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SCIENCE and NATURE STUDY

Iowa Elementary
Teachers Handbook
Volume V

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Iowa Elementary Teachers Handbook

VOLUME 5

SCIENCE AND NATURE STUDY

Issued by the
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JESSIE M. PARKER, Superintendent
Des Moines, Iowa

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FOREWORD

The course of study in elementary science has been organized around a series of pupil activities. The activities phase of the work is therefore developed in considerable detail and constitutes a major part of the material. The teacher's attention is called to the importance of referring to the section in the back of the book under the heading "Suggestions to Teachers." Here will be found many helpful suggestions concerning general concepts involved in the teaching of elementary science. It is important that teachers become thoroughly familiar with this section and with the introduction before starting any of the activities.

Certain new departures involving a change in teaching procedure are suggested in this material. Some projects are sufficiently broad that all grades can work on them together. In almost every instance some combination of grades is suggested. The purpose, of course, is to conserve the time of pupils and teachers. The suggested grade combinations have been carefully checked both as to difficulty of concepts and availability of suitable references.

Much emphasis is given to the importance of broadening the child's interest in the inanimate and living things that make up his environment; consequently many of the projects involve contact with and study of the various elements in his entire environment. Because of this much of the work in science will involve observation and study of both inanimate and living things, supplemented by extensive reading and study in the texts and references suggested. Care should be taken to acquaint parents with the nature of the work so that they will understand the purpose of the field work associated with this program.

The time allotment for science recommended in the Weekly Program in the *Manual for Use of Iowa Elementary Teachers Handbooks* is two 45-minute periods per week. The total time allotted provides for both recitation and study. It is extremely important that parents understand that the recitation period is not the only time when children are working

on their science program. The supervised study period is just as important to the child from the standpoint of learning as is the recitation period. There will doubtless be weekly periods when the children will not recite in their science classes, using the entire time for supervised study, but this does not mean that they will not be getting valuable learning experience in their science work. It is necessary that parents understand this departure from traditional practice in order to avoid unwarranted criticism.

The preparation of this volume has been made possible through the generous donations of time and service by Iowa educators. Grateful acknowledgment of such service is due Dr. Ernest Horn, Dr. Elmer L. Ritter, Dr. Barton Morgan, Mr. Paul B. Norris, and Mr. H. K. Bennett—the central committee responsible for the entire course of study—and to the following committee who prepared this manual: A. H. Haus-rath, George O. Hendrickson, Miss Johnnie Belle Gaar, M. L. Grant, Mrs. Dorothy Gangstead Hatch, Miss Eslie Hays, Ellis Hicks, H. J. Montgomery, Miss Margaret Murley, and E. P. Schindler.

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TABLE OF CONTENTS

	Page
I. Introduction	9
A. Purposes and Objectives	11
B. Organization of Teaching Program.....	11
C. General Discussions	12
D. Outcomes	12
II. Suggested Activities for Pupils.....	13
A. Selecting Pupil Activities.....	13
B. Pupil Activities, 1-77 (Detailed list on following page).....	14
C. Bibliography	92
1 -18 Pupil References	
19-54 Teacher References	
III. Suggestions to Teachers.....	102
A. Activities Involving Direct Contacts with Nature.....	102
1. Scientific Observations	102
a. Fifty Interesting Things to Look for in Fall.....	102
b. Fifty Interesting Things to Look for in Winter.....	104
c. Fifty Interesting Things to Look for in Spring.....	107
2. Nature Hikes	111
3. Science and Nature Hobbies.....	112
4. Home and School Experiments.....	112
B. Activities Arising from Direct Contacts with Nature.....	113
1. Bulletin Board Projects	113
2. Scrapbook Suggestions	113
3. Oral Reports	113
4. Nature Diaries	114
C. Reading to Extend One's Own Nature Experiences.....	115
1. Science Readers	115
2. Building a Science Vocabulary.....	115
D. Science and Nature Games.....	116
1. Science Vocabulary Game.....	116
2. Animal-Vegetable-Mineral Game	117
3. Bird, Beast, or Flower Game.....	117
4. Bird Game	117
5. A Nature Study Game.....	117
6. Rock Identification Game.....	118

PUPIL ACTIVITIES

No.

1. Holding a Fall Festival or "Harvest Home" Festival
- *2. Making a Leaf Collection
3. Making Leaf Prints, Plaques, Paper Weights, Calendars and Other Ornaments
- *4. Controlling House and Stable Flies, and Mosquitoes
5. Making an Insect Collection
- *6. Starting New Potted House Plants
7. Making Dish Gardens
8. Potting Bulbs for Indoor Blooming
9. Making an Outdoor Bulb Garden
- *10. Making, Starting, and Maintaining an Aquarium
11. Hunting Wild Animal Tracks and Reading the Stories They Tell
12. Hunting Wild Animal Homes
13. Making a Nature Map of the Neighborhood
14. Making Nature Ornaments
15. Making Decorations and Gifts from Plant Material
16. Making an Observation Ant Colony
- *17. Making a Collection of Plant Enemies
18. Rearing Insects
- *19. Protecting Ourselves from Storms
20. Enjoying Holidays Safely
21. Using Plant Saps
- *22. Getting Ready for Winter
- *23. Preserving Food
- *24. Determining How Well Plants Insure Their Kind for the Future
25. Feeding and Caring for Home Poultry Flocks
26. Making and Using Weather Forecasts
- *27. Establishing a School Museum
- *28. Differences and Similarities Among Animals
29. Midwinter Bird Census and Catalog
- *30. Conserving Our Winter Bird Life
- *31. Society for Prevention of Cruelty to Animals
32. Trapping, Hunting, Fishing
33. Keeping a Weather Chart
34. Heating Our Schools and Homes
- *35. How to Fire a Stove or Furnace
36. Keeping Cool in Summer and Warm in Winter
37. Making a Slide or Skating Pond
38. An Airplane Show
39. Using Machines to Save Labor
- *40. Securing Good Water for Our School and Homes
41. What Rural Electrification is Doing for Farm People

42. Keeping Household Electrical Equipment in Order
- *43. Lighting Our Homes Efficiently
- *44. Finding Out What Makes Things Run
45. Making Air Work for Us
46. Lighting Bicycles and Automobiles, and the Care of Flashlights
- *47. Fighting Fires
48. Making a Rock and Mineral Collection
49. Mapping the Sky
50. Making a Tree Exhibit
51. Making and Using an Electric Bird Identification Chart
52. Painting and Interpreting Bird Portraits
- *53. A Bird Day Program
54. Holding a Birdhouse Show
55. Attracting Birds to Our Neighborhood
56. Making a Bird Calendar and Itinerary
57. Charting Bird Migrations
58. Securing Good Seed for Field and Garden
- *59. Starting Seeds Under Glass
60. Making Plant Notebooks
61. Making Individual and School Gardens
- *62. Beautifying the School Grounds
63. Building a Nature Trail in a Park
- *64. Tree Planting—Arbor Day
65. Using Our Public Parks
66. Kite Day
67. Mixing Corn to Improve It
68. Hatching and Raising Baby Chicks
69. Making a Sundial
- *70. Caring for Small Animal Pets
71. Keeping Milk and Cream Cool
72. Rearing Young Game Birds
73. Bird Nesting Census
74. Protecting Plants from Damage
- *75. Taking a Census of Insect Pests in the Community and Studying Methods of Control
76. Stocking a Farm Pond or Garden Pool
77. Staging a Pet Show

*On pages 11 and 13 reference is made to starred items in this list.

I. INTRODUCTION

Elementary Science has been organized on the principle that children are naturally active, and wish to *do* and to *know* things. From their viewpoint all the world is new—it is theirs to explore and the things in it are theirs to handle. The child wants real experiences of his own. Usually he prefers to pet a rabbit himself rather than to watch someone pet it, or hear someone tell about it. As the child investigates his material surroundings, the efficient teacher-guide remembers that children have inquisitive and constructive urges which appear early in life. The guide may point out the successes of others in manipulating material things, and the naturally imitative child will wish to try these experiences himself. The child may also wish to interject some ideas and questions of his own. At such times the teacher should encourage and lead him to try to foresee the probable outcomes of his hunches. The child soon learns that a competent guide saves him time and materials, and insures more satisfactory outcomes. As a healthy, normal individual, the child will at times insist upon doing things his own way. He may wish to feed a rabbit something which you know very well the animal will not eat. Let him try it. He should be encouraged to explore and try out his own ideas. The teacher should not allow the child to become too dependent or parasitic upon detailed directions from others.

The child early desires to catalog his surroundings—to know what everything is and what he can do with it or what it will do for him. This leads to his acquisition of names for objects, collections, and groupings of various things, questioning, experimentation, and reading with a purpose to meet his growing needs. Witness boys and airplanes; girls and playhouses.

