

Set up this center near a hose, if possible. You will need water handy for refilling buckets and rinsing pans and hands.

Pie tins
Cookie sheets
Cookie cutters
Spoons
2 buckets of water
Plastic containers
Popsicle sticks
Milk cartons
Towels
Masking tape and pen

Procedure:

Indoors

Introduce song, "Dirt Made My Lunch."
Tell students they are going out to the garden site to explore soil.
Assign partners to work in 4 groups of 6 - 8 students.
Introduce volunteers and explain that these people will be in charge of the various activities.
Explain that everyone will have a turn to do all of the activities and that you will tell them when it is time to change centers.
Assign a group to each center leader and go out to the garden.

Outdoors

Students work in pairs, in groups of 6 or 8 as they rotate through the centers, spending about 15 - 20 minutes in each center.
Each center is supervised by at least one helper.
Center leaders demonstrate to each group of students at the beginning of each session.

Fall
Exploring Soil

Center 1: <u>Digging Holes</u>
Students dig holes and sift through the soil, looking at and collecting objects such as rocks, twigs, roots, bugs, etc., and sort them into various containers. Be sure to remind students to return any living organism to its home after gently looking at it.

Center 2: <u>Soil Sift</u>
Students experiment with different tools in three different types of soil and compare their likenesses and differences.
Which type of soil pours the easiest? Which soil sticks together? Which soil would plants like to grow in? Why? Have students try all three kinds.

Have students fill each of three plastic cups with a different type of soil. Have remaining students plant three seeds in each cup. Mark each cup with the type of soil used. Place them in a window in the classroom.

Center 3: <u>Soil Soup</u> (Teacher directed)
Give each pair of students a measuring cup and each student a tablespoon and container.

Ask each student to measure 1/2 cup of soil, and pour it into their plastic container. **(Draw a picture of a measuring cup half full of soil at the top of the Soil Soup chart. Mark 1/2 cup.**

Ask students to feel the soil and describe it. Does the soil stick to your fingers? Does the soil stick together? Can you make a ball?

Ask students to add 1 tablespoon of water to their soil. What happened to the soil? Do we have soil soup yet? How much water will we need to make soil soup?

Fall
Exploring Soil

Under the heading of "Water" make a tally mark on the chart for each tablespoon of water added.

As students continue to add water, one tablespoon at a time, ask them to describe how the soil changes. Share their ideas about why the soil soaks up water.

Continue to record the number of tablespoons added until the mixture becomes soupy.

Ask students to feel with their fingers and spoons to see if the mixture pours like soup.

Encourage student pairs to tell each other about their soup. What does it look like? How does it feel? How did the soil change as they added water? What else could we put in our soup? (grass, twigs)

Ask students to count the tally marks to see how many tablespoons they added.

Center 4: Mud Pies

Students mix soil and water in plastic containers to make mud. Then they may use pie tins, cookie sheets, cookie cutters, cups, etc. to make their own creations to "cook" in the sun. Supervisor should label students' work with masking tape.

Indoors

Read "Soil Soup" chart and have students help write a recipe.

Assessment: Have each student dictate something they learned about soil. Record each student's idea (older students may print their sentence) on a sheet of construction paper.

Then have each student illustrate what they did on their page and put them together as a class book entitled "Exploring Soil."

Extension: Regularly water and observe the growing progress of the seeds that were planted in the three different types of soil. Make a graph.

Sing "Dirt Made My Lunch."

Fall
Exploring Outdoors

Grade level: 1-2

Duration: 60 minutes per day for 3 days

Objectives: Students will discover animal habitats in the out-of-doors.

Students will make observations of soil using their senses as they dig in the garden to collect worms.

Curriculum Areas: Science, Math, Language Arts, Visual Art, Music, PE

Background: Earthworms can be found in soil that is rich in organic matter. Worms prefer soil that is not too acidic (like in a pine forest) or too sandy. They instinctively avoid light to hide from their predators and to keep from drying out. Earthworms must stay moist in order to breathe.

Worms swallow soil when they tunnel and excrete it as they move along. These excretions look like little black pellets on top of the ground. They are a sure sign that worms are close by.

To find worms, look in soil that is covered by decaying leaves. If you pour water on the surface they will come up. Make sure you feed decaying leaves to captured worms.

Preparation: Schedule two or three helpers (parents, instructional aides, older students).
Sing "Dirt Made My Lunch"(Arranged and copyright 1991 Banana Slug String Band Slug Music).
Set up 3 centers indoors
Set up 3 centers outdoors, one area for soil collecting, one area for worm collecting (see

background information), and one area for locating and observing animal homes.

Indoors

Materials:
Magnifying glasses
Tweezers
White construction paper
Egg cartons
Blank cards
An aquarium or several glass jars filled with a mixture of moist garden soil and some potting soil or compost, covered with decaying leaves.
Black construction paper
Tagboard or a large sheet of butcher paper
Crayons

Center 1: Laminate sheets of white construction paper.
Provide egg cartons and tweezers for sorting soil parts.
Provide magnifying glasses for looking at soil parts
Provide cards for labeling.

Center 2: Provide an aquarium or jars of soil mixture.
Use black construction paper to make skirts that can slide up and down easily to keep out the light.
Prepare a chart for recording observations of the worms' behavior for the next few weeks.

Center 3: Provide crayons
Prepare a large graph on tagboard or butcher paper to show different places animal homes were found. Leave space for students' animal pictures.

