1986

Life Science: An Outdoor Learning Approach

Deborah R. Thompson
University of North Florida

Suggested Citation
https://digitalcommons.unf.edu/etd/61
Life Science:
An Outdoor Learning Approach

by

Deborah R. Thompson

A curriculum project submitted to the
Division of Curriculum and Instruction
in partial fulfillment of the
requirements for the degree of
Master of Education in Biology Education

University of North Florida
College of Education

April, 1986

Signature Deleted

Dr. Marianne Betkouski, Advisor
Signature Deleted

Dr. Elinor Scheirer, Committee
Signature Deleted

Dr. James Mittelstadt, Committee
Abstract

The instructional materials prepared for this project are based on outdoor activities that correlate with the Duval County, Florida, Performance Objectives for Life Science in the seventh grade. Special emphasis is placed on hands-on, sensory experiences and observations, and sequencing of instruction within lessons. The review of related literature includes the philosophy of outdoor/environmental education, a historical perspective of outdoor/environmental education, and learning theory as it applies to the principles and practices of an outdoor approach to education.
Chapter 1 Life Science: An Outdoor Learning Approach

If taking a plant specimen that has been collected by the teacher out of a bucket and examining it under a binocular microscope is exciting to the student and contributes an important cognitive link, how much better is observing that plant in its natural habitat, investigating hints to its niche, then taking a small specimen oneself for microscopic examination! Students can learn by rote, "Liverworts [LIHV-uhr-wurts] are small, nonvascular plants. They are called liverworts because their leaflike parts resemble livers" (Bierer & Lien, 1985, p. 110). Students can learn about the growth habit of liverworts and where to find them, even see a picture of them. However, a liverwort is not a useful part of a student's understanding until he has seen it, touched it, and been where it grows. Discovering a liverwort in the woods causes cognitive linking that results in meaningful learning. Such a discovery provides the student with a feeling of accomplishment and may even motivate him to further exploration.

The student may read, "Mollusks [Mahl-uhsks]: soft bodied invertebrates with a muscular foot; for
example, scallops, snails, and octopuses" (Bierer & Lein, 1985, p. 523). The student may be told that the remains of these are the shells that can be gathered at the beach; or that eating fried clams is eating mollusks. Imagine, however, another possibility for instruction. The students are walking along the edge of the river and see some shells. Shells at the river? Closer examination reveals that some have been broken open and scattered nearby. The students examine the shiny inner surfaces of the shell and feel its rough outer surface. Looking around, the students notice tracks in the muddy area nearby. A raccoon? What better way to begin learning about mollusks... and concepts like food chain, habitat, niche, adaptation, not to mention skills that might be called upon in considering these - observation, data collecting, hypothesizing, classifying!

Using the out-of-doors for teaching nature study has been a method employed by teachers since the turn of the century. Comstock, the "mother of nature study" (Mann, 1932, p.5), wrote in 1908:

Nature study is despite all discussions and perversions, a study of nature; it consists of simple, truthful observations that may like beads on a string, finally be threaded upon the
understanding and thus held together as a logical and harmonious whole. Therefore, the object of the nature-study teacher should be to cultivate in the children powers of accurate observation and to build up within them, understanding. (Link, 1981, p.10)

In outdoor study or field work, the observations that are made of an organism and of how it interacts within its environment which when "threaded upon the understanding and held together as a logical and harmonious whole" provide the broad principles of ecology.

The thrust of many current outdoor/environmental education programs relies heavily on ecology concepts. But, it is important to consider whether these concepts can be fully comprehended by those students who do not have an understanding of or interest in the world around them. Both specific observations and the broad perspective are necessary to help the students become aware of the natural world and their interrelatedness to it.

Kinsey (1936) stated as his first objective for science teaching, "To interest the student in the world in which he lives" (p. 5). Biology, according to Kinsey
should be for students "an outdoor biology, it should be science that can be translated in terms of the living world through which they move" (p. viii). Currently, Life Science is an "indoor" biology in Duval County, Florida. The outdoor emphasis is limited to a single day trip to one of the county's Environmental Field Study Sites for fourth and sixth grade students. The subject matter and skills that make up Duval County Performance Objectives for Life Science, however, provide the teachers and the students with an appropriate case for taking to the out-of-doors in search of a more meaningful understanding of the natural world of which they are a part.

It is the purpose of this project to prepare instructional materials which are based on outdoor activities and which correlate with the Duval County, Florida, Performance Objectives for Life Science in the seventh grade. Special emphasis will be placed on hands-on, sensory experiences and observations, and sequencing of instruction within lessons. This emphasis is important for those students who are at a level of cognitive development in which they must deal with concrete objects in order to be capable of logical operations. For these students the observations and
hands-on activities will be especially helpful starting points for achieving an understanding of the concepts, principles, and skills which make up this curriculum. The sequencing of instruction within lessons, "concrete perceptual to abstract conceptual" (Hawkins, 1965, p. 69) will encourage development of higher-level thinking skills so necessary to the junior high school student.
Definition of Terms

"Discovery is the mental process of assimilating concepts and principles. Discovery processes include observing, classifying, measuring, predicting, describing and inferring" (Trowbridge, Bybee & Sund, 1981, p. 168).

Enactive stage is a stage of growth or cognitive level as suggested by Bruner in which a child understands the objects in his or her environment by action, or what the child does with these objects (Gage & Berliner, 1984).

Iconic stage is a cognitive level where information is carried by imagery. It is a stage of perceptual understanding (Gage & Berliner, 1984).

"Inquiry is the process of originating and investigating problems, formulating hypothesis, designing experiments, gathering data, and drawing conclusions about the problem solution" (Trowbridge, Bybee, & Sund, 1981, p. 168).

Outdoor Education is education in, about, and for the outdoors (Donaldson & Donaldson, 1958).
Symbolic stage is a cognitive level in which symbol systems may be used like language, logic, and mathematics (Gage & Berliner, 1984).
Chapter 2  Review of Related Literature

The first of the three areas which are a part of this review of related literature is the philosophy of outdoor/environmental education. The second area is a historical perspective. The final area concerns learning theory as it applies to the principles and practices of an outdoor approach to education.

Philosophy of Outdoor/Environmental Education

Educators have learned through the years the importance of teaching from natural situations. Teachers and students bring specimens to school to be touched, handled and studied. The outdoor educator says do not try to bring the world inside the classroom. Take the students out to where the world is (Sharp, 1952). Carlson (1947) suggests what psychologists have insisted for many years, that learning takes place only where it can connect with experience. Often, however, teachers go confidently ahead teaching mere words in a textbook without consideration for the child's real life associations.

Authors of textbooks pass on second-hand information that they find by observation and discovery. It should be the student who sees, discovers, or
explores a situation. This kind of learning is faster, more deeply appreciated, and retained longer. According to Smith (1952) this is the whole thesis of outdoor education.