Most of the self-recognized needs of children will appear as problems or constructive projects. For instance: What wood shall I use for an airplane frame? What food for my doll? To the extent that he thinks his way through such problems in systematic or orderly procedures and tries out his hunches, observing results and modifying his plans to find

better methods, he is using the scientific method and acquiring a scientific attitude. The scientific method and attitude apply equally to small or great problems. The teacher should see that the child uses basic scientific principles and procedures whenever such are known and applicable. An essential step in the complete learning experience centering about any problem should be a clear statement of the scientific principles involved in that problem in terms understood by the pupil. A first grader can learn, state, and remember that hammering a wire makes it hot. An eighth grader can grasp the idea of faster moving minute particles in the warm wire. To emphasize these principles and call attention to applications and implications of them should help to make science function more actively in pupils' lives.

Scientific thinking is not limited to elementary science; it should occur in all other subjects and activities. It is particularly important, therefore, that science be correlated with these other subjects. Language and reading will be used extensively in the science lessons, but frequently we will find correlations with agriculture, art, geography, health, history, industrial arts, and literature. In like manner these other subjects may frequently depend upon science to round out the child's understanding of some general problem. The pupil activities suggested in this course of study have been selected to facilitate correlation with other content and skill subjects. In fact, many such correlations are mentioned in the list of activities. For example, in the study of Indian and pioneer life, it will be learned that preparation for winter was of utmost importance. Science activity No. 22 should be studied at that time.

The committee responsible for developing this course of study was composed of highly successful teachers of elementary science and nature study in rural and graded town schools, a county superintendent of schools, a county agricultural agent, and professors of science and education who have had much experience in teaching functional science. The committee has drawn heavily upon all available sources but attempted to avoid duplication with other readily available teaching and study materials. Criticisms and suggestions for improvement are invited and will be most gratefully received.

A. Purposes and Objectives of Elementary Science and Nature Study

At the elementary level the purposes of science and nature study should be—

1. To broaden the child's interests in inanimate and living things that make up his environment
2. To deepen the child's understanding of the actions and effects of the inanimate and living things which appeal to his curiosity
3. To instill in the child a realization of the inevitability of nature's laws
4. To stimulate the child to think scientifically, within his mental powers, about natural and artificial forces and events which he encounters in his daily life
5. To build attitudes and appreciations in the child which will enrich his daily contacts and experiences with material things and natural forms and forces

Note: The specific objectives for each activity are not directly stated in the suggested pupil activities. Instead, they are implied in the introductory statements.

B. Organization of Teaching Program

For recommendations on time allotment see *Manual for Use of Iowa Elementary Teachers Handbooks* (Volume 1).

It is highly advisable to have all the pupils working in science activities throughout the year. If grades 4-8 are engaged in an activity not appropriate to grades 1-4, select another suitable activity for the lower grades.

It is suggested that the starred activities be selected in a four-year sequence. This provides a minimum of twelve activities for any one pupil over a period of four years, or three a year, which allows one major activity a season.

Because of the limited amount of time available for the study of science as such, large formal units of science instruction have been kept at a minimum. However, extensive use has been made of more limited *science activities* that correlate naturally with the other content subjects. The content and skill subjects are recognized as the major emphasis at each grade level. To facilitate the selection of science activities from the accompanying list and their correlations with other subjects, correlations and grade levels are indicated for each activity. It would be very desirable to keep a permanent record of the activities undertaken together with the dates, grades, and pupils involved. This can be done by jotting notes on the margins of the activity outlines in this booklet.

Science also offers a number of possibilities to keep youngsters actively and wholesomely busy during recess periods in rainy weather. Some of the activities of hobby type, or those involving

handwork, may be used as free activities during such recess periods. Nature games may be used occasionally as organized group activities at such times.

C. General Discussions

Occasionally, especially to select a new activity, science topics may be used for the general discussion periods in which the entire school or room participates. (See Part III, this booklet, for suggestions for teachers to aid.) Many of the activities suggested in the following section are suitable for these discussions. Some additional specific suggestions for general discussion periods are listed herewith.

1. Adventures in science
 - a. Stories worth reading or telling about great discoveries, inventions, scientists, new developments, etc.
2. Nature stories worth remembering
 - a. To be told, or read, or "made up"
3. Science and superstitious beliefs
 - a. From horsehairs to snakes
 - b. Snakes (hoop, joint, size of, sea monster, etc.)
 - c. Witchcraft, hypnotism
 - d. Bird migration (birds change to fishes and frogs)
 - e. Mythical gods and the elements (Thor—thunder)
4. Conservation of our natural resources
 - a. Soil (George Washington practiced it.)
 - b. Forests, minerals
 - c. Wild life—providing cover for wild game, tree planting, etc.
 - d. Vital, timely materials such as food in drought periods, clothing when scarce and expensive, etc.
5. Getting along in our surroundings
 - a. Adaptations
 - b. Balance of nature, interdependence
 - c. Natural enemies and friends
 - d. Protection—coloration, defense and attack
 - e. Man's place in his environment

D. Outcomes

The basic outcomes for elementary science and nature study should be the achievement of the aforementioned objectives by each student according to his abilities. More important than any specific scientific facts learned at the elementary level are the understandings of certain general scientific principles and growing tendencies to use scientific methods of thinking and solving problems and the development of scientific attitudes. These outcomes can be judged by the pupil's success with the various activities he undertakes, his method of procedure, and the use he can make of the principles involved. These outcomes are, therefore, of a type which the teacher's judgment should be able to evaluate.

II. SUGGESTED ACTIVITIES FOR PUPILS

In developing this list of suggested pupil activities an effort was made to comply as fully as possible with the following standards:

Activities engaged in by pupils should be significant; i. e., make some valuable contribution, and seem worth while both to the pupils and to the community; furthermore, these activities should definitely contribute to the desired educational outcomes.

Activities should provide maximum opportunity for pupils to learn by *firsthand experience* with science (problem solving, doing, observing, manipulating or feeling) rather than merely by *reading about science*. While reading should not be the exclusive approach to science, no school should neglect reading as an important part of science study. It is urged that much supplementary or free-choice reading in science be done, as indicated by the extensive list of suggested references for each activity.

The desired outcomes of elementary science can be achieved from many different experiences. With the limited time available in the weekly program for systematic science instruction, it seems more desirable to offer suggestions for a wide variety of pupil activities from which individual teachers may choose, rather than to prescribe a few large units of science instruction. In this way teachers may use their science periods each week in activities selected for their current timeliness and correlation with the large units being studied in the subjects of major emphasis. Those activities that cover the minimum essentials of scientific principles which should be taught in the first eight grades are starred in the Table of Contents.

A. Selecting Pupil Activities

The following list of suggested activities provides a broad cross section of the various areas of science and nature study which are appropriate for inclusion in the elementary grades. Certain activities are more suitable in one season of the year than another. For that reason they have been arranged in a seasonal grouping. Activities 1 through 27 were formulated for use in the fall; activities 28 through 48 for the winter season; 49 through 77 for spring. The activities are numbered approximately in their best sequence throughout the year. A few activities were meant to continue as individual projects into the summer during the vacation period.

Many of the suggested activities are well adapted to the local situation in one school but not necessarily in another. The local situation and conditions should always be considered, and activities should be selected which meet local needs and build upon the past

experiences of the pupils. It would not be wise to attempt to grow house plants in winter in a schoolroom not properly heated at nights and during week ends.

Each science activity may be selected so that it will be suitable for use in two, three, or more grades. Some activities are inclusive enough to provide desirable learning experiences for students of all ages and grade levels. Possible correlations with other content and skill subjects are indicated with each activity. All activities are keyed separately to the two lists of references in the bibliography at the end of this section (see page 92)—Pupil References (1-18), and Teacher References (19-54).

B. Pupil Activities

1. Holding a Fall Festival or "Harvest Home" Festival

An annual fall festival has become a firmly established tradition in some communities and school districts. This custom should spread. The school makes a natural center for the festival, and school teachers and children are expected to assume much responsibility in planning and conducting the event. This project affords an excellent opportunity to get children and school patrons to work cooperatively on a worth-while local activity.

a. Objectives

- (1) To make pupils and community aware of the important products and resources of the community
- (2) To raise standards of local products
- (3) To develop community pride in and consciousness of the resources and achievements of the people of the community
- (4) To learn to work cooperatively with others

b. Scope

- (1) Give every student some part in keeping with his abilities and interests.
- (2) Try to interest all parents and other school patrons by asking them to contribute the best of whatever exhibit material they may have. Examples: Best of corn produced on upland and best produced on bottomland; local crops and native plants; livestock and poultry in cooperation with 4-H Clubs; novelties, and hobby materials of adults.
- (3) Develop the kind of festival that will meet the community interests; namely, local crops, native plants.
- (4) Develop educational theme of "harvest festival" through program and exhibit features.
 - (a) Sand table exhibits (Grade Range: 1-3)
 - (b) Early harvest festivals (Grade range: 4-8)

- (c) Thanksgiving observance (Grade Range: 4-8)
- (d) Community history based on local points of interest

c. Committees for staging festival

- (1) Select active general committee representing various interests in the community.
- (2) Give students of upper grades prominent places on departmental committees.
- (3) Use first to third grade pupils as helpers or messengers to parents and other adults on committees.
- (4) Urge committees to develop original ideas for making their part of festival attractive, interesting, and educational. Example: Make flower show display in shape of horseshoe, or arrange as a garden display.
- (5) Provide a variety of *local* entertainment (music, novelty numbers) rather than movies or outside speakers.