Outdoors

Materials:
Designated areas for: soil collecting, worm collecting, and animal home observations
Paper, pencils, lapboards, tape
Trowels or spoons
Containers for bringing worms and soil back to the classroom

Fall
Exploring Outdoors

Procedure:

Indoors

Talk about soil. What is soil? What is made of? What do you think you could find in soil?
Write down student responses.
Who lives in soil? (worms).
What do worms eat?
What do we know about worms?
Write down student responses.
What other animals live outside?
What kinds of homes do they have?
Write down student responses.
Assign partners and divide students into 3 groups.
Have one or two helpers go along with each group as they are assigned to specific centers.
Have each group do 1 outdoor center and its related indoor center per day.

Outdoors

Center 1: **What is soil?**
Students work in pairs sharing a trowel or spoon.
Students spend time digging through the soil, talking to each other about what they find. Encourage students to use their senses to enhance their experience. After about 10 minutes, have each student scoop up a cupful to take back to the classroom to have a closer look.

Center 2: **Worm Hunt**
Students work in pairs sharing a trowel or spoon.
Remind students to be very careful not to injure the worms.
Talk to the students as they work. Encourage them to use their senses to look at, touch, and smell the soil as they dig through it.
Ask students to tell you about their observations. Have the students put the

worms into the container you have provided to be taken back to the classroom.

Center 3: **Animal Homes**
Students work with partners, each pair sharing paper, a pencil and a lapboard. Students are assigned to explore a large area including the garden area and any surrounding fields, looking for evidence of animal homes. They are to take turns drawing pictures of the animals they think might live there. They are then to tape their picture near the home so they will be able to find it again. Remind students not to disturb the home or the animal in any way. After the pair has marked two homes, they are to find another pair who has also finished and take turns showing each other what they found. After everyone has shown everyone else, have students collect their drawings and bring them back to the classroom.

INDOORS

Center 1: **What is Soil?**
Demonstrate to students how to *carefully* pour the soil on to the laminated mats and how to use their tweezers to poke through the soil to get small items. Talk about sharing the tweezers and magnifying glasses with their partners. Show them the egg cartons and cards. Help them label their soil parts (i.e.:grass, bones, twigs, roots, seeds, bugs, leaves, flower parts, rocks, etc.).

Assessment: Students tell about what they have in their egg cartons and what they know about soil.

Center 2: **Worm Homes**
Students gently take the worms they have brought in from the garden from the temporary containers and place them in the new homes you have prepared for them to be observed in the **Science Center** for the next few weeks.

Count how many worms there are and record the number on the chart you have prepared for recording observations during the next few weeks.
Construction paper skirts can be raised or lowered to make daily observations of the earthworms.
Don't forget to feed them daily by adding decaying leaves to the surface.
Before releasing worms into the garden, have students count them to see if there are more or fewer than before.

Assessment: Daily observations made by students.
Conclusions made at the end of the observation period as the worms are released back into the garden.

Center 3: **Animal Homes**
Discuss what kinds of homes were found and where. Which were hardest to find? Why do animals try to hide their homes? Make a graph of the different places animal homes were found (i.e.: ground, tree, bush, compost pile, cement, etc..). Use the students' animal pictures to fill in the graph.

Assessment: Which animals used materials to build a home? What did they use?
Why were there so many different kinds of homes?

Extensions: Students can experiment to find out what worms like to eat by trying things like grass clippings, oatmeal, or scrap of food in addition to the decaying leaves.

For physical education have worm races. Students keep their hands at their sides and twist and squirm across the floor.

Fall
Exploring Outdoors

Cut out pictures of animals in their habitats from old magazines (Ranger Rick or National Geographic), glue them on paper and write a sentence to describe each picture (i.e., "The robin lives in a nest in a tree."). Make a class book of Animal Homes.

Fall
Collecting Seeds

Grade Level: 2-3

Duration: 60 minutes

Objectives:
Students will discover that plants make seeds.
Students will collect and sort seeds.
Students will start new plants with collected seeds.

Curriculum Areas: Science, Math, Language Arts

Background:
Seeds come in a great variety of colors, shapes and sizes. They are made in the flowers of plants. Some seeds are designed blow in the wind. Others are designed to float in water. Still others stick to the fur or feathers of passing animals. Many seeds are encased in fruits and vegetables. Every seed, no matter how small, contains all of the genetic information needed to produce an entire plant.

Preparation:
Schedule two or three helpers (parents, instructional aides, older students).
Set up tables indoors or outdoors for groups of students to cut up fruits and vegetables to extract and sort seeds.
Designate an area outdoors, preferably a garden, for collecting seeds.

Materials:
Plastic knives
Tweezers
Magnifying glasses
Plastic containers or cups for seed-sorting
Blank cards for labeling
Scissors or garden clippers
Plastic containers or baggies for collecting
Larger knives for helpers
Fruits or vegetables for seed extraction (squash, melon, corn, apples, etc.)
Chart paper

Fall
Collecting Seeds

Procedure:

Indoors

What is a plant? How do they grow? How do they start?
Record student responses on chart paper.
Lead them to "seeds."
Where do seeds come from?
Read aloud The Carrot Seed, By Ruth Krauss(New York: HarperCollins, 1945).
Discuss.
Put students in small groups, each group with a helper.
Explain to the children that you are going to harvest the seeds without injuring the plant. The plant is still alive and will produce more fruit.

Outdoors

Take the students to the garden to collect seeds from flowers, and to harvest any fruits and vegetables. Make sure scissors or garden clippers are used so as not to injure the plant.
Allow the students time to look at the different stages of the various plants.
Remind them to be careful.
When each student has collected something, take the collection back to the classroom for further investigation.

Indoors

Have the students sit at tables with their group members and a helper.
Helper should cut open large vegetables such as squash, cucumbers and melons to show the seeds to the students.