Outdoor education is a method of teaching using the natural environment as a living laboratory. This is not an abstract approach to subject matter, but rather a sensory approach. Students use their senses, their eyes, ears, nose, and their muscles in the learning process (Mand, 1967).

Outdoor education restores the natural situation in which primitive man first learned, and so it brings into play two forces that are difficult to establish in any formal classroom: the quick enthusiasm and joy of learning, and the constant awareness of the steps by which we learn. The student in the out-of-doors is filled with curiosity and wonder as he comes upon things he cannot identify or does not understand; so his need is real and present. Whatever he learns will give immediate pleasure, therefore, and may be appreciated on the spot. Nor is the process of outdoor learning either remote or involved. More than is the case in any textbook, the learner sees
what he is getting and the steps by which he is getting it. (Conrad, 1947, p. 355)

According to Donaldson and Donaldson (1958), Outdoor Education is education **in**, **about**, and **for** the outdoors. "Its guiding principle is that famous statement of L. B. Sharp's: 'Those things which can best be taught outdoors should there be taught!'" (Donaldson & Donaldson, 1958, p. 7). **In** the outdoors is **where**. **About** the outdoors is **what**. It is education about outdoor resources and outdoor skills. Some feel that the **about** of outdoor education should be presented not as a subject, but rather as a location and as as a process whereby one can learn any subject through the outdoors (Ford, 1981). **For** the outdoors answers, "Why?"

**For** is central not only because it limits the field but because it implies a positive and moral approach. It strongly suggests that both the learner and the outdoors are better because of the experience. **For** implies both a mental attitude toward the outdoors and a set of skills and abilities which will enable the learner to do something about his attitudes. Skills are not enough; neither are good attitudes without implementation. (Donaldson & Donaldson, 1958, p. 8)
"The word 'for' answers the question 'why' because it implies the perpetuation of the outdoors by our conscious effort to understand and use it wisely" (Ford, 1981, p. 13).

Historical Perspective

Man has long examined his environment and noted that observing it directly is a good way of learning about it. This is shown in writings by Thames, an Egyptian king about 3000 B.C., Thales, a Greek scientist, Rousseau (1712-1778), a writer, and Pestalozzi (1746-1827), a pioneer scholar in early childhood education in Switzerland (Ford, 1981).

More recent activities in outdoor/environmental education have their roots in the nature study and natural history of the late 1800's and early 1900's. At that time students were taken outdoors on outings to do field studies. According to Rogers (1982), "school camping" is the term used from the 1920's through the 1950's for resident programs which were developed during that time. These programs were places where students would live and learn together in a camp setting for several days to a week. The programs were an outgrowth of the recreational summer youth camps of the organized camping movement and were based upon the pragmatic
educational philosophy of John Dewey and others. The leaders of these early school camping programs, such as L. B. Sharp and George Donaldson, believed that learning best occurs through direct experience in real life problem-solving.

The subject matter evolved to include, first, soil conservation; added later was the broader meaning of human conservation in the late 1930's (Stone, 1985). Leopold stated his land ethic in 1933, and biology began to take on ecological concepts as shown in biology textbook chapters by Kinsey in 1933 and 1938. Along the way, "school camping" became "outdoor education." In the 1960's environmental problems began to be raised. In 1962, biologist Carson made pesticide pollution a national issue by writing Silent Spring (Stone, 1985).

The 1970's might be called the "Environmental Decade" in the U.S. because a great deal of environmental legislation, including the Environmental Education Act of 1970, was enacted, and the Office of Environmental Education was created. The Office of Environmental Education developed a model Environmental Education curriculum for the schools. Even though after 1981 the Environmental Education Office no longer existed, environmental education for local school districts
continues to be otherwise funded and promoted by the federal government (Connect, 1983).

Presently, each state has an Environmental Education coordinator in its Department of Education. There is also nonformal environmental education which is conducted by efforts of the National Wildlife Federation and the National Audubon society through magazines, education centers, ecology camps, field programs, and film/lecture series (Connect, 1983). An international program called the International Environmental Education Program (IEEP) was set up through the United Nations to develop a general awareness of the need for environmental education, to develop concepts and methods in environmental education and to encourage incorporation of an environmental dimension into the educational process of the member states (Connect, 1983).

The movements of outdoor education and environmental education have merged forces. Environmental education provides an ultimate goal and outdoor education provides the most effective method and place for teaching toward this goal (Rogers, 1982). Current reflections in the U.S. of outdoor/environmental education include Environmental Science Centers where there are week-long
resident programs such as the Multnonah County Outdoor School (Gilfillan & Burgess, 1982) and the Santa Barbara County Environmental Education Outdoor Program in California (Santa Barbara County Schools, 1980). Many school systems maintain Environmental Science Centers which are used as day sites with planned curriculum including nature walks with interpreters and outdoor lab sites, as well as indoor components. Duval County, Florida maintains three such sites. One is in Cary State Forest, another, at Fort Caroline National Monument, and a third, identified as Tree Hill.

Other schools have built nature trails with teaching sites (Smith, 1984) or set up outdoor labs (Schneider, 1984) on school property. Coble and Koballa (1983) bring outdoor/environmental education full circle in the "rural advantage." They assert that thirty percent of the population who live in rural America have another very important resource available. Teachers there can present students with concrete examples of the science concepts that they are studying simply by making the countryside an outdoor classroom. "Students of all ages enjoy a feeling of freedom when their lessons are conducted outside the classroom, a feeling that has the power to inspire curiosity and may
lead to greater understanding and appreciation" (p. 22).

The difference between the nature study of the early 1900's and the outdoor/environmental education of today is found in a clearer understanding of man's role in maintaining a healthy, balanced environment. The challenge of outdoor education according to Link (1981) is not only to provide inspiration and to encourage observation as in the early days of nature study, but also to develop ethical values concerning environmental issues and "to gain a perspective on the human role in the mechanism called Earth" (p. 3).

Learning Theory

Julian Smith has frequently remarked that it is unfortunate that there had to be an outdoor education. How much better it would have been had all teachers everywhere sought out the very best teaching places and the very best ways of teaching in those places. Their search would have led them inescapably to the outdoors and to methods appropriate thereto. The educators would have written about good education, with no indoor/outdoor distinctions necessary. (Donaldson & Goering, 1972, p. 1)

In order to determine appropriate methods it is
useful to examine some principles from Piaget and Bruner. Children learn especially well from working with concrete objects. They manipulate, act, touch, see, and feel to acquire an understanding of concepts and relationships. More abstract forms of learning succeed in later childhood and adolescence. In some ways the subsequent kinds of understanding are based on both direct and internal manipulation of objects (Gage & Berliner, 1984).

Gage and Berliner (1984) suggest that the theories of Piaget and Bruner show that instruction should begin with a "messing around" stage. This "hands-on" touching stage builds enactive representations. In this stage action is the way a child understands his environment. The second part of the sequence concerns itself with developing perceptual clarity. The teacher points out important features of objects or events and provides concrete rather than abstract references for things. This part of the instruction builds iconic representations; information is carried by imagery. The third part of instruction represents the symbolic stage in which a verbal discussion of events occurs. Sometimes it is difficult for a student to assimilate abstract verbal discussions if the appropriate kinds
of preliminary experiences have not taken place. These theories have implications for sequencing instruction within a unit, as well as across semesters.

