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An Eight-Year-Old Looks At His World

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Children must learn to think. The study of science greatly widens the interests and knowledge of children and stimulates good thinking. Children have a natural interest in the study of nature and science. They note the effect, but the causes must be explained. To obtain lasting results, the study of science must be based on sound scientific principles, but it must be so simplified that a child's mind can understand.

Children have a flair for exploration into familiar fields. They are most interested in their physical comfort and social well-being. In learning about their physical environment, children want to know what things are for, where they come from, and what made them. That this inquisitive attitude continues throughout life has many times been proved to my satisfaction. Children from higher grades have often brought back to our classroom a specimen, or an experiment they have performed because of an interest that was aroused by their primary studies.

The study of science and nature is taught as a part of the major units of work. School experiences are integrated. Our task is to guide the all-round development of children rather than to teach subjects. The school today is a controlled learning environment where interest supplies the driving force; where opportunities are offered, not inflicted; where skill is acquired, not for the sake of the skill, but for its use.

The interest of the children and the questions they ask can guide us to the materials out of which an experience curriculum, rich in scientific learning, will develop. Explore the knowledge which your children possess. Lead them to make careful observations and to give accurate expression to their findings. While science is knowledge, it is to be approached by young learners as experience. Children must experience the world to know it.

The entire community lends itself to elementary science study. As children learn the interdependence of the water

plants in the aquarium, of the flowering plants and the flying insects, a realization of the interdependence of man upon man and of man upon his environment forces itself in upon the children's consciousness and they comprehend the need of finding their places in this world and of assuming their responsibilities.

All of our projects are planned in advance and the children, therefore, work toward a definite goal. Books, magazines, pamphlets, *The Weekly Reader,* live specimens, and real science experiences are all used. The little book, *Peter and the Frog's Eye,* by Julius King, has been of invaluable aid in introducing the wonders of this everyday world. Many boys and girls have seen pictures of themselves in this small boy who was blind to the beauties of the great out-of-doors until he saw them through the eyes of the frog. But Nature is the greatest text book. Children have been inspired by these nature studies to write stories and poems; they have read many books and told others of them; on their own initiative they have continued exploration in these fields. The exploration trips have caused ears and eyes to become keenly attune to the music and other manifestations of nature. The thrill of discovery has increased the spirit of comradeship between children and teacher.

When children find a need for proof, they begin to experiment. The experiments and experiences always should be treated in such a manner that the children learn to make relationships. When we watered our plants with a jar, we discovered that the hand on the side of the jar away from us looked larger. The hand really looked bigger than it was. This was a magnifying glass. A magnifying glass is always curved; the jar is curved and that is one reason why it makes things look bigger. We looked at our skin through a magnifying glass and saw the pores. Then we looked at a butterfly's wing and found it is covered with many tiny scales. One member of the class brought a toy microscope from home and told the class, "My microscope is a delicate instrument. It shows us many things that we could not see with our eye or with a magnifying glass. It makes things much larger than they really are so that we can see them. I also have a hand lens which helps me see tiny things. It is small and easy to carry."

Every child should have the privilege of observing the life activities of plants and animals under their normal environmental conditions. Observation in the outdoors, supplemented by the raising of plants and live animals in the classroom, will give children an insight into the workings of life that could not be had otherwise. Here the aquarium and terrarium prove most interesting as they lend themselves to the study of live specimens in their environment.

Gardening encourages the children's interest in living things. Gardening makes the children, as well as the plants, grow. The children especially enjoy the planning and planting stages of gardening. While waiting for growth to begin, the children read, make studies and experiment. They read about the biggest secret in the world—the secret of how plants make food. The experiment to see if water rises in plants, if plants really need sunlight, what seeds need to germinate; they also note the effect of weather on the garden and learn to read the thermometer.

Seeds, bulbs, cacti, houseplants and vines furnish experimental material. Carrots, parsnips, turnips, and beets may be partially topped and, placed in a shallow container of water, soil or sand, they will grow and make an attractive plant for the schoolroom. Some vegetables will grow nicely if cut in half, hol-

FIG. 1. First steps into our world of science.

lowed out and hung upside down so that the hollow will hold water.

A study of birds never fails to interest children. From reading stories about birds the class learns of the habits and characteristics of birds—how they learn to fly, how they care for their eggs, etc.