Give each student a plastic knife and a portion of fruit to extract seeds.
Line the containers with paper towels and instruct the students to put them on top of the paper so they will dry out.
Make labels to identify the seeds.

Assessment: Ask students what they learned about seeds.

Fall
Collecting Seeds

Where did you find the seeds? Are all seeds alike? Record additional information on chart paper.
Have students write about and illustrate what they did.

Extension: Make a graph.
Students choose from the seeds they collected and plant them in cups.
Students care for their plants and record their growth.

Winter
Planning and Preparing

Grade Level: K-1

Duration: 90 minutes

Objectives: Students demonstrate how to use garden tools safely.
Students participate in preparing soil in order to grow a garden.

Curriculum Areas: Science, Language Arts, Visual Arts

Background: No matter what kind of soil you have, it can be improved with the addition of organic matter. Turning plant material back into the soil after its growing season improves the soil.

The soil is loosened by inserting a spade into the soil and moving it back and forth. Then the soil amendment is worked into the top 4 to 8 inches. Do not work in wet soil. Digging and trampling can destroy the soil's structure. If the soil clumps to shoes and tools, it is too wet to work.

Materials:
Garden tools (hoes, rakes, shovels, spades)
Compost or other soil amendment
Large bowl of soil
Cups
Spoons
Seeds
Watering can
Construction paper
Crayons of paint
Listening center and books
Poster board or butcher paper
6 to 8 copies of a garden story (i.e., Pumpkin, Pumpkin by Jeanne Titherington)

Preparation: Check garden area a few days ahead of time to make sure soil is not too wet. If it is too

dry and hard, water it a day or two before the lesson.
Schedule helpers to work with 6 to 8 students in centers.
Find a children's book about gardening, such as Pumpkin, Pumpkin by Jeanne Titherington, and make a tape for a listening center.
Set up centers in the classroom.

Center 1: Each student will plant 3 or 4 seeds in a cup to place in the window to grow and eventually be planted in the garden.

Center 2: Students will listen to a garden story at a listening center.

Center 3: Students will draw or paint what they would like to see growing in their garden, and dictate or print a sentence about their picture. Helper prints the sentence on the paper.

Procedure:

Indoors

Discuss planting a class garden. What do we need to do? What should we do first? (Get the soil ready). Soil needs to be loose so plants can grow in it. Plants need nutrients. How can we get the soil ready for planting? What can we use to help us? (Tools).

Show the class the tools and help them identify each one as you discuss what jobs each tool would be good for. Ask volunteers to help demonstrate how to use each tool. Ask students what rules should be made about using the tools safely. List safety rules on poster or butcher paper. Here are some:

*** Always walk when carrying tools; never run.**
*** Keep sharp ends below shoulder level.**
*** Make sure everyone is out of the way.**
*** Don't use a tool in a crowded area.**
*** Never leave a tool lying in the ground; always stand it up.**

Winter
Planning and Preparing

Show how rakes and shovels can spring up when stepped on.

Assign 3 groups to go to the various indoor centers.
Take the remaining group outside to the garden area. Make sure students carry the tools safely.

Outdoors

Review safety rules.
Ask for ideas about how to share the tools.
Demonstrate how to loosen the soil and mix in the additive using the different tools (See Background).
Arrange students so that they will have plenty of space between them.
As students work, check that they are using the tools safely. Observe how students negotiate the sharing of the tools. Allow time to solve problems before intervening.

Rotate groups until all students have visited all three indoor centers and had a turn in the garden.

Assessment: As students put the tools away, ask each one to share something they learned about using the tools safely.

Extension: Make a class book out of their pictures from Center 3 and allow each student to read his/her page.

Winter
Food For Plants

Grade level: 1-2

Duration: 60 minutes, 30 minutes in the morning and 30 minutes in the afternoon
60 minutes 2-3 weeks later
30 minutes in the Spring

Objectives: Students will identify and collect plant parts to be buried in moist soil in a plastic bag.
Students will observe changes in plant material that has been buried in a compost bag for 2-3 weeks.
Students discover that they can create compost to enrich soil to feed growing plants.

Curriculum Areas: Science, Visual Art, Language Arts, Math, Music

Background: The process of decomposition releases nutrients into the soil, giving plants a fertile place to grow. In a natural situation leaves drop to the ground, insects scatter droppings, birds leave egg shells, etc. These things and others eventually become part of the soil Decomposers such as earthworms, fungi, and bacteria breakdown the materials that once were alive. As more items decompose, the soil becomes richer.

Students can observe the process of decomposition in bags of soil. Moisture and temperature both effect the speed of decomposition. Leaves and grass sitting in wet, warm soil in a plastic bag should be partially decomposed in 2-3 weeks. The rate of decomposition is also related to the amount of bacteria and fungi in the soil. Potting soil you buy at the store is sterile and must be mixed with soil from the garden in order to promote decomposition.

Winter
Food For Plants

Adding composted, or decomposed material helps soil in many ways. It helps the soil hold water, it improves aeration, and it adds nutrients, making the soil more fertile so plants can grow larger and stronger.

Materials:

A large plastic garbage bag with a twist tie
Plant parts (i.e. leaves, grass clippings, twigs, apple cores, small pieces of fruits and vegetables, etc.)
2-3 gallons of moist soil from the garden, or a mixture of garden soil and potting soil
Bags for collecting plant materials
Newspaper
Tweezers
Magnifying glasses
Rubber gloves
Paper, pencils, crayons
Chart paper or butcher paper
A calendar
Teacher-made plant journals
"Everything Grows" by Raffi (Everything Grows, Raffi, AMI Records, Hollywood, CA).
Popsicle sticks

Preparation:

Collect a variety of plant material scraps (i.e. grass clippings, leaves, twigs, apple cores, small pieces of fruits and vegetables).