Another important principle of instruction is that children need to learn about what is around them before attempting to understand things which are not in their everyday experience (Elkind, 1976). When applied to local concerns, this would mean that students in North Florida who study carnivorous plants should be led to discover the pitcher plants and sundews that grow along the roadsides before being introduced to a Venus's Flytrap which does not grow in North Florida.

Hawkins (1965) divides school work in science into three phases or patterns. He represents the phases by mnemonic signs $\bigcirc$, $\bigtriangleup$, and $\square$. The first phase he calls "messing about" (p. 60). In this stage the students are presented with materials and equipment and are allowed to construct, test, probe, and experiment without superimposed questions or interactions. Another phase is $\bigtriangleup$ in which the students work with multiply programmed materials with guiding questions and instruction. The third phase $\square$ includes discussion and lecturing, formal or informal. Hawkins (1965) proposes that, "theorizing in a creative sense
needs the content of experience and the logic of experimentation to support it. Through these phases the student moves from the concrete perceptual to the abstract conceptual" (p. 69).

Outdoor educators often assume that the outdoor setting automatically causes the student to expand and appreciate the mixing of his sensory, thought, and aesthetic powers (Ward, 1972). In the out-of-doors observation is central. There are appeals to the senses everywhere. However, Ward (1972) suggests that this "actual and tangible quality can be a limitation to cognitive learning" (p. 106). This does not automatically lead to conscious abstract thought. It is easy to remain at the level of perceiving, or sensory information. Yet, it is necessary to move forward into the realm of reasoning, inferring, and using that which is perceived. This is clearly shown in two types of concepts in science subject matter.

<table>
<thead>
<tr>
<th>category 1</th>
<th>category 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tree</td>
<td>process</td>
</tr>
<tr>
<td>Rocks</td>
<td>form and perspective</td>
</tr>
<tr>
<td>Birds</td>
<td>cyclic relationships</td>
</tr>
<tr>
<td>Mammals</td>
<td>cause and effect (Ward, 1972, p. 107)</td>
</tr>
</tbody>
</table>
Category 1 is the fact-collecting level, while category 2 is made up of concepts that are highly abstract.

Trowbridge, Bybee and Sund (1981) define two methods of moving from one level to the other. They are discovery and inquiry. "Discovery occurs when an individual is mainly involved in using his mental processes to mediate (or discover) some concept or principle" (p. 168). Such processes are observing, classifying, measuring, predicting, describing, and inferring. "Inquiry is the process of origination and investigating problems, formulating hypotheses, designing experiments, gathering data, and drawing conclusions about the problem solution" (p. 168).

Bruner suggests four reasons for teaching by discovery. The first reason is intellectual potency; the student learns and develops his mind by using it to think. A second is that as a consequence of succeeding at discovery the student receives an intrinsic reward not just the extrinsic reward of an appropriate grade from the teacher. Bruner also proposes that through discovery the student learns how to organize and conduct investigations. Finally, according to Bruner, the discovery approach aids in better memory retention (Trowbridge et al., 1981).
Learning is also enhanced by the emotions and feelings that occur as the student interacts with the natural environment. "The personalized and subjective involvement can heighten the sensory awareness. Certainly the related power of imagination can foster flexibility of outlook and the ability to reason by analogy" (Ward, 1972, p. 110).

In summary, from its earliest beginnings, outdoor education has evolved into education in, about, and for the outdoors. It happens in the out-of-doors. It is about nature, living organisms, and their interactions. It is for the outdoors as it endeavours to help students become more aware of their interrelatedness to the natural world around them so that they might learn to make wise decisions on environmental matters. Learning theory which exhibits sequencing from concrete perceptual to abstract conceptual seems to be an appropriate model for the outdoor educator's use in preparing for and implementing instruction.

"The trees and the skies and the lanes and the brooks
Are more full of wonders than all of the books...
So, come where the wild things are waiting outside
And let your soul taste of the joys that abide."

(needham, 1930)
Chapter 3 Procedures

In an outdoor approach to Life Science, students leave the confines of the classroom and discover directly the concepts otherwise taught secondhand in the classroom. The students use their senses to explore the natural world around them. The discoveries made during these explorations are a basis for examining the interrelationships required for survival in the biosphere.

The curriculum developed for this project consists of a series of sets of learning activities based on the concepts, principles, and skills that are represented by Life Science Performance Objectives for the seventh grade in the Duval County Public Schools, Duval County, Florida. The objectives are organized into sets according to the outdoor site at which the concepts, principles, or skills may best be demonstrated.

Seventh grade students at Baldwin Jr./Sr. High School will be the sample population for later implementation of this project. The outdoor sites chosen for implementation of the curriculum are in Duval and Nassau counties within a twelve mile radius of Baldwin, Florida, and are therefore easily accessible to these students. The sites include Cary
State Forest Environmental Education Center and a private twenty-acre site that lies along the St. Mary's River in Bryceville, Florida, which has been made available for outdoor study. These sites provide a variety of examples of flora and fauna indigenous to the region.

Within this curriculum, each set of activities begins with field-oriented learning experiences which mediate between the student and the organism or environment to be examined. These experiences include hands-on activities or observations. They are followed by questioning and clarification of basic concepts, principles, or skills. Finally, abstractions are discussed, perhaps developing into inquiry in the form of individual experimentation or research. This sequence is based on learning theories of Piaget and Bruner (Gage & Berliner, 1984) and the work of Hawkins (1965) in science learning phases.

In the preimplementation stage, that is before introducing this approach to the students, the appropriateness of the activities and the feasibility of their implementation were evaluated. Environmental Field Study Assistants from the Duval County Environmental Education program evaluated the
feasibility of implementing the activities. The Field Study Assistants have experience working in the field with students and may reliably predict student response to the activities. Preservice and inservice teachers were asked to examine the appropriateness of the activities as related to the performance objectives. See the appendix for an example of the check list used for the evaluation. Some revisions were made based on the responses to the activity evaluation check lists and comments. Additional evaluation and revision should take place after implementation based on the student's participation in and response to the activities.

Teachers who wish to use these activities should be familiar with their site, whether field study site or schoolyard, and with the types of plants and animals available as examples. Activities should be adapted to the site and modified according to the needs of the students.
Chapter 4

Life Science

Outdoor Learning Activities
LS 1.1.1 To demonstrate knowledge of the nature of science and biology, students will identify a definition of biology.
LS/h 1.1.1 To demonstrate knowledge of the branches of biology, students will identify botany as the study of plant life.
LS/h 1.1.2 To demonstrate knowledge of the branches of biology, students will identify zoology as the study of animal life.
LS/h 1.1.3 To demonstrate knowledge of the branches of biology, students will identify microbiology as the study of microscopic organisms.
LS/h 1.4.3 To demonstrate knowledge of classification, students will identify that organisms are divided into three major kingdoms (plant, animal, protist).