Another enjoyable study is that of insects. The children note the beauty of form in the butterflies and moths, also their colors and habits. The life histories of insects and frogs are studied and, where possible, specimens illustrating each stage of the metamorphic development are obtained. The ceaseless activity of ants and bees is observed. The grasshopper's wing covers are discovered to be his fiddles and his hind legs to be the bows. The children listen to the music of the locust and the honey bee. They learn that the fly has many eyes and that "Eight Legs" the spider, who really is not an insect, spins beautiful webs.

The silkworm is fed his diet of mulberry leaves and kept in a clean box until he spins his cocoon. If the worm is allowed to live inside the cocoon, it turns into a moth. The moth eats its way out of the cocoon and spoils the silk threads that should have been made into silk cloth. Many of the cocoons are put into boiling water to kill the worms inside. The water does not harm the silk. A few of the silkworms are allowed to turn into moths, because these moths lay the eggs that hatch the next generation of silkworms. The eggs laid are put into a fruit jar and placed in the electric refrigerator so that they will not develop until spring when mulberry leaves will be ready for their nourishment.

Pets are extremely interesting and necessary to most children. They bring them to school, it not being "against the rule" as was the case in Mary's schooldays, and here they study the habits of their pets and assume responsibility for their care. We have studied rabbits, turtles, chickens, canaries, garter snakes, bees and many others.

Many adjustments are made as chil-

dren learn to work together. Committees are formed to take care of the varied interests and as these groups carry on their research activities, the children become more and more considerate of the rights of others; in other words, they learn to be members of a group, to criticize and to take criticism. The habit of sharing information is definitely formed. For example, during a science discussion lesson, one child remarked that a kangaroo had a pocket for the carrying and feeding of its young. Many of the children wondered about this marvel and began searching for information and pictures, since it was not feasible to see a real kangaroo. Soon they found a picture of a kangaroo and a description of its unique method of transportation, which information was shared with the other members of the class.

We review and summarize in a science and nature program, frequently by playing the *Do You Know?* game in which each child participates. The following are examples of some of the facts learned:

Do you know that spiders are useful, catching flies and mosquitoes?

Do you know when the spider spins her web she puts sticky bubbles on some of the threads to catch her dinner? She dosen't get caught on the web herself because she knows which threads are the sticky ones.

Do you know that some spiders can spin little parachutes and sail about on them?

Do you know that Old Mother Nature has a band? The little black cricket and the grasshopper play on their fiddles. The katydid plays on his wing fiddles too. The frogs have a chorus and the bees hum a busy tune.

Do you know that the wooly bear caterpillar sleeps all winter like the real bear?

Do you know that some butterflies go South where it is warm in the winter, just like the birds? Not all of them go South, just as not all of the birds go. Some of the butterflies are sleeping in cracks under the bark of the trees. Some butterflies are caterpillars and they sleep all winter until spring.

A final summary, which we found to be most profitable and enjoyable, was an occasion when we invited the various grades in our elementary school to visit our class room. One of our children met the guests at the door and directed them to the various centers of interest. A table of our discoveries was the first exhibit. Among the objects on display, which were described by the children, were spiders, bees, comb and honey, wasps and types of nests, ants in a jar where their tunnels and storehouses were visible, earthworms, tadpoles, toads, frogs, garter snakes, a skin that had been shed while in the cage, a large water snake's skin, rabbit, fish, turtle and snails. Also on display were a bird center, many books and pictures, old birds' nests, a canary, microscope, hand lens, magnifying glass, plant cupboards, indoor garden, prepared flower pots, an experimental garden, cacti, seeds, rooted cuttings, museum, weather calendar and thermometer, butterflies, moths and other insects, trees, leaves, blueprints of leaves, magnet, compass, weathervane, and science books.

The following are some of the talks the children gave in defining terms and in describing equipment, experiments and other activities in the field of nature and science:

An Aquarium

This is our aquarium. We have fish in it. Water plants are needed for the fish. The fish are fed every morning. Snails help to clean the aquarium. Fresh water is put in once a week. The fish enjoy swimming through the castle. It is lots of fun to watch the fish eat.

How Water Rises in Plants

We set up an experiment to see if water rises in plants. The materials used were containers, water, food coloring, and celery. Glasses were half filled with colored water. Stems of celery were placed in the colored water. The experiment was placed in the sunlight. Soon the veins of the stems and leaves became colored. The experiment proved that water rises in plants.

FIG. 2. Two new leaves—Plants do need food for growth!

OUR EXPERIMENTAL GARDEN

We have an experimental garden in our room. We started the plants growing when they were tiny sprouting seeds, slips and cuttings. The seeds were planted in the sand and as soon as water, air and sunlight had been given them, they began to grow. The slips and cuttings were little parts of the big plants. We put the slips in sand and in water that they might root. Before long, little white roots were growing from the slips. The slips were then ready to plant in dirt. Come and see our plants sometime.