Prepare a gallon or so of soil in a large plastic garbage bag.

Prepare a work place outdoors

Prepare a worksheet for each student to draw "before" and "after" pictures of their chosen item for decomposition.

Staple a few sheets of paper together with a construction paper cover for each student to be used as Plant Journals.

Winter
Food For Plants

Procedure:

Indoors

Begin this lesson in the morning.
Show students some samples of plant materials and the soil that they will be using.
Ask students what they think will happen to the materials if they were buried for a long time. What do old leaves look like after they have been lying on the ground for a long time?

Outdoors

Give the students collecting bags and take them outdoors for a walk in the garden and around other areas of the school grounds. Instruct them to collect plant material to bury in their compost bag. Tell students to bring back scraps from their lunches. Avoid fats, oils and meat as these types of items will turn rancid and smell bad.

Indoors

After lunch collect the scraps the students have brought back.
Hold up several different items and have students tell what it is and where it came from. Have them predict what will happen to them after they have been buried for 2-3 weeks. Record on chart paper or butcher paper.

Ask each student choose 1 item to bury in the bag. Have them to describe their items and draw pictures on the "before" side of their worksheet.
Help students record their predictions of what will happen to the items after being buried for 2-3 weeks.

Outdoors

Have the students bring their item to the work place you have set up.

Winter
Food For Plants

Have them take turns putting on the rubber gloves and burying their item in the soil in the bag, adding soil when necessary.
When everything is mixed, blow air into the bag and tie it shut.
Bring it back to the classroom and place it in a warm spot.
Get a calendar and decide together when would be a good day to open the bag. Mark it on the calendar.
Check the bag periodically to make sure it doesn't dry out.

2 -3 Weeks Later

Indoors

Have students get out their recordings and the predictions they made of their items before they were buried in the compost bag.
Discuss these recordings and predictions.

Outdoors

Take students out to the work place where you have spread newspaper on the ground.
Begin to dump out the contents of the bag on to the newspaper.
Have students take turns putting on the rubber gloves and pulling out one item and placing it on the newspaper. Other students watch for their item to be pulled out.
Save the bag of compost to be used for planting.

Indoors

When students have identified their items, bring them inside and have them match them to their "before" pictures.
Allow students to examine their items with magnifying glasses to see what changes took place.

Instruct students to draw their item the way it looks now on the "after" side of their worksheet.

Winter
Food For Plants

Assessment: Have students describe to you what happened to their items. Help them write a sentence under their "after" drawings.

Extension: Use compost to fertilize the soil in containers for planting seeds to be placed near windows in the classroom or in a greenhouse. (Broccoli, peas, lettuce and green beans all grow well in pots).

Have the students care for their plants by giving them water and fertilizer when needed. Have students keep a journal of their plant by recording when they give it water and fertilizer and by measuring it and drawing it periodically.
Sing "Everything Grows" by Raffi (Everything Grows, Raffi, AMI Records, Hollywood, CA).

Early Spring
Indoors

Have each student compare his plant with the drawings in his plant journal. Discuss changes, growth, and time.
Draw the plant as it looks now.
Draw predictions of how it will look in 1 week, 2 weeks, 3 weeks, 1 month.

Have each student put his name on a popsicle stick and take it outside to plant with his plant.

Outdoors

Water the plants thoroughly.
Dig a hole and put a mixture of compost and soil in the hole.
Transplant the plant quickly, avoiding root exposure to the air.
Plant a little (not too much) deeper than it was in the container.
Firmly press down the soil around it.
Water.

Winter
Food For Plants

Put craft stick with student's name next to it so students can continue making recordings in their plant journals.

Assessment: Each week, have students make recordings in their plant journals and compare them with their predictions. Discuss the plant's progress.

Winter
Experiencing the Water Cycle

Grade level: 2-3

Duration: 90 minutes

Objectives: Students will participate in a demonstration of the water cycle.
Students will observe how and why water changes from solid to liquid to gas.
Students will measure and record evidence of evaporation.

Curriculum Areas: Science, Math, Language Arts, Visual Arts,Social Studies.

Background: Evaporation and condensation are two processes that take place in the water cycle. Evaporation takes place as the sun heats bodies of water on the land and causes the water to raise in temperature and evaporate into the air, forming clouds. As the clouds rise, they come in contact with cooler air. When the warm moist air of the clouds come in contact with the cool air, the vaporized water in the clouds turn to liquid and it rains. This process, is called condensation.

This process can be demonstrated in the classroom. Boil water in a small saucepan or a tea kettle. Fill a metal cake pan or cookie sheet with ice, and hold it over the steam coming from the boiling water. The "cloud" of steam will condense and form drops of water on the bottom of the metal pan. When the drops become heavy enough, they will begin to fall and it will be raining in your classroom.

Materials:
Paper cups
Measuring spoons
Hot plate
Water
Small saucepan or tea kettle

Winter
Experiencing the Water Cycle

Metal cake pan or cookie sheet
Pot holders
Ice
Observation sheets (1 for each student. See attached reproducible page).

Preparation: Run through the experiment to see how long it takes and how it works. This experiment will be affected by the air's relative humidity.

Xerox an observation sheet for each student.

Part 1
Procedure:

Outdoors

Give each pair of students a paper cup and have them label it with both names and put a tablespoon of water in their cup. Then have the students place their cups outside, some in the sun and some in the shade. Ask the students what they think will happen to the water if they leave their cups outside for an hour. Have them record their predictions on their observation sheets. Allow the students to go out and check on their cups of water a couple of times during that hour.