Concepts: kingdoms - plant, animal, protist; biology, botany, zoology, microbiology, botanist, zoologist, microbiologist

Materials: a trowel, plastic bags, a plant press, a dip net protist collector, 4 microscopes with mirrors, 8 slides, 8 cover slips, 4 droppers, and note pads and pencils for one group
Activity:
Divide students into three groups. Give a "hunt list" and appropriate field apparata to each group.

group 1
1. Find one small plant with a flower. Use the trowel to dig it up. Put it in a plastic bag.
2. Find 5 leaves of different sizes. Put them in the plant press.
3. Find some pine needles. Put them in the plant press.
4. Find a plant with very small leaf-like parts. Dig it up and put it in a bag.
5. Find 2 different ferns. Put a piece of each in the plant press.

group 2
Find 10 animals or signs of animals like the following:
1. tracks
2. a spider web
3. a burrow
4. a nest
5. droppings (scat)
6. food litter

Write down what you found and where you found each item. Describe or draw a picture of it.
group 3
Take the dip net protist collector and walk along the edge of some water pulling the dip net along in the water. Collect samples from four different places. Observe the samples. If you can see something, it is not a protist. Protists are microscopic organisms. Take your samples to where the microscopes are set up. Make slides of each sample. What do you see? Which sample seems to have the most microorganisms - protists?

Allow time for students to find the items and follow all directions. Meet together at a designated place and time. Tell the students that what they have all been doing is biology - the study of living things. Each list included organisms in one of three large groups of living things. These groups are called kingdoms. They are plant, animal, and protist. The study of plants is called botany. The study of animals is zoology and the study of microorganisms (protists) is microbiology. Specialists in these studies are botanists, zoologists, and microbiologists. Ask group 1, the botanists to show what items they have found and demonstrate what field apparata they have used. Then ask group 2, the zoologists, to tell what animals or signs of animals they have found. Have them read
their descriptions and show their drawings. Finally, ask a student in group 3, the microbiologists, to describe how to use the dip net protist collector. Have another tell what they found.

More Questions and Hypotheses:
1. If you were a zoologist what kind of animal would you like to observe? What would you like to learn about it?
2. If you were a botanist and you wanted to know how many plants of a certain kind there were in an area how could you find out?
3. If you were a microbiologist where would you go on this site for a water sample with lots of protists? Why do you think that place is a good place for protists to live?

The purpose of this activity, aside from developing the parallel concepts of the branches of biology, is to cause students to begin to observe the world around them rather than to just look about. It is an introduction to field work. If time and class size should permit it would be appropriate to rotate the groups so that all students have an opportunity to experience all three "hunt lists." The following is a concept map of those concepts developed in this activity.
botany
biology
microbiology

— botanist — plants
— zoologist — animals
— microbiologist — protists

— zoology — animals — kingdoms
LS 5.5.1 To demonstrate knowledge of the plant groups, students will identify examples of plant groups which have no conducting tissue.

LS 6.1.3 To demonstrate knowledge of ecology and pollution, students will identify a producer as an organism that can make its own food.

LS 6.2.2 To demonstrate knowledge of food chains the student will establish and maintain an aquarium or a terrarium; and examine food chains and food webs.

LS/h 3.1 Students will identify examples of non-vascular plants as lichens, mosses, liverworts, algae and fungi.

Concepts: non-vascular plants, algae, fungi, lichens, mosses, liverworts, spores, chlorophyll, producer, decomposer

Materials: for field work - hand lens, small notebook, and pencil for each student, plastic bags, 4 jars, photographs or magazine pictures of examples of plants to be found; for spore prints - mushrooms (to be collected), paper of different colors, bowl or jar to cover each mushroom, a fixitive spray or varnish; for each terrarium - a large jar with a lid, gravel, soil, plants of similar habitat (to be collected)
Activity: Tell the students that they are going on a botanical field excursion. They will be looking for specific types of non-vascular plants. That is, plants with no special system for moving food, water, and minerals around the plant. They must make field notes which include the type of plant, color of the plant and the type of habitat. (What is it like where the plant lives? Is it wet, dry, shady or sunny?) They may add a sketch of the plant if they wish. Students are divided into groups and given photographs or pictures from magazines of algae and asked where they think they might find algae on the site. Since water would be obvious from the pictures their response should be at the river's edge or in the slough. Have students find some algae. Observe it in the water. Dip some out in a jar and observe it. Record observations in field notes.

Students should be given pictures of each of the other non-vascular plant groups one group at a time. They should go through the process - find, observe, record data - for each. Be sure to allow plenty of time for the students to examine specimens with a hand lens, compare them to the pictures, and comment in their field notes. Collect some mushrooms for spore prints and some lichens, mosses, liverworts, and other small plants from the same
habitat type for the terrariums. After all examples have been found and field notes are completed consider together the following questions.

1. What characteristics do the habitats have in common?
2. Did all of the plants you looked for live in wet or damp places?
3. Did you see any seeds?
4. Since chlorophyll, a green pigment is necessary for the plant to make food, do you think that all the plants you observed are producers, that is, make their own food?
5. What colors were the plants that you examined?
6. How do you think those that do not make their own food get their nutrients?
7. Decomposers are organisms that get their food from dead and decaying matter. Which of the organisms that you examined do think are decomposers?

After this discussion divide students into groups so that they can make spore prints and/or terrariums.

**Spore prints:** (Chinery, 1977, pp. 148-149)

1. Carefully cut the stem off the mushroom close to the cap.
2. Place the cap on paper.
3. Cover the mushroom cap with a bowl or jar.
4. Allow it to sit undisturbed for several hours or overnight.
5. Carefully lift off the mushroom.

While making spore prints name the parts of the mushroom - cap, gills, stalk, and discuss the function of the spores.

**Terrariums:**
1. Place a layer of gravel in the bottom of the jar.
2. Cover with some soil.
3. Add some plants.
4. Cover.
5. Water slightly if it seems dry. Leave the top off for a short time if water begins to condense on the inside surfaces of the jar.
6. Over the next days and weeks observe often. Look for changes in the plants and the presence of insects.
7. Add other organisms, but remember that there must be sufficient food, water and oxygen for them.

While making terrariums discuss one or more of the following. Why use plants from similar habitats? What do you think causes drops of water to form on the inside surface of the jar? What animals might be living in the terrarium already?
A botanical field excursion sounds like an adventure and it is! Students may need to be reminded to use their hand lenses, but most are intrigued with them and find the miniature world of the simple non-vascular plants somewhat amazing. This activity helps students learn to make specific observations and careful field notes. Using the field notes to answer the follow up questions provides practice in skills necessary for scientific inquiry. The following is a map of concepts to be learned in this activity.
LS/h 3.3.1 To demonstrate knowledge of vascular plants without seeds, students will identify xylem as conducting tubes which carry water and minerals from roots to leaves.