d. Preparation of exhibit rooms

- (1) Rooms and equipment
 - (a) Clean rooms and equipment, as chairs, table; wall-board for booth material, sheets, tacks, crepe paper, and pins should be available for use.
- (2) Decorations
 - (a) Each class might have special room or booth to decorate.
 - (b) Materials: leaves, fruits, seeds, gourds, cattails, grains, winter bouquets and weeds, posters, cut-out silhouettes, and drawings (Grade Range: 1-3)
 - (c) Make decorations simple—just elaborate enough to make proper setting for exhibits.

e. Exhibits

- (1) Corn and small grains (10-ear and single ear samples, peck of small grain shown in ordinary pail)
- (2) Vegetables (5 carrots, 5 onions, or any size, number, or measure as desired)
- (3) Flowers (Best arranged bouquet, best specimen of flower species, or exhibit of special bouquets)
- (4) Sewing, canned and baked goods (Exhibits from these phases are especially available where schools have home economics classes.)
- (5) Manual arts (Exhibits possible where manual training and agriculture classes are taught.)
- (6) General school exhibits (Examples: handiwork, notebooks, art work, penmanship, etc.)
- (7) Livestock and poultry (Exhibits of these are especially possible in consolidated school communities.)
- (8) Hobby display (Examples: wood carving, aeroplanes, etc.)

- (9) Health exhibit (Possibilities: school lunches, organized play activities program)
- (10) Conservation exhibit (Possibilities: soil erosion, wild life, native plants)
- (11) Community organization activity exhibits (P.T.A., 4-H Club, Girl Scouts, Boy Scouts, etc.).

Note: Exhibits should be selected for any one community that will conform to community interest and availability of products. This section of exhibits will vary with every school situation. The teacher in charge, with her committee, will have to select the kinds of exhibits that are desired for the festival.

f. Program

- (1) Prepare the program in keeping with the local festival.
- (2) Home talent programs create much interest; use that local boy, girl, or adult who can sing or play.
- (3) Use exchange program features from other schools.
- (4) See that the program has one good thought-provoking educational feature. Do not make the program purely entertainment.

g. Correlations: Agriculture, citizenship, geography, history, home economics, art, industrial arts, language, music, spelling, general programs

h. Grade Range: 1-8

i. References

- (1) For pupils: 1, 7
- (2) For teachers: 25, 39, 41

2. Making a Leaf Collection

Leaf collections appeal to children's artistic, nature-loving, and collecting interests, and are suitable for exhibits, displays, posters, and cut-outs. Leaf collections are an important part of the work of plant scientists and make a good beginning for the young, scientific-minded pupils.

a. Gather and identify leaves from all available native trees.

- (1) Discuss different types of leaves (simple, compound, etc.).
- (2) Group leaves into similar types:
Black walnut and butternut; hickory, ash, sumac; maple, sycamore; elm, ironwood, hackberry; birch, hawthorne, basswood; white oak (round lobes) and black oak (pointed lobes)

b. Gather and identify leaves from nonnative trees (Chinese elm, blue spruce, etc.).

- (1) Make a collection of the common fruit tree leaves.
- (2) Make a collection of "evergreen" leaves, and note length and different number of needles in bundles for pines; short, single leaves on spruce, etc.

- c. Gather and identify leaves of other plants.
 - (1) Ornamental bushes and shrubs (lilac, spirea, Japanese barberry, etc.)
 - (2) House plants, garden plants, bush fruits, etc.
- d. Press, preserve, and mount leaves.
 - (1) Press leaves under weight, between newspapers, wall-paper catalogs, or magazines, with absorbent paper. Change to dry paper daily if mold is apt to appear.
 - (2) Heat paraffin in a shallow pan and dip leaves, allowing excess paraffin to drip off into pan. Keep paraffin hot, but not smoking, for a thin coating. Spread on flat surface to dry.
 - (3) Mount on appropriate sheets with scotch tape or strips of gummed paper.
 - (4) Label with name of plant, place and date collected, and name of collector.
 - (5) Group into similar types and places in notebooks, scrap-books, or on bulletin board, and display or file for future study.
- e. Correlation: Art, industrial arts, physical education, reading, spelling
- f. Grade Range: 4-6; 1-3, simple leaf collections
- g. References
 - (1) For pupils: 1, 7, 13, 18
 - (2) For teachers: 23, 25, 30, 39, 41, 49, 54

3. Making Leaf Prints, Plaques, Paper Weights, Calendars, and Other Ornaments

Attractive gifts and ornaments for school and home, providing handwork and satisfaction of producing real things of value, can be made easily. At the same time this activity will build increased interest in plants and their identification.

- a. Leaf plants can be made by spatter silhouettes or by blue-printing or photographic processes.
- b. Direct silhouettes can be made by making outline of leaf shadow (avoid tracing) and cutting out of construction paper. (Grade Range: 1-3.)
- c. Leaf plaques can be made by plaster of Paris casts. (Grade Range: 4-8.)
 - (1) The simplest process is to place leaf face down in a shallow saucer or dish large enough to hold entire leaf.
 - (2) Mix a thick paste of plaster of Paris and pour or press into dish, covering leaf about half inch deep. Place a knotted loop of string in plaster in proper position to hang finished plaque. Allow to stand until hard. Veining will show plainly.

- (3) Finished cast can be painted with natural green or autumn colors.
- (4) A more realistic, embossed effect can be achieved by placing modeling clay or plasticine in bottom of dish first, pressing under side of leaf into clay until a clear mold is obtained. Dish is then filled with plaster of Paris as previously described.
- d. Leaf prints or plaques can be mounted as wall ornaments, calendars, etc.
- e. Correlations: Art, industrial arts
- f. Grade Range: 1-8
- g. References
 - (1) For pupils: 1, 7, 8, 13
 - (2) For teachers: 25, 39, 41, 49, 54

4. Controlling House and Stable Flies, and Mosquitoes

Some flies and mosquitoes are not only a nuisance, but are spreaders of serious diseases. The number of flies and mosquitoes in any locality can be decreased often by man's control measures.

- a. Look for breeding places of flies (garbage, manure piles, plant refuse).
 - (1) Examine such a place or object to find eggs, larvae, pupae, and adults.
 - (2) Notice other places where flies are found.
 - (3) Consider relationship between flies and cleanliness.
 - (4) Find out what flies eat (houseflies eat most human foods, etc.).
 - (5) Make a list of diseases that could be transmitted by flies.
 - (6) Observe how flies are controlled.
 - (a) Cleanliness with prevention of breeding places
 - (b) Killing the flies
 - (c) Exclusion and discouragement
- b. Look for breeding places of mosquitoes in pools, rain barrels, and tin cans to find larvae and pupae. Eggs are not discerned so easily.
 - (1) Examine mouth parts of several mosquitoes and find out what and how they eat.
 - (2) Tell how mosquitoes carry germs of disease from the bloodstream of one person to another.
- c. Destroy breeding places.
 - (1) Punch holes in tin cans before they are thrown away, screen rain barrels, etc.
- d. Screen homes and schools; keep barns darkened; use fly spray.
- e. Correlations: Health
- f. Grade Range: 4-8
- g. References
 - (1) For pupils: 6, 7, 9, 11, 13, 15, 16, 18
 - (2) For teachers: 4, 48

5. Making an Insect Collection

This is another activity which appeals to children's collective and artistic interests and which is a professional activity of scientists.

- a. Learn how to catch insects by making and using a collecting net.
- b. Make a list of various places where insects can be found, such as in water, in the soil, on sandy areas, underneath dead bark, in manure and carrion, on vegetation, in air, etc.
- c. Kill insect by placing it in a bottle or jar with a small piece of cotton saturated with gasoline or a dry-cleaning liquid. (Keep inflammable liquids away from flames.)
- d. After an insect has been killed, it should be pinned correctly.
 - (1) On large insects the size of a potato beetle or grasshopper there is a definite place on the body where the mounting pin should be inserted. Know these places for various types of insects.
 - (2) Label on paper under each insect:
 - (a) Name of insect
 - (b) Locality where specimen was captured
 - (c) Date of capture
 - (d) Name of collector
 - (3) For use in trays or boxes with glass covers, place grasshoppers, moths, butterflies, dragonflies, etc., on back on cardboard, spread wings, hold them spread with paper strips pinned across the wings, and let them dry in position for about three days.
- e. For insects mounted on pins, use corrugated cardboard in bottom of cigar box.
 - (1) Place a moth ball in each box to keep away other insects which might destroy your collection.
 - (2) Keep the box dry to prevent mold.
 - (3) Keep the collection dark so colors will not fade.
- f. Correlations: Agriculture, art, industrial arts, reading, etc.
- g. Grade Range: 3-8
- h. References
 - (1) For pupils: 4, 6, 7, 8, 11, 13, 15, 16, 18
 - (2) For teachers: 23, 25, 26, 35, 49

6. Starting New Potted House Plants

House plants carry the welcome green of spring and summer through the fall and winter months. Every home and school-room (if protected from freezing temperatures at night and during week ends) is brightened by house plants. Their propagation, growth, and care teach much.