Indoors

After an hour, have the students retrieve their cups and record what they see. If there is any water left in their cup, have them carefully pour it back into the measuring spoon and see if it is all there.

Assessment: Ask the students what they think happened to the water. Where did it go? Which cups lost water the quickest? What caused the water to go away? Have them record their answers on their observation sheets.

Part 2:

Indoors

Then tell them that you are going to perform a demonstration to show where the water went. Ask students if they believe that you can create a rainstorm right in the classroom. Tell them that you want them to think of a

hypotheses that answers that question and write it on their observation sheet.

Turn on the hot plate to its medium-high setting. Put two cups of water in the saucepan or tea kettle and place it on the hot plate.

Put ice in the metal cake pan or cookie sheet, enough to cover the bottom of the pan. When steam is rising from the heated water, ask the students what they see happening. Discuss the meaning of the word "evaporation."

Now hold the pan of ice approximately 18 inches above the pan of water. Be sure and use pot holders to hold the pan.

Allow small groups of students to come up to the demonstration table for a closer look. Ask what is forming on the bottom of the pan of ice. Students should see tiny droplets of water. As these droplets grow in size, their weight will make it impossible for them to stay on the bottom of the pan. Soon they will begin to fall.

Discuss condensation.

Assessment: Then direct students to draw and write what they observed on their observation sheets.

Extension: Ask the students what the pan of water represents in nature. They should respond by saying a lake, ocean, river, or other body of water. What does the hot plate represent? (the sun) What is the steam? (clouds) What is the pan of ice?(cold air)

Winter
Experiencing the Water Cycle

Have the students then draw a picture of the water cycle using nature, and drawing arrows to show where the water is going.
Have them write a story to tell what is happening in their picture.

Winter
Experiencing the Water Cycle

Observation Sheet

What did you do?
Draw:

Tell: _____

_____

_____

What do you think will happen? _____

_____

_____

One hour later...

What happened?_____

_____

Why?_____

Where did the water go?_____

Winter
Experiencing the Water Cycle

Observation Sheet

Do you think your teacher can make it rain in your classroom?_____

What did your teacher do?
Draw:

Tell:_____

_____

_____

Draw a picture of the water cycle using real things in nature. Draw arrows to show where the water is going.

Tell about where the water is going._____

_____

_____

Spring
Planting and Watering

Grade Level: K - 1

Duration: 90 Minutes

Objectives: Students explore water using a variety of tools and materials.
Students discover the correct amount of water required by plants.
Students plant seeds.

Curriculum Areas: Science, Math, Social Studies, Language Arts, Visual Arts, Music

Background: Water is made up of one oxygen atom and two hydrogen atoms. The hydrogen atoms grab on to whatever oxygen atoms they come near. Therefore, water seems to cling to surfaces.

Whether an object floats or sinks depends on its density. An object floats in water if it is lighter than the quantity of water that would take up the same amount of space. While an empty bottle floats, it sinks when filled with water.

Plants, like all other living things, need water to live and grow. However, one should take care not to over-water because plants also need air. Most plants cannot get enough air from the soil when it is saturated.

Water only when it is necessary. When you do water, soak the soil 3 to 6 inches below the surface. You should encourage your plants' roots to grow as deep as possible. If you only sprinkle the surface, they will develop shallow roots and will die if it gets dry.

Preparation: Schedule 3 or 4 helpers to work with students in centers.

Spring
Planting and Watering

Purchase seeds suitable to your growing conditions.

Soak the planting area the day before you are planning to plant your seeds.

Get butcher paper or tagboard for recording ideas during introduction.

Gather materials and set up two centers indoors, and two centers outdoors.

Indoors

Center 1: Sink or Float

Materials:
2 tubs of water
Paper plates marked **"Sink"** and **"Float"**
A variety of items from the garden and classroom such as: a big rock, a little, rock, a leaf, a stick, seeds, a pencil, chalk, plastic lids, a crayon, a paper, clip, a marble, a cotton ball
30 3-inch squares of aluminum foil
Sponges and towels for clean-up

Center 2: Water drops

Materials:
3-4 small containers of water
6-8 medicine droppers
6-8 plastic lids
6-8 paper clips
6-8 plant stems, rocks, leaves, sticks, etc.
6-8 magnifying glasses
6-8 pennies
6-8 sheets of waxed paper
6-8 toothpicks

Outdoors

Center 3: Sieves and Funnels

Materials:
2 tubs of water
1 watering can
8-10 different sized empty plastic containers
An ice pick or nail

Spring
Planting and Watering

Different sized funnels (cut the tops off 1- and 2-liter soda pop bottles)

Make different kinds of sieves by punching various numbers and sizes of holes in several of the containers. Make the holes from the inside. Holes can be enlarged by inserting a pencil and pushing it through. Here are some suggestions for different sieves:
1 pencil-size hole in the center of the bottom, 1 pencil-size hole in the side, 1 pin hole in the center of the bottom, 10 pinholes on the bottom, 6 pencil-size holes.

Center 4: Planting Seeds

Materials:
Seeds
Trowels
Tongue depressors and markers
A clipboard or pad to draw a map of your garden

Procedure:

Indoors

Tell students that you are going to plant some seeds in the garden. Show the seed packets and help students identify them by looking at the pictures. Pour the seeds in bowls so the children can see what seeds look like.

Share ideas about what plants need. Plants need light, soil, water, and some space to grow. Where should we plant our seeds? (in soil) Where can plants get light? (from the sun) Where can plants get water? (from rain) What could happen if it rains too much? too little? How can we make sure out plants get the right amount of water? Record on butcher paper of tagboard.