LS/h 3.3.2 To demonstrate knowledge of vascular plants without seeds, students will identify phloem as conducting tubes which carry food down the stem from leaves to roots.

LS/h 3.3.3 To demonstrate knowledge of vascular plants without seeds, students will identify club mosses and ferns as examples of vascular plants without seeds.

Concepts: xylem, phloem, club moss, fern, frond, spores, sori

Materials: a small clay flower pot and a quart jar to each person or group, sphagnum moss to fill the pots, samples of non-vascular plants

Activity:
Show students some examples of non-vascular plants. Also show them some club mosses and ferns. Ask the students which are generally larger. Non-vascular plants on land are limited in size because they do not have a system for moving food and water within the plant. Nutrients and water must seep from one cell to another. Vascular plants have a system of conducting like a circulatory system. Conducting tubes called xylem
carry water and dissolved minerals from the roots to the rest of the plant. Other conducting tubes called phloem carry the food made by the plant from the leaves to the rest of the plant. Ask the students the following questions:

1. From this information do you think that trees have xylem and phloem? do mushrooms? do lichens? do ferns? Support your answer.

2. Have you ever seen a fern seed? Ferns do not have seeds but they have another kind of reproductive cell called a spore. Can you see where the spores might be found on the fern?

Take the students to an area of the site where several types of ferns grow. Collect some fern fronds with sori.

Sow fern spores: (Link, 1981, p. 89)

1. Use small clay flower pots which have been sterilized in boiling water for twenty minutes.

2. Fill the cooled pots with sphagnum moss, through which boiling water has been poured.

3. Invert pot in the bottom of a quart jar.

4. Sow spores on clay pot, and put a little bit of water in the bottom of the jar. Cover.

5. Set out of the sun.
6. In a few weeks you will see prothallium: the beginning fern form. If you maintain proper growing conditions a while longer, sporophyte will form. Pick off and plant in a woodland soil.

Questions for the curious:
1. What is alternation of generations?
2. What is unique about a resurrection fern?
3. What is a fiddlehead?
4. What is meant by once-cut, twice-cut, and thrice-cut?

The objectives for this activity are found only in the advanced Life Science curriculum. Questions for the curious will require library research. A different approach to this activity would be to ask for some volunteer "fern specialists" to research the questions before going into the field so that they might share the information as the students are collecting ferns.

The following is a concept map of the concepts considered in this activity.

Vascular plants

xylem and phloem

without seeds with seeds

club mosses

ferns

fronds sori—spores
LS 5.3.1 To demonstrate knowledge of taxonomic keys, students will use a dichotomous key to classify objects/phenomena.

LS 5.5.6 To demonstrate knowledge of the plant groups, students will identify pine or cypress as an example of a cone-bearing plant.

LS/h 3.4.5 To demonstrate knowledge of vascular plants with seeds, students will identify gymnosperms as cone-bearing plants which do not produce flowers.

Adapted from "On Pines and Needles" in What's a Tree to Me? (1985, pp. 8-13)

Concepts: needle, cone, pine, cypress, evergreen, deciduous, cone-bearing plant, gymnosperm

Materials: A ruler, pencil, and a "Key to Some Common Florida Conifers" (What's a Tree to Me?, 1985, p. 13) for each student or group of students.

Activity:
For this activity take the students to an area of the site where pine, cypress, and hardwoods are in close proximity. Trees that will be used as examples when working with the key should be tagged ahead of time with brightly colored bands and numbers. Have the students
take a moment or two to pick up a leaf from the ground. Allow students to compare the leaves. The teacher should then pick up some pine "leaves" and ask if any students picked those also. Continue with questions and comments as follows.

What are pine "leaves" called? Do you see any trees that have no leaves or needles? Some trees lose all of their leaves during a certain season. These trees are called deciduous. Can you name any? Do pine trees lose all their needles in the same season? Pine trees do not lose all their needles at once. They are always green so they are called evergreens. Who can point out a small pine tree? See how the needles attach to the tree? How many needles are in each bundle? Look around and find a pine cone. Examine the cone. Can you find the seeds in the cone? Trees with needles and cones are called conifers. Conifers are plants that are in the group called gymnosperms. They have seeds but no flowers. The sheet I am giving you now is called a key. This kind of key helps you to find out the name of a plant by examining the plant very carefully.

Choose a tree and demonstrate how the dichotomous key works. Then divide the students into smaller groups.
Ask the students to find the names of the trees that have been tagged by using the key. When identifications are completed have the students get back in a big group and compare identifications. Go through the key together with any trees for which there is a discrepancy. Before leaving the area ask the students to state concept definitions for the concepts listed.

Questioning is central to this activity. Questions are used to focus the students' attention and to direct observations. The one page key is an excellent tool for practice using a dichotomous key. The following is a concept map of the concepts developed in this activity.

```
gymnosperm
   |
  cone-bearing plant
    |
   (conifer)
      |
 evergreen   deciduous
      |
    pine   cypress
      |
   needles
    and
   cones
```
LS 5.5.7 To demonstrate knowledge of the plant groups, students will identify flowering plants as the most advanced plant group.

LS 5.5.8 To demonstrate knowledge of the plant groups, students will examine the parts of a flower and locate sepals, petals, stamens and the pistil.

LS 5.3.2 To demonstrate knowledge of taxonomic keys, students will develop classification systems.

LS 5.3.3 To demonstrate knowledge of taxonomic keys, students will construct two or more classification schemes for the same set of objects.

LS/h 3.4.2 To demonstrate knowledge of vascular plants with seeds, students will identify angiosperms as those plants that produce flowers.

LS/h 3.5.4 To demonstrate knowledge of plant organs, students will identify the function of the flower as reproduction.

LS/h 3.5.5 To demonstrate knowledge of plant organs, students will examine and identify the structures in a flower.

**Concepts:** angiosperm, sepals, petals, stamens, pistil, monocot, dicot

**Materials:** small notebooks and pencils for each group,
plastic bags for collecting, a plant press, sketch pads for one group, camera that makes instant pictures, film and flash, rulers, hand lenses

**Activity:** Flowering plants- the most advanced plant group.

**Flower lab** - Take the students to a place on the site where there is a profusion of a particular flower. Azaleas are great examples. Have each student pick a flower and sit down and look at it carefully. Help them to identify each of the following on their flower: petals, sepals, pistil, stamen. Ask these questions: How many petals are there? How many sepals are there? How many stamens are there? Do you see any pollen? What is the function of the flower? How many pistils are there?

**Field Guide** - Explain to the students that they are going to make a field guide for the site. A field guide is a book that helps to identify the organisms in a certain area. This will be a flower field guide. Divide the students into three groups. Those who like to draw will sketch flowers. Those who want to collect and press flowers will do that. The students who are left get the camera! Each group must also write down certain information for each flower.