PLANT CUPBOARDS

People keep food in cupboards. When people want food they go to the cupboard to get it. Some plants have cupboards. Beets, turnips, carrots, and sweet potatoes are plant cupboards. You eat this kind of cupboard. As the plants grow, they put food away in their cupboards. Then the plant wants food, it takes it from the cupboard. Put a sweet potato into a bowl of water. Keep the bowl in the dark for about two weeks. When you look at the potato, you will find a little plant.

GREENHOUSES

We took a trip to the greenhouse. We have a garden and a small greenhouse in our classroom and we wanted to see what a real one was like. On the way to the green house, we looked for signs of the season. At the greenhouse we found some lovely cut flowers. They had them in a refrigerator case. Besides the cut flowers and potted plants, they had vegetables growing right in the ground floor of the greenhouse. We saw how the top windows opened and we saw the furnace that keeps the plants warm in the winter time. There was a cat too to keep the mice from eating seeds as they were planted. The greenhouse looked like a glass castle with green everywhere.

MUSEUM

We have a museum in our room. All of the boys and girls keep many things in it. We find articles for the museum on the way to school, in the parks, fields, woods, and in our homes. We find things wherever we look. All of us go exploring and find seeds, leaves, nuts, stones, old birds' nests and bugs. We keep the treasures we find on some shelves. The museum is interesting and helps us with our work.

CONE TREES

There are many different kinds of cone trees. The pines have their needles arranged in bundles. Firs have flat needles which are green on top and have two white lines on their under side. Spruces have stiff sharp needles. All of the cone trees belong to one big family—the pine family or "conifers." Cones really are a kind of seed pod. Most of the pines are evergreens. This means that they do not shed their leaves. It means that

their leaves do not turn brown and fall all at one time, as the leaves of the elm or maple trees do. They fall when they are ready to die and new needles take their places.

Roots Work for Trees

A tree has many roots. It has big roots and many little roots. The big roots keep the tree in the ground. The little roots get water from the ground. The water goes from the roots up into the tree. Water helps to make the tree big, for there is food in the water for the tree. In winter, trees go to sleep. The roots do not work. When winter is over the roots get water for the trees again. When the roots of the maple tree go to work, sugar water is pulled up into the maple tree. Men make maple sirup when the sugar maple roots go to work.

Birds' Nests

There isn't any harm in taking old birds' nests after the little birds are grown and through with them. So we went on a nest-hunting trip. All of the children looked for nests. We found a robin's nest made of mud and grass, and an oriole's nest that was like a soft swing. The different birds make as many different kinds of nests as people do houses.

Specimens of Insects

The specimens we have of insects were killed with gasoline. One drop of gasoline on the head of the insect kills it instantly without any struggle. The gasoline soon evaporates and leaves the insect in perfect condition.

Animals Find Winter Homes

Animals know winter is coming. Many of them grow warm winter coats; others find new homes for winter. Bears eat and eat when winter is coming. They then sleep all winter. Sleeping all winter is known as hibernating. Squirrels and raccoons have homes in trees. Mice and chipmunks live in the ground where they have found holes and stored their food for the winter. Many of the birds fly away for the winter. They find homes down in the South. Other birds stay here all winter and they are the ones we must remember to feed this winter.

Feeding Plants

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For four years students in our high school biology classes have been interested in experiments with plant foods. The first year a few students performed a few experiments. Last year forty or fifty of the hundred and twenty in the department were applying plant foods, potting, watering, watching and recording their observations on corn, lawn grass, house plants, sweet potatoes, and other plants.

Our laboratory has no greenhouse facilities. We have ten windows in the three rooms (laboratory-classroom, stock-room, and office) of which only four are available for plants. Two of these have tiers of glass shelves to give additional space. These sound like poor conditions for handling so many experiments, and we no doubt could do better work with less limited facilities. In spite of that the experiments have been interesting and seemingly profitable.

As yet we do not have enough data to make conclusions about the general usefulness of the nutrient solutions prepared in the laboratory, nor of *Vigoro, Kem, B_1,* nor other prepared soil fertilizers.

The disposal plant for the sewage of our town, like that of many others, accumulates the sludge in dried form. This is available, free, to farmers or townspeople. But as soon as they began to use it came the widespread complaint, "It burns the grass." If you could see the amount spread on some of the town lawns you would understand why "it burns."

At our invitation, one daily paper has twice published pictures of some of the plants raised in our laboratory in which