Take half the students out to the garden area for exploring water and planting seeds. Divide the remaining students in half to spend 15 to 20 minutes at each indoor center.

Spring
Planting and Watering

Center 1: Sink or Float

As students what they think will happen as they take turns choosing objects and dropping them into the water. Thumbs up if they think it will float and thumbs down if they think it will sink. Ask students to share ideas about why some things float and some things sink. Place objects on the "sink" and "float" plates.

After each student has had a turn, crumple a square of foil into a ball and ask whether it will sink or float. Drop it in the water. Now ask what they think a flat square will do. Drop it in the water. Discuss.

Give each student their own square and allow them to experiment on their own using the other objects as well. They may place items on the "sink" and "float" plates.

Center 2: Water Drops

Ask students where they have seen water drops. Could we make water drops get bigger? Are water drops sticky?

Give each student a dropper, magnifying glass, and a plastic lid or sheet of waxed paper. Ask them to make a water drop on their surface. Can you make the drop bigger? Have students add another drop. Do the drops stick together? Have students add drops, one at a time, until their drop becomes a puddle.

What else does water stick to? Give each student a paper clip. Challenge them to stick water to it. Allow them to try the other objects you have brought to the center.

Give each student a penny. How many drops of water will stay on your penny? Record

predictions. Count together as students add one drop at a time until it spills off.

Outdoors

Divide students into 2 groups to spend 15 to 20 minutes at each center.

Center 3: Sieves and Funnels

Ask a student to choose a sieve or a funnel and fill it by dipping it into a tub of water. Tell the other students to watch as the student holds the sieve over the tub. What does the falling water look like? Repeat until each student has had a turn.

Allow students to experiment with the sieves and funnels until all have been tried. Ask students to line them up in order from slowest flowing to fastest flowing.

Ask a student to pour some water from the watering can. Show the students each sieve. Which is the most like our watering can? Which would be best for watering our newly planted seeds? Test the sieves the students chose against the watering can.

Center 4: Planting Seeds

Follow the directions on the seed packets and have students take turns planting the seeds in rows at the correct depth and spacing for each specific variety of plant. Plant half the garden, leaving the other half for the indoor group.

After two groups have completed both centers, have students water carefully, using the appropriate sieves.

Then bring indoor groups to the garden and the outdoor groups into the classroom and

repeat the process until all students have visited all 4 centers.

Assessment: Review the chart you made with your students before they began their investigations. What did you discover about water? What kinds of things float? sink? What are water drops like? What would be a good way to give plants water?

Have students draw pictures of their favorite activity and dictate or print a sentence about what they are doing.

Extension: Plan and implement a watering schedule.

Teach and sing the songs "Oats and Wheat and Barley Grow" and "Everything Grows"(Raffi, AMI Records, Hollywood, CA).

Spring
Feathering Our Nests

Grade Level: 1-2

Duration: 90 minutes

Objectives: Students will observe birds and their nests.
Students will develop understanding about why different birds use different materials in building their nests.
Students will construct nests using natural materials.

Curriculum Areas: Science, Social Studies, Visual art, Language Arts

Background: Birds' nests are as diverse as birds themselves. The availability of materials and places to build, along with the needs of the particular type of bird reflects the location and design of its nest. Most land birds use plant material, mud, hair, and spider webs. Some birds build alone, while others work in pairs or small groups.

Children must be reminded not to disturb the birds or the nests **in any way** while making their observations. They should never touch the nest or anything very near to it.

Materials: Bird nest pictures
Materials for nest-building (i.e.: twigs, hay, grass clippings, weeds, string, yarn, wire twisties).
Bags for collecting nest-building materials
A bucket of dirt for making mud
Trowels or spoons
Paper plates
Paper cups

Preparation: Schedule 2 or 3 volunteer helpers (parents, associates, older students).
Find large pictures of birds' nests (A poster showing a variety of birds' nests can be

Spring
Feathering Our Nests

Forest Service office or by writing:
U.S.F.S., PO Box 2417 Washington DC 20013.
Allow 2-3 weeks).
Check your library for books about birds and nests.
Locate an outdoor area where your students can build nests.

Procedure:

Indoors

Read aloud a book about birds and nests.
Begin discussion. Who has seen a bird's nest? What did it look like? What was it made of? What did the bird look like?
After several have shared, show poster or pictures of different kinds of nests. What kinds of birds made them? Why do different birds make different kinds of nests?
What if you were a bird? What kind of nest would you build?
Assign partners.
Explain to the students that you are going to take them for a walk to look for signs of birds' nests and to look for materials that could be used in nest building. Give each pair of students a bag to collect materials. Remind students that they must not disturb living things.

Outdoors

Take the students and volunteers for a walk in the garden and around the school grounds. Ask the children what senses they can use to detect signs of birds. Where would be a good place to look for a nest? What would be a good thing to use in building a nest? Allow children to wander in small groups with volunteers to look for birds and nests and to collect good building materials.

Then take them to the place you have prepared for nest-building. Show them the materials you have supplied and the mud in the bucket..

Spring
Feathering Our Nests

Give each pair of students a paper cup to carry materials in, a paper plate to build a nest on and a place to work. Instruct each pair of students to help each other construct any kind of nest they want.
Encourage students to get ideas about how to hold their nests together from other teams. When the nests are finished have both students put their names on the paper plate and carefully bring them back to the classroom.

Assessment: **Indoors**

Have each pair of students share with the class what materials they used in building their nest, how they held it together, and why it is good. Where would be a good place for this kind of nest?