1. the name of the plant (if they already know it)
2. color of the flower, its size, number of petals
3. location (mark on a map of the study site if one has been prepared)
4. habitat (dry, wet, sunny, shady)

Tell students that if they are unable to answer any of the questions for a certain plant that the class will help them later.

**Classifying** - Use the plants, photographs and/or sketches that the students return with to build at least two different classification schemes. Discuss with the students which characteristics might be used to separate the angiosperms into groups. Introduce monocot and dicot. Choose one flower of each and ask the students to determine the differences. Build a key by organizing and reorganizing flowers into groups, separating out those with unique characteristics as they are identified.

Take a picture of the class for the title page of their field guide. They are the authors! Sometime soon put the field guide together using the class's classification scheme. Give the students an opportunity to return to the site and use their field guide. Before using the guide add the common names of the plants.

**More Questions and Hypotheses:**
1. What characteristics of angiosperms, the flowering
plants, do you think cause them to be called the most advanced plant group?

2. How are flowers and fruit related?

3. If you found a composite flower, in what special way was it different from the other flowers?

If students are asked to name a plant they will usually say a tree or a flower. If they are asked to name a flower they will usually say a rose. This activity allows the students to examine other kinds of flowers, even those that they would have considered only weeds. Making a field guide of flowering plants of the area gives them something to show for their time and effort. Making the key for the guide makes using a dichotomous key fun rather than an overwhelming prospect. If they can make a key, surely using one cannot be so hard! A concept map of the concepts to be learned in this activity follows.

```
angiosperms—most advanced plants
   (flowering plants)
       monocot
       dicot
           parts of a flower—for reproduction
               petal
               sepal
               stamen
               pistil
```
LS 5.5.2 To demonstrate knowledge of plant groups, students will identify the functions of the root as absorption of water and anchorage of the plant.
LS 5.5.3 To demonstrate knowledge of plant groups, students will identify the functions of a stem as support, transport, and storage.
LS 5.5.4 To demonstrate knowledge of plant groups students will identify the main functions of a leaf.
LS/h 3.5.1 To demonstrate knowledge of plant organs, students will identify the major function of the leaf as photosynthesis.
LS/h 3.5.2 To demonstrate knowledge of plant organs, students will identify the function of the stem as support for the leaves and flowers.
LS/h 3.5.3 To demonstrate knowledge of plant organs, students will identify the function of the root as anchorage and support.
LS/h 3.5.6 To demonstrate knowledge of plant organs, students will classify leaves according to simple or compound, vein pattern, and margin.

Concepts: root, stem, leaf, fruit, simple, compound, vein pattern, margin, photosynthesis

Materials: samples of vegetables and fruits for plant
parts like carrot, raddish, celery, lettuce, potatoes, cabbage, rhubarb, bean sprouts, grapes, orange, apple, tomato; for leaf rubbings - paper, crayons; for leaf prints - paper and shoe polish; for sun prints - a file folder, plastic wrap and sun print paper for each.

Activity:
This is a great activity for around lunch time. If the garden is about ready for harvest take the students to the garden and take the vegetable and fruit samples from there. Ask questions while in the garden. If the garden is not ready, spread out the samples on the lunch table and proceed with the questions.

1. What is a root? Where do you usually find it?
2. Which item on the table is a root?
3. What do you think it does for the plant?
4. What is a stem? Where do you usually find it?
5. Which items on the table are stems?
6. What is the stem's function in the plant?
7. What is a leaf? Where do you usually find it?
8. What does it do for the plant?
9. Is the color of a leaf important?
10. Where does the plant make the food that is stored in the part that we eat?
11. What do we call food making in the leaf?
After the discussion samples become lunch, of course!

Next ask students to take a few minutes to collect some different kinds of leaves. The students may choose to do leaf rubbings, leaf prints, or sun prints, or a combination if time and materials permit.

**Leaf crayon rub:** (Project Learning Tree, 1977, p. 16)

Lay a leaf down, put a sheet of newsprint on top of it, and use the side of a crayon to rub across the leaf. Rubbing firmly all over the leaf will show the veins as well as the outline. A dark crayon will produce a clearer print.

**Leaf Print:** (Chinery, 1977, p. 129)

Shoe polish can be used to make a print. Use a small brush or your finger and spread the color on the back of the leaf. Place your painted leaf on a piece of paper with the polished side downward and cover with another paper. Rub gently but firmly and take away the top paper. Lift the leaf away by its stalk.

**Sun Print**:

Keep the sun print paper inside the folder until ready to use. Take it out in a shady place and put leaf on it right away. Cover with plastic wrap and place in the direct sunlight for a couple of minutes.
After the prints are made, explain that leaves can be classified by the way they look. Ask the students to examine each other's prints and look for similarities. Show the students a simple leaf and have them show their prints if they are of a simple leaf. Continue in this manner to discuss compound leaves, leaf margins, and vein patterns. Before leaving the site, review functions of plant parts.

Seventh grade students usually already have an idea about what roots, stems, and leaves are but find discussing them in terms of lunch fun. Functions become an extension of the obvious. Leaf prints can be used again in classification practice or to make a key. Following is a concept map of the concepts to be learned in this activity.

![Concept Map]

- plant
  - root
    - absorb water
  - stem
    - support
  - leaf (characteristics)
    - photosynthesis
    - simple
    - compound
  - store
  - transport
  - anchor
  - vein pattern
  - margin
LS 5.2.1 and LS/h 1.4.1 To demonstrate knowledge of classification, students will identify a definition of taxonomy.

LS 5.6.1 To demonstrate knowledge of the animal groups, students will identify insects as the largest group of animals on earth.

LS 5.6.2 To demonstrate knowledge of the animal groups, students will identify bees, termites, wasps, or ants as social insects.

LS/h 5.1.1 To demonstrate knowledge of skeletal systems, students will identify a definition of exoskeleton.

LS/h 5.2.1 To demonstrate knowledge of invertebrates, students will identify an invertebrate as an organism without a backbone.

LS/h 5.2.2 To demonstrate knowledge of invertebrates, students will identify examples of organisms classified as invertebrates.

LS/h 5.2.3 To demonstrate knowledge of invertebrates, students will determine by investigation the habits and physical characteristics of an earthworm.

LS/h 5.4.1 To demonstrate knowledge of the phylum Arthropoda, students will identify two common characteristics of all arthropods.

LS/h 5.4.2 To demonstrate knowledge of the phylum
Arthropoda, students will identify the three major classes of the phylum Arthropoda as crustaceans, insects and arachnids.

LS/h 5.4.3 To demonstrate knowledge of the phylum Arthropoda, students will describe distinguishing characteristics of the class crustaceans, insects, and arachnids.