- a. Observe growth habits of plants.

- (1) Visit greenhouse or some student's home where flowers are a business or hobby, and note methods of propagation, such as cuttings, layering, slips, seeds, or roots.
 - (2) Propagation equipment. (Get small wooden cheese boxes or cigar boxes for containers. Use sand for starting soil for plants.)
 - (3) Growing equipment. (Secure flower pots of varying sizes, tin cans, and a few small pebbles. Soil should be rich, light loam of sandy nature, or good rich, black loam soil to be mixed with sand or leaf moss.
 - (4) Make use of pebbles in bottom of containers to aid drainage.
- b. Selection of house plants should be determined by:
- (1) Light conditions of rooms. (Geraniums require bright light; ferns are best away from direct sunlight.)
 - (2) Temperature of rooms. (Some like cool rooms; others, warm rooms.)
 - (3) Humidity of rooms. (Cacti thrive in dry air; ferns, in moist air.)
- c. Care of potted plants
- (1) Plants need moderate watering, occasional insect spray, and repotting when roots fill soil and cling to side of pots.
- d. Decorating containers for potted plants
- (1) Tin cans may be painted or covered with colored paper.
- e. Correlations: Agriculture, art, home economics, industrial arts
- f. Grade Range: 4-8
- g. References
- (1) For pupils: 1, 2, 8, 13, 18.
 - (2) For teachers: 20, 23, 31, 35, 46, 48.

7. Making Dish Gardens

Dish gardens are miniature gardens of small living plants grown in a dish. The Japanese have developed dish gardening into a fine art, but it is also a very popular activity in our country. Miniature houses, fences, gates, pools, footbridges, and china animals or people are used to create complete little landscapes.

- a. Make an indoor garden for a Christmas gift.
- (1) Choose an attractive container about 2 or 3 inches deep and 6 or more inches in diameter.
 - (2) Prepare a well-drained seed bed with gravel and sand in the bottom.
 - (3) Obtain suitable plants, such as ferns or moss for grass, etc.

- b. Prepare a dish garden to fit a definite location in the school or home. Plan this as an art project and carry out the idea as in "a."
- c. Make an experimental egg shell farm or garden.
 - (1) Experiment with small plants planted in egg shells supported by sand.
 - (2) Experiment with different types of soil.
 - (3) Experiment with different types of seeds.
- d. Make a miniature garden scene.
 - (1) Make a Japanese or Mexican landscape garden.
 - (2) Make a miniature plant garden of an original plan.
- e. Correlations: Art, home economics, industrial arts, reading
- f. Grade Range: 1-8
- g. References
 - (1) For pupils: 5, 13, 18
 - (2) For teachers: 23

Greenwood, Thelma, *Indoor Gardens*, Unit Study Book No. 252, American Education Press, Inc., Columbus, Ohio, 1938.

8. Potting Bulbs for Indoor Blooming

Potted bulbs make much appreciated gifts and attractive ornaments for school and home.

- a. Propagation materials—sawdust, sand, pebbles, or fiber material shavings
Containers—dishes, paper cartons, flower pots
- b. Determine selection of bulbs desired.
 - (1) Observe methods of growing bulbs as selected. Narcissus bulbs planted in fiber material in paper cartons may be obtained ready to produce flowers.
 - (2) Watch bulbs develop and find out how to take care of any special needs.
- c. Correlations: Agriculture, art, home economics, industrial arts
- d. Grade Range: 1-8.
- e. References
 - (1) For pupils: 8, 13
 - (2) For teachers: 23, 25

9. Making an Outdoor Bulb Garden

Children enjoy bulb gardening and the thrill of their colorful flowers early in the spring. A sheltered but sunny spot close to the schoolhouse, or in a bed in the open, is most suitable. This project may be used to initiate interest in beautification of the school grounds and the pupils' own home grounds.

a. Choosing bulbs

- (1) From illustrations in nursery catalogues, select the desired flowers which come from bulbs, and those which come from seeds.
- (2) Secure bulbs from local growers or order them.
- (3) Group varieties for a pleasing color arrangement.

b. Make a planting plan.

Pick a suitable location for the bulb flowers (tulips on the south side, lilies on the north or shaded location).

c. Plant the bulbs in accordance with directions in catalogues.

d. Correlations: Agriculture, art, reading

e. Grade Range: 1-8

f. References

- (1) For pupils: 1, 5, 6, 8, 11, 13, 16, 17, 18
- (2) For teachers: 23, 24, 25, 35, 37

10. Making, Starting, and Maintaining an Aquarium

An aquarium provides for a vast amount of experimentation in learning daily observations, and continuous interest in and study of life processes. Many lessons may be effectively learned from mistakes as well as successes in the details of aquarium management. Pupils should be challenged to make their aquariums succeed, but should be ready, like all good scientists, to profit from their mistakes.

a. Make a list of all different kinds of containers you have seen used for an aquarium (fish bowls, battery jars, cookie jars, wash tubs, etc.).

b. List the good and bad points of each type of container, then make your selection. (Choose one with large water surface).

c. Decide what things are going to be in the aquarium. (Animals—fishes, snails, clams, leeches; plants; sand; water).

d. Study how each part of the aquarium affects the others.

- (1) Animals depend upon plants (for food—photosynthesis, etc.).
- (2) Plants depend upon animals (for food-organic).
- (3) Plants depend upon soil (for minerals and support).
- (4) Plants depend upon sunlight (for manufacture of food—photosynthesis).
- (5) Plants and animals depend upon water (for dissolving and transporting food).

e. Try continuously to improve your aquarium.

- (1) Have the right amounts of plants, animals, sunshine, sand, and water so that each works at its best.
- (2) Determine the right amount of food to give the animal life in order to prevent putrefaction of excess food, formation of poisons, etc.

- (3) Experiment with use of scavengers (snails, clams, crayfish, etc.).
- (4) Experiment with use of turtles, snakes, salamanders, tadpoles, frogs, and other forms of water life.
- f. Keep written records of your successes and failures. Write reasons for each, animals involved—kinds, food, treatment, behavior.
- g. Correlations: Reading
- h. Grade Range: 1-6
- i. References
 - (1) For pupils: 5, 6, 8, 13, 57
 - (2) For teachers: 23, 25, 30, 32, 49, 57

11. Hunting Wild Animal Tracks and Reading the Stories They Tell

Many Indians and people of all races become highly skilled in "reading the sign"; that is, telling the story of animal adventures from their tracks and trails. Some people become so expert they can tell not only the kind of animal but also its sex, age, speed of travel, purpose, and how long ago the track was made. How can this be done?

- a. Decide what tracks should be seen in various places.
- b. Investigate these places.
 - (1) Shores of lakes, ponds, marshes, and edges of creeks or rivers may yield tracks of muskrat, mink, raccoon, mice, or herons, bitterns, and other shore and marsh birds.
 - (2) Dusty lots and roadsides may yield tracks of sparrows, doves, pigeons, chickens, dogs, rats, horned lark.
 - (3) Fence rows, meadows and pastures blanketed with snow should show presence of juncos, sparrows, skunk, fox, mice, quail, pheasant, dogs, domestic cats, crows, cottontails, horned lark.
 - (4) Thickets and woods after snowfall may indicate presence of cottontails, squirrels, quail, pheasant, crows, mice, blue jays, opossum, fox, sparrows.
- c. Sketch these tracks and compare them with illustrations you may have at hand.
- d. Determine which foot made which track (for 4-footers only).
- e. Try to get some idea of how the animal was moving to make such tracks. Was it loping, running, hopping, jumping, walking?
- f. Take notes on the tracks.
 - (1) Did the animal walk on toes, palms, heels, or combination of these?
 - (2) How many toes does the animal have?
 - (3) Is it "pigeon-toed"?
 - (4) Is there a tail track?