Extension: Have the children find a good place outside to put their nests. Will a bird use it? Check them weekly to see what happens.

Spring
Discovering Plants' Needs

Grade Level: 2-3

Duration: Three days, 30 minutes each day

Objectives: Students will plant and care for plants. Students will discover that plants cannot survive when deprived of water, light, or air.

Curriculum Areas: Science, Math, Visual Arts, Social Studies, Language arts

Background: Plants need water, light, air, soil, and space in order to grow and be healthy. The sun provides energy to convert carbon dioxide, which is taken from the air, and water into food for the plant.

Materials:
Milk cartons saved from school lunches (one for each student plus 4 extras per group to be used in the experiment).
Fast sprouting seeds(i.e.: Radish, bean, sunflower, marigold)
Soil
4 large, clear plastic bags
4 cardboard boxes
Craft sticks
Optional: 1 more milk carton per student
Construction paper

Preparation: Cut the tops off the milk cartons.
Divide the students into cooperative learning groups of 4 or 5.

Procedure:

Indoors

Part 1: Assign cooperative learning groups.
Have the students help each other fill the cartons with soil, plant the seeds according to the directions on the package and dampen the soil, and put them in a window.
(Optional: Have each students plant an extra plant to be used as a Mother's Day present).

Spring
Discovering Plants' Needs

Wait a few days, keeping the soil moist, until the seeds sprout.

Part 2: After the seeds have sprouted and taken hold (about a week later), have each group choose 4 healthy plants to be used for the experiment. Subject each plant to different growing conditions.

Plant #1--Plant has soil, water, and air, but no light. Place a cardboard box over the entire plant.
Plant #2--Plant has light, soil, and water, but no air. Seal entire plant in a large, clear plastic bag.
Plant #3--Plant has light, soil, and air, but no water. Do not water.
Plant #4--This plant will have everything it needs: light, water, air, and soil.
Give each student an observation sheet. Have them measure and record the height of each plant on the appropriate graph.
Have students measure and record the growth of each plant weekly on their observation sheets.

Outdoors

Students take their remaining plant outside to transplant into the garden. Have them put their name on a craft stick and stick it in the soil to mark their plant. Each student is to water and care for his/her plant daily and measure it weekly and record its growth on their observation sheets.

Part 3: After several weeks compare plants and graphs.

Assessment: Are there differences in the rate of growth of the plants with different growing conditions? Why?
Which plants were successful? Which plants failed? How did they look?
What do plants need to grow and be healthy?

Spring
Discovering Plants' Needs

Students record findings on their observation sheets.

Extension: Students cover and decorate the milk cartons of their remaining plants and take them home for Mother's Day presents.

Spring
Discovering Plants' Needs

Observation Sheet

Number the graph in centimeters, starting at the bottom. Each week shade in the graph to represent your plants' actual growth. Divide the last column in half to compare different growing conditions.

Soil, water, air, but NO LIGHT	Soil,light, water, but NO AIR	Soil, light, air, but NO WATER	Soil, water, light, air. Inside-Outside

Soil, water, air, but NO LIGHT | Soil,light, water, but NO AIR | Soil, light, air, but NO WATER | Soil, water, light, air. Inside-Outside

Appendix E
Recommended Literature

Aliki. (1962). My five senses. New York: Harper. This book introduces the senses to young readers.

Aliki. (1987). The story of Johnny Appleseed. Englewood Cliffs, NJ: Prentice. Retells the wandering of John Chapman, whose devotion to planting apple trees made him a legendary figure in American history.

Back, C. (1986). Bean and plant. Englewood Cliffs, NJ: Silver Burdett. Remarkable color photographs show how a bean plant develops, from the first tiny shoot to the mature plant with bean pods.

Brown, M. (1979). Stone soup. New York: Scribners. In this story of cooporation, three hungry soldiers come to a town where all the food has been hidden. They make a soup of water and stones, and all the town enjoys a feast.

Burnie, D. (1988). Birds. New York: Knopf. This photo essay on birds includes good pictures of nests.

Carle, E. (1977). The grouchy ladybug. New York: Crowell. Each hour the grouchy ladybug challenges bigger and bigger animals to a fight, before returning to her original spot to dine on aphids.

Carle, E. (1987). The tiny seed. Saxonville, MA: Picture Book. A family of seeds is blown by the wind. The tiny seed survives the seasons, and grows into a big flower and spreads its seeds the next fall.

Carle, E. (1989). The very busy spider. New York: Philomel. Farm animals try to distract a busy spider from spinning its web, but the spider persists and builds a web anyway. The raised

images on the page can be felt as well as seen.

Coldrey, J. (1989). Strawberry. Englewood Cliffs, NJ: Silver Burdett. Excellent photographs and text detail the development of a strawberry plant.

Cole, J. (1986). The magic school bus at the waterworks. New York: Scolastic. Ms. Fizzle takes her class on a magical trip to the waterworks--an entertaining trip full of science facts.

Cooney, B. (1982). Miss Rumphius. New York: Viking. Great Aunt Alice Rumphius was once a little girl who loved the sea, longed to visit faraway places, and wanted to do something to make the world more beautiful--which she accomplished by planting lupines.

Cottam, C., & Zim, H. (1987). Insects. NY: Golden. This is a teacher reference for all grade levels, with full color pictures and brief, interesting descriptions of insects.

Dunrea, O. (1989). Deep down underground. New York: Macmillan. In this counting picture book, garden animals present the numbers from one to ten, as earthworms, toads, ants and others march, burrow, scurry and scooch deep down underground.