Concepts: taxonomy, insects, social insects, exoskeleton, invertebrate, earthworm, phylum, Arthropoda, class, crustaceans, arachnids

Materials: small notebook, pencil, and hand lens for each student, a few jars to collect grasshoppers or crickets and a clear plastic cloth, a dip net for collecting crayfish. Observation cards

Activity:
Introduce the day's activity with the following background information. Animals that do not have a backbone are invertebrates. Some invertebrates have an outside covering called an exoskeleton. Insects are one kind of invertebrate. There are so many kinds of insects that they are the largest group of animals on earth. Today you will observe 5 different invertebrate animals. Follow the instructions on the observation
cards you are given. When your group has finished at
an observation site return to the teacher for a new set
of cards.

Observation cards:

Observe an ant colony
Find an ant colony in the front field. Observe it for
a little while. Write a few sentences about what you
see happening. Why do you think ants are called social
insects? Can you name some other social insects?
Draw a picture of an ant. How many legs does it have?
Are they jointed? How many body parts does it have?
Does it have antennae? Does it have an exoskeleton?

Observe an earthworm
Go to the worm bed under the big oaks. Take the cover
off the bed and turn up a couple of handfuls of soil.
Look at the worms closely. Describe how one moves in
your notes. Hold one. How does it feel? Draw a picture
of an earthworm. Do not forget the segments. Does
an earthworm have an exoskeleton?

Observe a spider in its web
Take the first path and look for a spider web with
a spider in it. What is the spider doing? What direction
is it facing? Sketch the web and the spider. How many
legs does the spider have? How many body parts does
it have? Does it have an exoskeleton? Does it have jointed legs?

**Observe a crayfish**

Get a dip net and go to the river. Look for the marker to show you where to dip. Dip out a crayfish. Examine it carefully. Does it have an exoskeleton? How many body parts does it have? How many legs does it have? Are they jointed? Sketch the crayfish. Put the crayfish back in the river.

**Observe a grasshopper or cricket** - adapted from "Grasshopper Gravity" (Project Wild, 1983, pp. 59-60)

Take the clear plastic sheet and some jars and go to a grassy place in the front field. Two students pull the plastic sheet to the ground to capture grasshoppers or crickets under it. Pick up one and put in a jar. Examine it carefully. Does it have an exoskeleton? How many legs does it have? Are they jointed? Does it have wings? How many eyes does it have? Does it have antennae? Let your insect go. Watch it move. How would you describe the way it moves?

When students have completed their observations continue with the following discussion.

Organisms can be classified or grouped according to their characteristics. Taxonomy is a system for
for doing just that. It has seven major categories. We will just talk about the first three today. First, what were all the organisms that you observed today? (animals) The first category is kingdom. We studied organisms in the animal kingdom. The next category is phylum. The organisms that we studied today are in two phylums. Can you think of any characteristics that 4 of the organisms had that one did not? (exoskeleton and jointed legs) Which organisms had these characteristics? (ants, grasshoppers, spiders, and crayfish) Earthworms did not have these characteristics. They are in a different phylum than the others. Those with an exoskeleton and jointed legs are in the phylum Arthropoda. The groups within the phylum are called classes. One class, the insects, has three body parts and six legs. Which organisms are insects? Another class of arthropods have two body parts and eight legs. Which was that? They are the arachnids. A third class is the crustaceans. What other animal did you observe today? What were its characteristics. It is a crustacean.

For further investigation:
Ant behavior - "Ants" (Outdoor Biology Instructional Strategies, 1980)
Build an ant house - (Chinery, 1977, pp. 98-99)
(Hillcourt, 1961, pp. 198-191)
Earthworm effects on the soil - (Project Wild, 1980, pp. 73-74)
"Studying Spiders' Webs" - (Chinery, 1977, pp. 104-105)

Nature questions: (Hillcourt, 1961, p. 46)
If time remains play nature questions. The leader assumes the identity of an organism (invertebrate in this case) without revealing the name. The leader answers with "yes" or "no" questions put to him/her by the other students until they have guessed the organism.

This activity allows students to examine invertebrate animals and their behavior. Characteristics identified provide the basis for introducing taxonomy. The nature questions game may provide the teacher with an insight into both their level of knowledge of other invertebrates and their level of abstract reasoning.

Taxonomy

\[
\begin{align*}
\text{Kingdom} & \quad \text{Animals} \nonumber \\
\text{Invertebrates} & \nonumber \\
\text{Phylum} & \quad \text{Arthropods} \quad \text{(Annelids)} \\
\text{Class} & \quad \text{crustaceans} \quad \text{arachnids} \quad \text{insects} \\
\text{crayfish} & \quad \text{spider} \quad \text{grasshoppers} \quad \text{earthworm} 
\end{align*}
\]
LS 5.6.6 To demonstrate knowledge of the animal groups, students will identify an example of an animal with a backbone.

LS 5.6.7 To demonstrate knowledge of the animal groups, students will list characteristics and examples of fish, amphibians, reptiles, and birds.

LS 5.6.8 To demonstrate knowledge of the animal groups, students will identify an example of a cold-blooded animal.

LS 5.6.9 To demonstrate knowledge of the animal groups, students will identify hair or fur as being characteristic of a mammal.

LS 5.6.10 To demonstrate knowledge of the animal groups, students will identify mammals as the group to which man belongs.

LS/h 5.1.2 To demonstrate knowledge of skeletal systems, students will identify a definition of endoskeleton.

LS/h 5.1.3 To demonstrate knowledge of skeletal systems, students will identify the major functions of a skeletal system as support and protection.

LS/h 5.5.1 To demonstrate knowledge of vertebrates, students will identify a definition of vertebrates.

LS/h 5.5.2 To demonstrate knowledge of vertebrates,
students will identify examples of the five classes of vertebrates.

LS/h 5.5.3 To demonstrate knowledge of vertebrates, students will identify distinguishing characteristics of the vertebrate classes amphibians and mammals.

LS/h 1.4.4 To demonstrate knowledge of classification, students will construct a dichotomous key for familiar vertebrates.

**Concepts:** vertebrate, endoskeleton, cold-blooded, warm-blooded, fish, amphibian, reptile, bird, mammal.

**Materials:** a picture of a vertebrate animal for each student, safety pins

**Activity:**

Animals with backbones are called vertebrate animals. Their skeletons are on the inside and are called endoskeletons. What do you think these skeletons do for these animals? (provide support and protection)

Do fish have backbones? How do you know? Can you name some examples of amphibians? reptiles? birds? mammals? Do they all have backbones? Name some other characteristics of each.

"Wild Animal Scramble" (Cornell, 1979, pp. 78-80)

Pin an animal picture on the back of each student.
At the signal, the students take turns asking questions to get clues to their own identities. Encourage them to question a number of other students. The students can ask as many questions as they want, but answers are limited to yes, no, and maybe. As soon as the students feel certain that they know the name of their animal, have them write down their animal's name and their own name. After everyone has finished, call the students up one at a time with their backs to the rest of the group. Announce what the student's guess was.

Dichotomous key:
For this key the students should keep the pictures they used in the preceding section. Spend some time grouping the animals (pictures being held by the students.) For example, all cold-blooded animals in one group, all warm-blooded animals in another group. All warm-blooded animals with feathers step forward. Continue until key is completed.