- g. Make up an animal story as told by the tracks.
 - (1) Was it hunting for food?
 - (2) Did it have a fight?
 - (3) Was it killed?
 - (4) Was it in a hurry or just nosing along?
- h. Some mud tracks are very clear-cut. Make plaster casts of them for future study.
- i. Correlations: Art, language, industrial arts
- j. Grade Range: 4-8
- k. References
 - (1) For pupils: 1, 7, 8, 9, 11, 35, 57
 - (2) For teachers: 23, 25, 28, 45, 57

12. Hunting Wild Animal Homes

Animals build their homes in certain preferred places and in many different styles, each probably for a very good reason. What is the probable reason for each type of home?

a. Mammals

- (1) Look in meadows, pastures, along fence rows for burrows of mice, ground squirrels, pocket gopher, badger, skunk, fox, weasel.
- (2) Look in wood piles, corn cribs, piles of old lumber, and many other places for the nest of the house mouse and barn rat.
- (3) Investigate woods to find leaf and tree nests of squirrels; nests of mice under rotten stumps, beneath loose bark, in piles of dead leaves; nest of the raccoon in hollow trees. In patches of woods or thickets you may find dens of opossum, skunk, woodchuck, fox.
- (4) You may find the nest of the cottontail in your front yard, along a fence row, in a strawberry patch mulched with straw, in an old stack bottom, in a sodded field.
- (5) You may find cottontails in many places — woods, thickets, pastures, grain fields, weed patches, yards.
- (6) Visit large marshes or sloughs to find muskrat houses. How does the muskrat live in his house? Does it look the same in spring as in fall?
- (7) If you are lucky you may be able to visit the home of the beaver. What does the beaver use to build his house?
- (8) If you can, notice how the animal has constructed its nest—one or several rooms, lined or unlined, carpeted or uncarpeted.
- (9) Did the animal construct its nest or did it just move into one constructed by another?

b. Birds

- (1) Make a list of all the places in which you find birds' nests—trees, thickets, fence posts, birdhouses, on the ground, on the water, etc. Tell why they choose such places for their homes.
- (2) Keep a record of all materials used in construction of the nest—sticks, horsehair, feathers, string, mud, root-lets, grasses, etc.

c. Insects

- (1) Examine the nest of a bee, wasp, or hornet. Of what is it made? How is it constructed? How many rooms does it have?
- (2) Examine an ant hill. Can you trace the corridors and rooms?
- (3) If you have pictures, study the ant nest.

d. Other animals

- (1) Possibly you can locate nests of fishes along edges of ponds, lakes and streams.
- (2) Look for crayfish mounds and burrows near shorelines of streams or bodies of water. How are they constructed?
- (3) Look for spider nests and notice how they are made. What use does the spider make of its nest?
- (4) Read where and how the alligator constructs its nest. For what is the nest used?

e. Whenever you find an animal nest or home, ask yourself these questions:

- (1) Why was the nest built? Was it to store food? For protection from enemies? For protection from weather? To raise young?
- (2) How was the nest built? Did the animal use its teeth, bill, cheeks, feet, toes, tail, in building the nest?
- (3) How long does the nest last? Is it used more than once?

f. Correlations: Language, reading

g. Grade Range: 1-8

h. References

- (1) For pupils: 1, 4, 5, 6, 8, 9, 11, 13, 16, 35, 57
- (2) For teachers: 19, 23, 24, 25, 27, 28, 42, 45, 49, 57

13. Making a Nature Map of the Neighborhood

Most people are unaware of the many interesting features of their local natural surroundings and think they must go to some distant place to see them. A local nature map would not only call these places to their attention but would be a source of interest to other people in the neighborhood.

- a. First make an outline map of the school district or of the neighborhood to be included. Show roads, railroads, bridges, buildings, in their proper location.
- b. Divide into groups or assign individuals to make approximate measurements on locations of other nature items to be shown on map.
- c. Include such items as may be found locally—ponds, streams, creeks, swamps, muskrat mounds, springs, towns, farmsteads, woods, ravines, gullies, hills, big rocks, rock outcroppings, crows' roots, etc.
- d. Have children decide on appropriate symbols for each type of nature item, or make small drawings to paste on map at proper location.
- e. If local points of special interest or of local historical significance are present, show them, also.
- f. Margin of map may be ruled into boxes where descriptive notes can be written in.
- g. Display map in schoolroom, local store, or some other public place.
- h. Correlations: Geography, history, language, art
- i. Grade Range: 4-8
- j. References
 - (1) For pupils: 57
 - (2) For teachers: 25, 39, 45, 54, 57

14. Making Nature Ornaments

Children and their parents prize nature ornaments made by themselves and like to exchange them as gifts. This may be a school or home activity. Children are apt to observe more closely, and learn the names and characteristics of plants and seeds sought for ornaments.

- a. Materials—walnuts; hickory nuts, hazel nuts; acorns; corn and other hard fruits and seeds purchased or gathered; attractive woods such as walnut; strong colored string, narrow leather thongs, or other material on which to string seeds, fruits, or sections thereof.
- b. Procedure
 - (1) Make walnuts or hickory section bracelets and necklaces. With scroll saw cut sections of nuts. Select sections with most attractive patterns. With sand paper smooth selected sections. Dip smooth sections in varnish or shellac; polish when dry. String sections on leather thongs.

- (2) Make acorn, hazel nut, or hard-seed bracelets. With small hand drill or gimlet drill holes through seeds or fruits, or use eye screws set into them. Seeds or fruits may be dipped in enamels of one or more colors after, or before, drilling. String on attractively colored strong thread or string.
- (3) Make wooden bracelets or necklaces. Saw in small sections of various shapes, such as beads, cubes, etc. Finish and string as above.
- (4) Make acorn necklaces. Use small screw eyes that may be obtained from a hardware store. With an awl make a hole in center of cap and down into top of cup a short distance. Screw the eyes into the two portions of the acorn, leaving the eyelet to string the acorns by. Glue cap to acorn, for even if they fit tightly at first they will dry and fall apart. String with a leather thong. Shellac acorns.

c. Correlations: Art, home economics, industrial arts

d. Grade Range: 1-6

e. References: 57

15. Making Decorations and Gifts from Plant Material

Plant material provides readily available and easily prepared ornaments. It lends itself to much originality in planning and making decorations. Children will become better acquainted with plant structures and their names by using them in such projects.

a. Securing materials

- (1) Collect and press plants that are suitable for silhouettes such as ferns, sedges, goldenrod, and tree leaves.
- (2) Gather spruce and pine cones for decoration purposes.
- (3) Arrange a winter bouquet of straw flowers—milkweed stalks with pods, black haw fruits, bush clover, and branches of roses with fruits.
- (4) Make a collection of curiously shaped gourds—large hickory nuts, chestnuts, etc., to be used as a centerpiece at Thanksgiving.
- (5) Bring in twigs of common barberry with as many red berries as possible. Keep in moist sand to prevent them from drying out.
- (6) Save ice cream and butter boxes, and cottage cheese paper cartons to be used as small flower pots.
- (7) Collect acorns, especially of ellipsoid outline. The acorns of white oaks are very satisfactory. Be sure to get the right cap to fit each.
- (8) Secure wandering Jew and coleus plants from which to root slips later.

b. Making gifts

(1) Plant silhouettes

- (a) Use blueprint paper which can be secured from school supply houses or a county engineer's office. Sheets can be cut in two so as to give plenty of material.
- (b) Place the pressed plant on blueprint paper and expose to sunlight for a minute or two. Good directions are given with purchase of paper, including washings afterwards.
- (c) Use ordinary white paper to place pressed plants on and spray or spatter colored paints on. The use of a wire mesh and toothbrush makes spatter work more uniform and prevents large blotches.

(2) Barberry centerpiece

- (a) Stick small variously colored berries on the thorns.
- (b) Use a glass frog to support and arrange the twigs.
- (c) Set in flower bowl containing moist sand.

(3) Flower pots from crepe paper for Mother's Day

- (a) Secure a crepe puller (small wooden block with tiny holes through which crepe paper is pulled, available at notion stores).
- (b) Cut strips of crepe paper an inch or less in width. (This will depend somewhat on the crepe puller used.) Cut across the weave of the paper.
- (c) From the rim of paper carton cut down almost to the bottom slits for weaving. There must be an uneven number.
- (d) Weave crepe paper into the carton, continually spreading the container at first if you wish a wide-open basket.
- (e) Use small tin cans of the right height to set into basket (or cut down tall cans).
- (f) Shellac (using either white or colorless shellac) the crepe paper baskets; otherwise, moisture from the plant will deteriorate the paper.
- (g) Root wandering Jew, coleus plants, etc. in water and transplant to tin cans, which in turn will be set into the basket.

(4) Flower pots from butter boxes

- (a) Cut butter boxes in two and cover with cream colored construction paper shellacked to resist moisture. Root wandering Jew, etc., as before, and transplant in containers.

c. Correlations: Art, industrial arts, home economics

d. Grade Range: 1-6

e. References

For pupils: 1, 57

16. Making an Observation Ant Colony

An ant colony can be easily set up and maintained in the schoolroom. Ants are spoken of in proverbs, fables, and literature because of their interesting social behavior. Observe their activities closely in the schoolroom as an example of specialization and division of labor with soldiers, nurses, laborers, and other types of workers.

- a. From plaster of Paris make a cast which has several small pits or hollows connected with runways, or drill holes in a block of wood and connect with grooves.
 - (1) Secure a pane of glass, or piece of metal or wood, to cover the top of the cast or board.
 - (2) Place the ant home on an inverted pan, stone, or block of wood in a larger pan of water so that the home is surrounded by water to prevent the escape of the ants.
- b. Stocking the colony
 - (1) At a large ant hill or colony, using hand tools, take up ants of several sizes together with soil, preferably putting all into a covered pail, and carry them to the schoolroom.
 - (2) Try to get a queen (which has a longer abdomen than any others) and some pupae, commonly called "eggs."
 - (3) Transfer the ants with as little soil as possible to the new home. With suction tubes they may be picked up without soil and blown onto the plaster cast.
 - (4) Keep the cast covered except when necessary to observe the ants.
 - (5) Feed them bread crumbs, small pieces of meat, sugar, etc. See which foods are preferred. There are many different kinds of ants, and some prefer certain foods.
 - (6) Observe the feeding and other actions of workers, nurses, soldiers, etc.
 - (7) Read about ant behavior and care.
- c. Summarize what you have learned from the care and study of ants, especially adaptations of body form to limited duties and tasks.
- e. Correlations: Citizenship, language, reading
- f. Grade Range: 5-8
- g. References
 - (1) For pupils: 2, 5, 6, 8, 9, 11, 13, 16, 17, 18
 - (2) For teachers: 23, 25, 30, 49

17. Making a Collection of Plant Enemies

Plants are killed by many different causes, man included. Man must learn to check his own destructiveness and to protect plants against other foes. In conservation man is the caretaker of plants which in turn are very useful to him.

a. Explore the out-of-doors for common ills among plants, such as blight, galls, wheat or oat rust, corn smut, defoliation by insects, and witch's broom on trees.

(1) Make a collection of such enemies.

(a) Label and give date and place, such as "gall on oak in September."

(b) Arrange into groups—those caused by animals, those caused by plants.

(2) Examine closely the nature of these pests.

(a) Cut open galls.

(b) Look at rust spots with hand lens.

(c) Look for insect eggs and larvae on vegetation.

b. Observe man's destructive forces and how he has attempted to combat them.

(1) How are forest fires being controlled?

(2) How can virgin forests be saved (national and state forests)?

(3) What has caused erosion and how can it be checked?

(4) How has the soil lost its fertility, and what are the means for making it over? (Fertilizers, rotation).

c. Make a collection of plants (actual specimens or pictures) which are injurious to life.

(1) Direct poisoning—poison ivy, angel mushroom

(2) Bacterial disease—tuberculosis

(3) Spoiled food—bread mold

(4) Skin irritants—primrose of greenhouse

(5) Parasites (living on other life)—ringworm on man, dodder on plants, bracket fungi on trees

(6) Weeds taking over the land

d. Exhibit or show your collection to others. Write or tell about your observations.

e. Correlations: Agriculture, health, language, reading

f. Grade Range: 3-8

g. References

(1) For pupils: 2, 3, 7, 13, 15

(2) For teachers: 23, 30, 35, 38, 44

18. Rearing Insects

Children are fascinated by the continuous observation of the various stages in the life cycle of insects. Insects show such wide and numerous differences in their many forms and functions that an entire lifetime of study on this one subject would reveal only a small part of the interesting facts about insects. They are well suited to classroom observation.

a. Butterflies, moths

- (1) Examine vegetable gardens and find cabbage worms, tomato worms, cutworms, celery loopers, corn earworms.
 - (a) Place these worms in containers with their natural food.
 - (b) Watch development from larval (worm) stage through pupal (changing) stage to adult.
- (2) Hunt for cocoons of Cecropia, Luna, Prometheus, Polyphemus on leaves and twigs of woodland trees.
 - (a) Keep these cocoons.
 - (b) Observe the transformation from the inactive pupa to the beautiful adult.
- (3) Put a piece of material infested with clothes moths in a container with a glass top.
 - (a) Observe development from egg to adult.
 - (b) Does the moth eat cloth?
- (4) Keep the small, white worm you find in an apple in a container with food for it to eat. What does this worm become?

b. Beetles

- (1) Follow the same procedure with white grubs.
- (2) Find the thick, pinkish, humpbacked grubs which eat leaves of potato plants, and determine what they are.

c. Wasps

- (1) Tear open the nests of mud-daubers to find out what the young look like and what they eat.
- (2) Keep some unmolested nests under observation to watch for any developments that may occur.

d. Cut out a block of firm soil (pasture sod), keep in a glass container at room temperature, and notice results.

e. Record and tell about your findings and your fun: kinds of insects, where found, what they did, etc. Save specimens.

f. Correlations: Agriculture, hikes, language, reading, arts

g. Grade Range: 3-6

h. References

- (1) For pupils: 7, 9, 11, 13, 15, 16, 17, 18
- (2) For teachers: 19, 23, 25, 26, 32, 49

19. Protecting Ourselves from Storms

Because we know storms will come and we will be exposed to them, it is well to discuss how to prepare beforehand. Also, fear arises in the minds of some children, and intelligent discussion with proper preparation before storms allays such fears.

a. Rainproof clothing

- (1) Discuss need of rubberized clothing and why.
- (2) Discuss care of rubber clothing. (Keep away from heat.)

- b. Thunderstorms, shelter
 - (1) Advise against seeking shelter under trees.
 - (2) Explain where to stand in basements for safety in case of tornadoes.
 - (3) Avoid touching wire fences or electrical wires.
- c. Lightning and lightning rods
 - (1) Explain how lightning rods protect buildings.
 - (2) Explain what lightning is.
- d. Tornado shelters
 - (1) Explain proper shelters in caves and cellars.
- e. Correlations: Geography, health, home economics, language, reading
- f. Grade Range: 1-8
- g. References
 - (1) For pupils: 3, 5, 11, 13
 - (2) For teachers: 19, 22, 44, 45

20. Enjoying Holidays Safely

Holidays and picnics should be joyous experiences and provide pleasant memories. Too often they are marred by accidents and other unpleasant after-effects. In planning these occasions give attention to safety, food, water and the other incidentals which may make or mar the success of the day.

- a. Safe driving (discuss with children):
 - (1) Car brakes—hazards of faulty brakes
 - (2) Focusing car lights
 - (3) Checking tires and air pressure
 - (4) Safe driving speeds
 - (5) Signals. Teach the children how the signals are made, their meanings, and why they are necessary.
 - (6) Urge children to use traffic signals while riding bicycles.
 - (7) Safe distances in driving.
 - (8) Avoid hopping cars or sleighs.
 - (9) There are dangers in riding sleds tied behind cars or sleighs.
 - (10) Use safe places for coasting.
- b. Picnics, dangers involved
 - (1) Carry drinking water with you, or drink water at fountains only or from wells which bear signs telling that the water is safe.
 - (2) Avoid sharp knives. Let a grown person do the carving.
 - (3) Fires
 - (a) Start fires in safe places away from trees or buildings.
 - (b) Prevent fires from spreading.

- (c) Be sure the fire is completely extinguished before leaving it.
 - (d) Carry a safety kit with you.
 - (e) Cover burns with a prescribed ointment.
 - (f) Show pictures of poison ivy and teach methods of curing it. (Wash with laundry soap.)
- c. Boating
- (1) Sit quietly in boats.
 - (2) Always be accompanied by a person who can operate the boat and who can swim.
- d. Enjoyment of the picnic versus overeating. In order to enjoy the many different possible activities on a picnic, overeating needs to be particularly guarded against.
- (1) Be temperate in eating as well as in drinking.
 - (2) Avoid abundance of rich foods.
 - (3) Avoid heavy lunching between meals.
 - (4) Eat well-balanced diets.
- e. Write or tell about happy, joyous picnics and holidays, and what you and others did.
- f. Correlations: Citizenship, health, language, reading
- g. Grade Range: 1-8
- h. References
- (1) For pupils: 2, 13, 16
 - (2) For teachers: 29

21. Using Plant Saps

In some parts of the world plant saps and their products are of great money value and vital to our modern life (rubber, sugar, etc.). Experiments are under way to develop new uses for the saps of plants which grow in our own state. Saving our wild plants from needless destruction may provide a supply of some worth-while products yet to be discovered.

- a. Study an account of harvesting maple sap and the process of making maple sugar. How do we use maple syrup and sugar?
- b. If possible, visit a sorghum mill.
 - (1) How is the cane prepared for processing?
 - (2) Why is it crushed?
 - (3) Why is the juice boiled?
 - (4) How long is the juice boiled?
 - (5) When is the sorghum done?
 - (6) How do we use cane syrup and sorghum?
- c. Study accounts of the manufacture of cane and beet sugar.
 - (1) How are the raw materials prepared?
 - (2) How are the juices treated?
 - (3) How do we use these sugars?
 - (4) What other sugars do we use?

- d. Study accounts of the manufacture of rubber. (Consider milk weed, wild lettuce, and other plants with sticky juices.)
 - (1) Where do we get rubber?
 - (2) How is the raw material treated?
 - (3) Make a list of all the uses we have for rubber.
- e. Study the manufacture of turpentine, camphor, rosin, and tar.
 - (1) From what sources do we get the saps?
 - (2) How are the saps treated?
 - (3) How do we use the finished products?
- f. Study accounts of other saps and plant juices useful to us.
 - (1) Some saps are used for medicines. Make a list of as many of these as you can.
 - (2) Saps of large cacti are used also. How? (Aloes cacti, etc.; banel cactus, a source of water on desert.)
- g. Summarize kinds of saps, plants from which they come, nature of the saps, products from and uses of products.
- h. Correlations: Geography, history, language, reading
- i. Grade Range: 4-8
- j. References
 - (1) For pupils: 6, 7, 8
 - (2) For teachers: 23, 25

22. Getting Ready for Winter

Winter is an important event with all living things. All plants and animals make preparation for winter in one way or another. Those which prepare will survive, others perish. Man has to aid his domesticated plants and animals prepare for winter. He must also plan for his own adequate food, clothing, warm shelter, and the other necessities and comforts needed during the winter. What can he learn from nature in these preparations?

- a. Animals' preparation for winter
 - (1) Lower animals
 - (a) Where do earthworms go for winter? Crayfish? Spiders?
 - (b) How do insects prepare for winter?
 - i. Pass winter in egg stage (grasshoppers, etc.); in larval stage deeper in ground (white grub); in cocoon (luna moth).
 - ii. Adults seek shelter in refuse, clumps of grass, etc. (chinch bugs, box elder bugs).
 - iii. Bees store honey as food.
 - (c) Find illustrations in reading and through observation in nature of lower animals preparing for winter.

(2) Higher animals

(a) Cold-blooded backboned animals

- i. Where are frogs and toads, etc., in summer? (Feeding in fields, etc.). Where are they in the winter? (Hibernating in burrows, in mud, etc.) Study about activities or lack of them.
- ii. Where are reptiles and fishes in summer? Winter? Study and observe their spring appearances and fall movements.

(b) Warm-blooded backboned animals

- i. Where do many birds of summer go? Do they migrate south? Why? How do resident birds prepare? Quail and pheasants become fatter in autumn. They seek shelter in tall weeds and woody thickets near food supplies as weather becomes cooler. Study about others and observe in nature.

(c) Mammals

- i. Some animals store food. (Squirrels store nuts, etc.)
 - ii. Some animals store fat in body and hibernate (bears, woodchucks).
 - iii. Some animals grow longer, thicker hair (horses, etc.)
 - iv. Find other illustrations in nature and in reading.
- (d) What do we do for animals? (Put out food for birds; store hay and grain for domestic animals, etc.)
- (e) Make a notebook with pictures and diagrams of your findings and stories about the animals.

b. Getting plants ready for winter

(1) Wrapping rose bushes

- (a) Many roses need protection during winter.
- (b) Earth, burlap, straw, strawy manure, and plant stems may be used for protective coverings.
- (c) Earth mounded up around base of roses and then covered with strawy manure makes excellent covering for small lawn roses.
- (d) Roses on trellises may be wrapped with straw and burlap. Climbing roses may be taken from trellises, placed prostrate on the ground and covered with earth. When earth is frozen add a layer of straw or strawy manure.

(2) Covering and mulching perennials

- (a) Plants that live from year to year need some winter protection from freezing and thawing weather.
- (b) Leaves, straw, cornstalks, strawy manure, or coarse plant stems may be used.

- (c) Cover with some material that will not pack down solid when covered with ice and snow (cornstalks, straw).
 - (d) Covering or mulching materials should be free from weed seed. Why?
 - (e) Nature provides leaves for use as mulching around perennials.
- c. The farmer prepares for winter
- (1) Drying and storing of seed and feed
 - (a) Note harvesting methods used on home farm for storing and preserving crops.
 - (b) Most farms use several methods: grain bins, corn cribs, silos, seed corn drying houses, etc.
 - (c) Some grains are put in shock for drying, as oats, barley, wheat, and like crops.
 - (d) Garden produce
 - i. Storage of vegetables in storage caves or cellars.
 - ii. Carrots. (Store in earthen jars with a little moist sand to retain moisture evaporation.)
 - iii. Cabbage. (Sink barrel in ground outdoors and cover with burlap and a layer of straw during winter months, or until used.)
 - iv. Potatoes. (A dry, cool, dark cellar is necessary for storage.)
 - (2) Ever Normal Granary
 - (a) This is a government plan by which corn and grains may be held in storage while the producer can borrow the money value of the crop until it is sold.
 - (b) The granary plan makes it possible to keep grain on farm where produced.
 - (c) Such a plan insures a more uniform supply of grain on hand for use year after year.
 - (d) Definite specifications of storage bins as to construction so as to protect grain must be met. Producer must comply with A.A.A. program to be eligible to seal corn.
 - (e) Ever Normal Granary plan is under direction of U. S. Department of Agriculture and in cooperation with the producers.
 - (3) Write about or tell in story form your observations and reading.
- d. Correlations: Agriculture, citizenship, geography, history, language, literature, reading, spelling, art
- e. Grade Range: 1-8
- f. References
- (1) For pupils: 1, 4, 5, 6, 8, 11, 13, 16
 - (2) For teachers: 24, 25, 45

23. Preserving Food

Nature provides an abundance of food at certain seasons of the year, and little food at other times. People who live in climates which have a winter season have always found it necessary to save food in a time of plenty for use during the rest of the year. Much progress has been made in the science of food preservation, greatly improving the health of people and guarding against disease.

- a. Food preservation is the process of preventing food spoilage.
 - (1) Spoilage is due to overripening and to germs (bacteria) which destroy the food.
 - (2) Preservation depends upon keeping bacteria from working on the food by:
 - (a) Destroying all bacteria in the food and food containers.
 - (b) Keeping the food under conditions which retard ripening and keep these bacteria from working.
- b. Primitive and Indian methods of preserving food
 - (1) Drying (dried buffalo meat, dried corn, "hard tack")
 - (2) Smoking (smoked meats, smoked hams)
- c. Pioneer and early civilized methods of preserving food
 - (1) Drying and smoking
 - (2) Salting (salt pork)
 - (3) Spicing (cloves and other spices—hot tamales)
 - (4) Pickling (pickled beets, pigs feet, etc.)
 - (5) Fermentation (wines, cheese, etc.)
- d. Modern methods of preserving food
 - (1) All of earlier methods
 - (2) Canning and preserving (canned peas, peach preserves)
 - (3) Pasteurization (milk)
 - (4) Refrigeration (frozen beef, frozen strawberries, household refrigeration)
- e. Assign pupils reports and demonstrations on various methods of preserving food.
- f. List foods preserved by various methods.
- g. Discuss value of better methods of preserving food.
- h. Compare foods to be found on Columbus' ships and on a modern ocean liner. Explain differences.
- i. Visit a cannery, refrigeration locker service, refrigeration plant, cold storage warehouse, butcher shop, ice cream factory, or creamery.
- j. Correlations: Agriculture, geography, health, history, reading
- k. Grades: 4-8
- l. References
 - (1) For pupils: 3, 8, 13, 18
 - (2) For teachers: 19, 20, 29, 35, 37, 40, 44, 49, 51, 53

24. Determining How Well Plants Insure Their Kind for the Future

Many plants are loaded with fruits and seeds in autumn. Their variety in form, color, etc., is attractive to the child who, with a little encouragement, will bring many to school. Through study of them much may be learned about the process of reproduction.

a. Working in the field

- (1) Make a collection of fruits just before maturity and at maturity to insure:

- (a) Getting all the seed of each fruit and all the fruits of a plant

- (b) Observing methods of dehiscence (the means the fruit has of opening up naturally). What would be the result if all seeds fell just beneath the parent plant?

- (2) Record dates when various fruits were collected, giving habitat (where collected).

- (3) Make observations on those fruits which are dispersing (scattering their seeds), such as the milkweed seed floating through the air, sticktites caught in clothes, acorns that roll down ridges.

b. Computing the number of seeds per plant

- (1) Assign milkweed pods of one plant, heads of sticktight from another plant, sunflower, tomato, etc., to different groups of pupils.

- (2) Determine from figures whether plants having numerous seeds are the most abundant.

- (3) Look for interesting markings on seed coats with magnifying glass.

c. Testing for germination

- (1) Select a few types of seeds easily germinated. (This must be done in late winter or spring for most seeds need an after-ripening period.)

- (2) Determine the percentage of viability (ability to reproduce) from the seed tested. As an example, if half the sunflower seeds grew, a 50 per cent germination would be the result.

d. Arrange a special science table exhibit at Thanksgiving.

- (1) Label so as to distinguish between fruits and seeds. (The cocklebur and hickory nut are fruits; the pea and bean when shucked from the pod are seeds.)

- (2) Arrange according to types of fruits, such as the "berry," including orange, tomato, or "wing or key" including maple, boxelder, elm.