Ehlert, L. (1987). Growing vegetable soup. San Diego,CA: Harcourt. A father and child prepare their garden, plant vegetable seeds, care for, and harvest their crop. They make vegetable soup using the vegetables from their gargen. Includes recipe for vegetable soup.

Appendix E
Recommended Literature

Ehlert, L. (1991). Red leaf, yellow leaf. New York: Harcourt. Accompanied by exceptional illustrations, a child describes the growth of a maple tree from seed to sapling. The end of the book contains a collection of tree facts.

Galdone, P. (1973). The little red hen. Boston: Clarion. None of the little red hen's lazy friends are willing to help her plant, harvest, or grind wheat into flour, but all are eager to eat the cake she makes from it. Her friends learn to help when there's work to be done.

Hirschi, R. (1991). Harvest song. New York: Cobblehill. All summer long a girl helps her grandmother with the work on the farm,and in the fall they harvest. Beautifully illustrated.

Hoberman, M. (1978). A house is a house for me. New York: Viking. Unforgettable rhymes and great illustrations playfully describe the dwellings of many different animals and things.

Holloway, J., & Harper, C. (1990). Earthworms are animals. Cleveland,OH: Modern Curriculum. Here is an easy-to-read explanation of why earthworms are animals.

Hutchins, P. (1971). Titch. New York: Macmillan. Titch is not old or big enough to do the things his siblings do, but he can plant a seed that grows and grows.

Kellogg, S. (1988). Johnny Appleseed. New York: Morrow. Tells the life of Johnny Appleseed. Appealing illustrations for younger children.

Krauss, R. (1945). The carrot seed. New York: Harper. A young boy plants a carrot seed and,

although everyone tells him that it will not grow, he cares for it and harvests a huge carrot.

Lobel, A. (1972). Frog and Toad: The garden. New York: Harper. Available in Spanish. Toad plants a garden and tries many ways to get his seeds to grow, including reading, singing and yelling.

Lobel, A. (1969). Small pig. New York: Harper. A pig who has had his pen cleaned goes off in search of mud, and discovers that good mud is hard to find.

McLaughin, M. (1986). Earthworms, dirt, and rotten leaves. New York: Atheneum. This book helps answer student questions about the soil as an ecosystem.

McMillan, B. (1988). Growing colors. New York: Lothrop. Photographs of green peas, yellow corn, red, potatoes, purple beans, and other fruits and vegetables illustrate the many colors of nature.

Merrill, C. (1990). A seed is a promise. New York: Scholastic. Observes the connection between seeds and growing plants, and seeds' "promise" to grow, sometimes even when a thousand years old.

Oechsli, H. (1985). In my garden. New York: Macmillan. A general guide to beginning gardening with specific instructions for growing beans, carrots, lettuce, peppers, and other vegetables.

Overbeck, C. (1982). How seeds travel. Minneapolis, MN: Lerner. Discover how seeds move from place to place by wind, water, and animals, and how they function in plant reproduction.

Appendix E
Recommended Literature

Peters, L. W. (1988). The sun, the wind and the rain. New York: H. Holt. Two stories are told side-by-side:One explains how a mountain is shaped by the sun, wind, and rain; the other describes a child's attempt to build a sand mountain at the beach, which is also affected by the elements.

Peters, L. W. (1991). Water's way. New York: Arcade. A simple story weaves in the phase changes of water. Whether water is rising from the ocean to form clouds, forming dew on the grass, or falling out of the sky in snowflakes, "water has a way of changing."

Raffi. (1989). Everything grows. New York: Crown. Photographs and an original song tell how "everything grows, anyone knows, that's how it goes."

Romanova, N. (1985). Once there was a tree. New York: Dial. In this Russian Tale,a decomposing tree stump attracts many living things which make use of it. Finally a new tree grows from the same spot.

Rylant, C. (1984). This year's garden. New York: Bradbury. Here is a story of a garden through the seasons. A large rural family grows and preserves its food. The book beautifully introduces the relationship between a family and its garden.

Shulevitz, U. (1969). Rain rain rivers. New York: Frarrar. A child sits cozily indoors, observing the rain and thinking about where it goes.

Titherington, J. (1986). Pumpkin, pumpkin. New York: Greenwillow. A young boy plants a pumpkin seed and watches it grow. He picks the pumpkin that forms and carves it into a

jack-o-lantern, but saves six seeds for planting in the spring.

Tripp, P. (1968). The little red flower. Garden City, NY: Doubleday. Mr. Green Thumb is the only one who knows how to care for the only flower in a grim factory town. When he falls sick, other people want to learn how to care for the flower too.

Williams, V. B. (1986). Cherries and cherry pits. New York: Greenwillow. Bidemmi draws pictures with a magic marker, narrating as she draws. She tells of saving cherry pits and planting them in the yard, and of one that grew roots and sprouted into a tree.

Watts, B. (1987). Dandelion. Englewood Cliffs, NJ: Silver Burdett. This photo essay shows how a dandelion changes from flower to seed, and how the seeds are blown away to start the process over again.

Watts, B. (1990). Tomato. Englewood Cliffs, NJ: Silver Burdett. This book uses color photographs to show the development of a tomato plant from seed to fruit.

Zion, G. (1959). The plant sitter. New York: Harper. While his neighbors are on vacation, Tommy takes care of their plants and discovers how much work,as well as fun, it is to care for them.

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Crabtree, M. (Ed.). (1992). Life lab science: Earth is home: Grade 1. Santa Cruz, CA: Videodiscovery.

Crabtree, M. (Ed.). (1992). Life lab science: Change around us: Grade 2. Santa Cruz, CA: Videodiscovery.

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