Suggestions for the interested:
"Birding Calling" (Cornell, 1979, pp.100-101)
"Tracks!" (Project Wild, 1983, pp. 45-46)

When students are asked to name an animal, they will name a mammal. This activity explores all five of
the vertebrate groups and their distinguishing characteristics. These characteristics are then used to classify and to construct a key. Following is a concept map of major concepts in this activity.

```
Vertebrates
    (backbone - endoskeleton)
        cold-blooded
        fish  amphibians  reptiles
        warm-blooded
        birds  mammals
               man
```
LS 6.1.1 To demonstrate knowledge of ecology and pollution, students will identify a definition of ecology.
LS 6.1.5 To demonstrate knowledge of ecology and pollution, students will distinguish between man-made pollution and the process of natural decomposition.
LS/h 6.1.1 To demonstrate knowledge of ecology, students will identify a definition of ecology.
LS/h 6.2 Students will identify the areas of the earth that are included in the biosphere.
LS/h 6.5 Students will identify a community as all the organisms that live and interact in a particular area.

Concepts: ecology, biosphere, community, natural decomposition

Materials: a hand lens for each student

Activity: "The Fallen Log" (Project Learning Tree, 1977, p. 100)

Gather students together and tell them that they are about to examine some living things, watching for the ways that these things interact with each other and the world around them. This is ecology - the study of the interaction of living things with each
other and their environment. We could study the whole biosphere, but the biosphere includes all the environments on the earth where life is found. Instead we are going to study just one small area and its community. The community includes all the organisms that live and interact in this small area.

Go to a fallen, rotting log. Spread the students out along the length of the log. Ask them to look carefully with their hand lenses at the section of the log in front of them. Ask the following questions. Allow the students to observe and respond.

1. What is the condition of the bark on the log?
2. What evidence of plant growth is there on the log? Do you see fungi (mushrooms), algae, mosses, young bushes, trees?
3. What evidence of animal activity is there on or around the log? Are there insect holes, ants, woodpecker holes, animal dens?
4. Are there examples of animals or plants inside the log?
5. Is there sawdust around the base of the log indicating breakdown by insects and small animals?
6. What kind of tree is this? What might its age have been when its death occurred? Why did it die?
When a living thing dies, like this tree, it begins to decay, or rot. This is brought about primarily by certain organisms that consume the organic matter and use it to carry on their own life processes. Thus they will finally reduce this tree to the things from which it was made in the first place. We call this process natural decomposition. How is a fallen tree in your front yard different from a beer can thrown in the gutter?

This activity gives the student an opportunity to do ecology, that is, to study the interaction of some living things with one another and their environment. Following is a concept map of the concepts to be learned in this activity.

```
Ecology
   /     \     \     \  
  |      |     |     |  
(environment) (living things) (result of some interaction)
   /     \       \   
  |      |       |   
biosphere rotting log community natural decomposition
```
LS 5.5.5 To demonstrate knowledge of the plant groups, students will identify the Venus's flytrap as a plant that can trap insects.

LS/h 6.4.1 To demonstrate knowledge of adaptation, students will identify a definition of adaptation.

LS/h 6.4.2 To demonstrate knowledge of adaptation, students will identify an example of protective adaptation as camouflage or mimicry.

LS/h 6.4.3 To demonstrate knowledge of adaptation, students will discuss ways in which animals are adapted to living in their environment.

Conceps: adaptation, protective adaptation, camouflage, mimicry, Venus's flytrap

Materials: for Unnature Trail - 10 to 15 man-made objects; for Invent an Animal - one or two vegetables (potatoes, string beans or carrots) which have been painted white the night before for each student, two boxes of Invent-an-Animal junk like toothpicks, popsicle sticks, masking tape, rubber bands, string, clay, cotton, pipe cleaners, construction paper, scissors, paint, water and paper towels; pictures of carnivorous plants

Activity:

Unnature Trail: (Cornell, 1979, p. 40)
Choose a 40-to 50-foot section of trail and place along it 10 to 15 man-made objects. Some of them should stand out brightly, like flashbulbs or balloons. Others should blend with their surroundings, and therefore be more difficult to pick out. Keep the number of objects planted secret. The students walk over the section of trail one at a time, with intervals between them, trying to spot (but not pick up) as many of the objects as they can. When they reach the end of the trail, they whisper to the teacher how many they saw. If no one saw all of them, tell everyone how many were seen, but that there are still more. Let them start over again. End the game by discussing which things were easier to spot and what made the other things harder to see. What are the clothes that hunters and soldiers wear to blend in with their surroundings called? Animals are also sometimes camouflaged in their surroundings. Some animals look like another animal or object in their environment. This is mimicry. Both are protective adaptations.

Invent an Animal: (Outdoor Biology Instructional Strategies, 1979)

Select two areas with different prevailing colors for activity sites. Each student should select an animal
body from the white painted carrots, potatoes, or string beans. Explain that there will be two teams and each will work in a different site. Each participant will find a home or habitat for his animal in his team's site. He will camouflage his animal so that its color and shape blend into or match its surroundings. The animal should then be placed in its habitat spot without burying or hiding the animal. After the animals are in place the teams will switch sites and try to find the other team's animals. When the animals are found, place them next to each other for discussion.

1. Why were the hard to find animals so difficult to locate? Why were some animals easy to spot?
2. If you had been predators searching for animals to eat, which animals would have survived?
3. Look at the animals from the two sites. In what ways are they different? Why?
4. In what other habitats might some of these animals also be camouflaged?
5. Can you think of any other adaptations that animals have? (An adaptation is any feature of an organism that helps it to survive and reproduce.)

In Search of Insect-trapping Plants:
Plants have adaptations, too. Some very uniquely
adapted plants are those that capture insects. These plants are most abundant in soil that is low in nitrogen. They obtain added nutrients from their insect diets. Show the students pictures of Venus's Flytrap, Pitcher Plant, Sundew and Bladderwort. Go in search of these and other organisms with adaptations. (You will not find the Venus's Flytrap as it does not grow in this area.) The teacher should have already found appropriate specimens of the plants so that the students' attention is directed in the right general area.

Adaptations are found in all of nature. These are just a few fascinating ones. Following is a concept map of the concepts examined in this activity.

```
adaptation
  protective adaptations
    camouflage mimicry
  traps insects for minerals
    Venus's flytrap
```
References


   New York: Oxford University Press.


Nashua, New Hampshire: Delta Education.


Charles E. Merrill Publishing Company.
Appendix

Activity Evaluation Check List

Life Science: An Outdoor Approach

<table>
<thead>
<tr>
<th>yes</th>
<th>no</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

 Does this activity or set of activities include:

 1. field-oriented learning experiences or observations?

 2. hands-on activities?

 3. questions or directed discussion?

 4. questions or suggestions for further study?

 Will this activity or set of activities be

 5. interesting to the students?

 6. feasible to implement in the field?

 Is this activity or set of activities

 7. appropriate to the stated objectives?

Comments: