

Multifunctional Use of a Natural Laboratory for Teaching Biology to Elementary Pupils

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The learning situations described may be conducted in any natural environment in the out-of-doors. Any natural ecological zone will provide multifunctional uses for learning.

Biology and nature are one. Biology is a study of living organisms—life histories, growth processes, conditions for maintaining life, and interrelationships in a space environment. Life on this planet has developed and evolved as an end product of earth's geological evolution, gravitational force, magnetic field, and atmospheric environment. Earth differs from other planets in temperature, moisture, growing season, and chemical elements essential for maintaining living cells. If life is to continue, the natural environment must be maintained, for each plant and animal species has a specific niche in the cycle of life. Young learners should understand the nature of the environment under which life has evolved and is maintained.

For pupils to learn essential biological concepts, they must become involved in studies with living plants and animals in ecological situations where organisms normally live. Knowledge, to be meaningful, is acquired by pupils during the processes of investigation. When good learning is a desired end result, there is no substitute for children's direct involvement with living specimens.

In the planning of the Laboratory School at Colorado State College, an inner area, bounded by outer classroom sections, was designed to provide pupils with living organisms and related natural habitats indigenous to the local area. The planned natural enclosure includes a pond, grassland-plains section, and rocky-hillside habitats together with

common plants and animals normally supported in these ecological units. Small trees, wild flowers, grasses, and other plant life are established. Selected animals, common to local ecological associations, include rabbits, birds, frogs, turtles, tortoises, snails, fish, butterflies, moths, dragon flies, earthworms, sow bugs, and microorganisms. Occasionally children bring newly hatched chicks, ducks, young salamanders, and other species that become a basis for processing information. Animals are maintained for long or short periods of time; then they are usually returned to native habitats in which they find homes.

In the same area, near the pond, a small greenhouse provides space for elementary children to perform plant studies. This building provides optimum light, humidity, water, and soil for plant experimentation. Here, there are sufficient numbers of selected plant specimens for individual or group study of quantitative differences and responses to variations of light, moisture, soil, and other environmental factors.

Learning in biological studies is largely inductive because pupils begin with natural materials to provide intellectual experiences. For example, animals are observed for behavior and life histories. Plant species are observed for adaptations that maintain a flow of energy and materials in an ecological association.

Similar principles that illustrate interrelatedness among plants and animals are



studied beyond the school environment in the surrounding landscape, from which new problems are brought into the classroom for investigation. Conversely, the school's man-made habitats, when explored, raise questions for which field work in the wider expanses of the community helps to find answers. These problems extend to ponds, grassland, foothills, and mountains.

Examples of Investigations Conducted by Pupils in School's Natural Laboratory

The pond has stimulated many studies that may be duplicated in any available water habitat:

The life history of selected insects, such as the water boatman, damsel or dragonfly, or water striders are studied.

Interrelationships among animals and plants, as mapped from an analysis of a food chain, become evident.

Pond water is examined for identification of small organisms that are an integral part of a food chain.

Responses of simple animals to light and other environmental conditions excite much interest for study.

Change in population of organisms maintained in a water culture is ascertained and population density is associated with conditions such as temperature, chemicals, and turbidity.

Certain animals associated with a pond, such as frogs, turtles, and fish, provide the means for studies in behavior and life history.

The animals needed are available throughout the year whenever problems involving them arise in the program. Frogs in the pond find their way in the surrounding reeds and cattails to bask in the sun or out on the surrounding patches of soil. From these points, children watch a large frog lunge back into the pond when a person moves near the area. The distance from which the frog leaps has interested pupils, who have attempted to measure the distance of the "broad jump." Pupils observe how a frog uses its powerful rear leg muscles for fast movement.

Animals and plants of the grassland are observed for variations and support in a food chain within the ecological association. Also the behavior of an animal may be recorded and analyzed. The adaptations of a rabbit, its nest among weeds, its protective coloration, method of locomotion, eating habits, and sensory sensitivities receive the children's attention. Observations of the rabbit may serve as models for the study of other animals.

Huge rocks that maintain plant life—moss and lichens—are situated in one part of the enclosure. Crustose lichens on the surface and mosses in soil-filled crevices provide children with examples for study of characteristics and adaptations to a changing environment. The way in which these plants contribute to the disintegration of a rock is noted, as pupils observe bits of rock attached to root-like structures.

Since the initial placement of plants in the designed natural area, pupils have noted changes in the dominance of certain kinds of plants. This has led to a study of plant succession in the habitat and among other nearby locations. Land from which plant cover has been removed, and land from which flood waters have receded provide observations of obvious plant successions; the effects of man's intervention in the normal cycle of life are readily observed.

Such animals as turtles and toads roam about the premises. Data concerning behavior, rate of locomotion in relation to position of the appendages, and body characteristics for protection are collected. Often these same animals provide a model for the study of reptilian and amphibian life. The available animals become a source for information useful in introducing the idea of evolutionary development.

Meteorological instruments are maintained for obtaining such atmospheric data pertinent to growth of plants, as temperature, humidity, precipitation, air pressure, and wind velocity. These measurements are compared with measurements of water loss and wilting among plants. Such an analysis indicates plants that can withstand the varying atmospheric conditions.

Wherever habitat studies are made, either within the school's natural area or in the wider community, soils are tested for water-holding capacity, available chemicals, and acidity. Splash effects of drops of water come in for investigation. Soil-holding capacity of certain plants is carefully investigated, for conservation practices are of concern to people in the community and state.

Some groups have conducted population surveys of organisms. For this purpose, pupils have constructed squares from four strips of wood or metal. The squares are placed in selected areas to allow groups of two or three children to make a survey of



types of life and environmental forces. Such a population count can be made early in the spring and at later specified seasonal periods to note changes in population and conditions.

Because the greenhouse provides somewhat optimum temperature, humidity, water, and soil conditions, pupils can obtain adequate quantitative information on rates of plant growth under controlled conditions. Some examples of controlled investigations are:

How will the growth of a cellophane-covered plant differ from that of a non-covered plant?

What happens to plants that are covered with different colors of cellophane?

How do different chemicals in water affect the growth of plants?

How do different amounts of light affect plants as they grow?

How fast do certain seeds germinate?

What parts of the plant grow the fastest?

What happens to the growth of a plant if I place three bar magnets in the soil?

What parts of plants grow into new plants?

What effect does cold temperature have on root growth?

How does a plant change if grown in the dark or in full or partial sunlight?

What changes are occurring among plants in a square meter of earth?

How will vibration affect growth of certain plants?



How does weightlessness affect selected plants and animals?

When living organisms under natural conditions are provided for observation, learning activities can be designed, which enable children to discover processes for themselves. Any act of learning should include a variety of types of exercises that children can perform and investigate. Situations in the out-of-doors should be used, rather than artificial contrived ones. Natural facilities

that help children answer their own questions and motivate them to raise new questions are those that increase the children's scientific knowledge.

Learners must come to associate with biology as the study of life itself. The study of living plants and animals is of most importance, though it should be supplemented by reading, telling, and talking about living forms. This study of life itself has been the method of investigation used by scientists from the early Greeks to the present day.

Rabies VII: Informing the Public

There is a need of the public for more education concerning the care of pets. Pet owners should be fully informed about the laws of their community; they should also understand that these laws are intended to protect rather than to restrict. Local dog clubs, particularly obedience training clubs, are often willing to put on demonstrations that emphasize the advantages of good care and training. Often the most aggressive and vociferous agitators, on both sides of a question, are persons who are the least well informed or who are prejudiced on a particular issue.

The AVMA further recommends strict observance of local rabies control regulations and local leash and licensing laws. Also, all pets should be identified by a license tag and a rabies inoculation tag, stray dogs should be reported to the police or local pound, and if bitten by an animal, the victim should contact his physician immediately and report the injury to the local board of health or police department.

Educational Records

Educational Records Sales, 157 Chambers Street, New York 10007, has a new catalog listing phonograph records, film strips, books and transparencies, for grades K-12, that have educational significance.

Scientists Invited to Become Astronauts

The National Aeronautics and Space Administration and the National Academy of Sciences are seeking experienced scientists of exceptional ability "to conduct scientific experiments in manned orbiting satellites and to observe and investigate the lunar surface and circumterrestrial space." The National Academy of Sciences is inviting applications from U.S. citizens (and persons who will be citizens on or before March 15, 1967) no taller than six feet, born after August 1, 1930, and having a doctorate in the natural sciences, medicine, or engineering. Prospective applicants can obtain complete information by writing to Science as Astronaut, National Academy of Sciences—National Research Council, 2101 Constitution Avenue, N.W., Washington, D.C., 20418. The deadline for completed applications is midnight, January 8, 1967.

Health Hazards of Smoking

A pamphlet of this name has been published by the Cigarette Cancer Committee of the Roswell Park Memorial Institute which is a part of the New York State Department of Health. This pamphlet is available from the Institute which is at 666 Elm Street, Buffalo, New York, 14203. It is full of factual material concerning the health hazards of smoking and gives detailed instructions on how this material may be used in different types of school situations.