- (3) Arrange according to means of dispersal, such as:

- (a) Wind—milkweed, dandelion, elm

- (b) Explosion—violet

- (c) Animals—sticktight, cocklebur

- e. In addition to exhibits of materials, write or tell about observations and experiences or reading.
- f. Correlations: Agriculture, arithmetic, geography, health, language, literature, physical education, reading, spelling, play activities
- g. Grade Range: 3-6
- h. References
 - (1) For pupils: 3, 13
 - (2) For teachers: 19, 25, 53

25. Feeding and Caring for Home Poultry Flocks

Many children like to take responsibility for some part in the family's earning activities. Assistance with the home poultry flock is within their abilities, and results can be quickly noticed.

a. Poultry survey

- (1) Determine the breeds and number of poultry kept in the community.
- (2) Let older students complete survey on neighbors' farms from which there are no students in school. Which farms do not have any poultry? Discuss advantages of poultry flocks.
- (3) Have each student make a report on home flock as to numbers and breed.
- (4) Prepare a summary chart of the survey.
 - (a) Analyze results as to why certain breeds are kept in the community.
 - i. Personal preference
 - ii. For egg producing purposes (Leghorns)
 - iii. For meat producing purposes (Jersey Black Giants)
 - iv. General purpose birds for both meat and eggs (Rhode Island Reds)
- (5) Let pupils find out why their parents keep certain breeds of poultry.

b. Management of poultry flock

(1) Housing

- (a) Draw diagrams of outlines of different types of poultry houses in the community.
- (b) Discuss advantages of each.
- (c) Investigate proper housing conditions for poultry as to:
 - i. Capacity of house (3 or 4 square feet per bird)
 - ii. Arrangement of nests
 - iii. Proper roosts
 - iv. Proper waterers
 - v. Proper feeders

- vi. Lighting conditions
- vii. Ventilation and heat conditions
- viii. Kind and condition of scratching litter
- (2) Selection of laying flock
 - (a) Sorting the laying flock
 - i. Culling (This may be demonstrated by some local person.)
 - ii. Keep only the healthy birds.
- (3) Feeding the home flock
 - (a) Look up proper feeding practices in bulletins.
- (4) Marketing high-grade eggs
 - (a) Keep eggs clean and gather often.
 - (b) Store in a cool place and market weekly.
 - (c) Demonstrate candling of eggs at a store or local farm.
- (5) Egg production records
 - (a) Have student check home flock for eggs produced during one month or for the school year if he is especially interested.
 - (b) Observe egg record of high-producing flocks and note where home flock ranks.
 - (c) Observe trap nesting for determining individual hen's egg production.
- (6) Keep records of successes and failures, with reasons; gains or losses in money; care, food, etc., of chicks. Write or tell about proper selection and care of poultry.
- c. Correlations: Agriculture, language, reading, spelling
- d. Grade Range: 7-8
- e. References
 - (1) For teachers: 25, 35

26. Making and Using Weather Forecasts

Weather is always with us. We talk about it a great deal but can do nothing to change it. Hence, all man has been able to do about weather is to try to foretell it and make suitable preparation for it. Scientific study has improved forecasting in accuracy and in period. Many people rely on these forecasts a great deal.

- a. Should the work of the Weather Bureau be continued?
 - (1) List many ways by which the farmer may be benefited by weather forecasts.
 - (2) State ways in which members of the farmer's family benefit by weather forecasts.
 - (3) Make lists of other occupations and people in various parts of the United States that profit by weather forecasts.
 - (4) Find information by visiting a weather bureau, or by reading a text, or reference books about the following topics:

- (a) Information needed by meteorologists for forecasting the weather
 - (b) Manner of getting this information
 - (c) Time of getting this information
 - (d) Instruments needed for getting the necessary information
 - (e) Number of weather stations in Iowa
 - (f) Number of weather stations in the United States
 - (g) Location of nearest weather station
 - (h) Location of main Weather Bureau of the United States
 - (i) Date on which the first Weather Bureau was established in the United States
 - (j) Amount of salaries and other expenses annually
 - (k) By whom financed
 - (l) Per cent of accuracy of weather forecasts
 - (m) Reasons for inaccuracies of weather forecasts.
 - (5) Form your opinion, after careful consideration, on advisability of continuing or discontinuing the Government Weather Bureau, and state your conclusions.
- b. Studying weather forecasts
- (1) Study a newspaper's weather map daily for two weeks.
 - (a) See what weather conditions are shown.
 - (b) Watch to see if predictions are true in your locality.
 - (c) Find out if the forecasts were true in localities near you.
 - (d) Find a reason for forecasts being true in some localities and not in others.
 - (2) Send for a few of the daily weather maps from the Government Weather Bureau at Washington, D. C. (Current maps are not always available.)
 - (3) Study the government weather map by observing the signs for:
 - (a) Snow, rain, hail, sleet, clear condition, cloudy condition, partly cloudy, and wind.
 - (b) Find the places having the same temperature in the Mississippi Valley.
 - (c) Find the places east and west of Iowa having the same air pressure as Iowa.
 - (d) Notice the general directions of the winds in the United States.
 - (e) Observe the weather conditions of Iowa and Alaska. Is Alaska on the U. S. weather map?
 - (f) Find a low air pressure area.
 - (g) Does a "high" follow this "low"?
- c. Read about winds that have low air pressure.
- (1) List the ways in which cyclones, tornadoes, thunderstorms, and hurricanes differ.

- (2) List the ways in which cyclones, tornadoes, thunderstorms, and hurricanes are alike.
- d. Making your own weather forecast
- (1) Record daily on a chart at 8:00 a. m. the following information:
 - (a) Temperature
 - (b) Kinds of clouds
 - (c) Direction of cloud movement
 - (d) Movement of clouds—slow or fast
 - (e) Sunshine, cloudy, partly cloudy
 - (f) Direction of wind
 - (g) Velocity of wind
 - (h) Relative humidity (if hygrometer is available)
 - (i) Air pressure (if barometer is available)
 - (j) Precipitation
 - (2) Observe the clouds.
 - (a) Learn to recognize the cumulus, nimbus, stratus, and cirrus clouds by finding facts concerning their color, shape, height, and composition.
 - (3) Record and learn the weather indicated by each kind of cloud.
 - (4) Making observations about the wind
 - (a) Observe the wind's direction
 - i. A wind blowing from the south to southeast and a steady falling barometer indicate a storm from the west or northwest.
 - ii. A wind blowing from the east to northeast and a steadily falling barometer indicate a rain from the south or southwest.
 - iii. A wind blowing from the west to northwest and a rising barometer indicate cool, fair weather.
 - (b) Observe the velocity of winds.
 - i. The velocity of winds may be determined somewhat by the following facts:
 - a. A breeze barely moves the leaves of trees, and has a velocity of 1 to 5 miles per hour.
 - b. A fresh wind moves small branches of trees, and has a velocity of 5 to 15 miles per hour.
 - c. A brisk to strong wind sways large branches of trees, and has a velocity of 15 to 25 miles per hour.
 - d. A high wind sways the trees, and has a velocity of 25 to 35 miles per hour.
 - e. A gale breaks branches of trees, and has a velocity of 35 to 75 miles per hour.
 - f. A hurricane destroys houses and uproots trees, and has a velocity of 75 to 100 miles per hour.

- g. A tornado tears down buildings, pulls up trees, and may have a velocity of 200 to 300 miles per hour.
- ii. Observe the thermometer.
 - a. A rising thermometer is favorable for rain.
 - b. Refer to a text or reference book for information about the relation between humidity, temperature, air pressure, and winds.
- iii. With the information you have gained by reading and observation, form conclusions as to the kind of weather you may expect within a short time. Do not become discouraged if your first attempts are unsuccessful. Remember that forecasts made by experienced weather men are sometimes wrong.
- iv. Weather signs and superstitions
 - a. After observing, reading, and reasoning, decide which of these proverbs are reliable and which are not reliable. Give reasons for your decision.
 - (i) A ring around the moon indicates a storm.
 - (ii) A dog eating grass is a sign of rain.
 - (iii) Rain before seven, clear before eleven.
 - (iv) Rainbow in the morning, sailors take warning.
 - (v) Clear sunset, fair day tomorrow.
 - (vi) Thick fur on animals in the fall indicates a very cold winter.
 - b. Add to this list some weather signs and superstitions you know.
 - c. Decide as to their reliability.
- v. Interesting customs and myths
 - a. Find in a reference book some interesting ways by which people have tried to control the weather.
 - b. Read the myths containing explanations given by people in early times for the causes of:
 - (i) Seasons
 - (ii) Thunder
 - (iii) Lightning
 - (iv) Droughts
 - (v) Rain
- e. Correlations: Agriculture, geography, health, history, language, literature, reading, spelling
- f. Grade Range: 5-8
- g. References
 - (1) For pupils: 1, 2, 5, 6, 8, 13, 18
 - (2) For teachers: 19, 23, 24, 30, 31, 37, 40, 43, 48, 51, 53

27. Establishing a School Museum

A school museum stimulates pupils to observe nature and their surroundings more closely in order to contribute interesting specimens to the museum, and teaches oncoming classes what to see in nature. Moreover, the museum is a continuous source of illustrative material for science, nature study, and general lessons. Parents and friends will contribute or lend many items to your museum.

a. Specimens that make an interesting museum

- (1) Rocks, minerals, lava, petrified wood, fossils
- (2) Animal exhibits: mounted animals, skulls, backbones, teeth, rattlesnake rattles, snake skins, feathers
- (3) Insect specimens: butterflies, moths, cocoons
- (4) Sea life specimens: sponges, shells, coral, starfish
- (5) Fungi: bracket, puffballs, earthstar
- (6) Plant specimens: mounted pressed flowers, weeds, leaves, twigs, seeds, cones, gourds
- (7) Galls

b. Display

- (1) If a cabinet with drawers and glass doors is not available, orange crates may be used. Colored paper on shelves will add to the attractiveness of the collection.
- (2) Specimens may be arranged according to classification or ownership. Pupils' names along with the name of the object should be written on a gummed label and attached to the specimen.
- (3) Moth balls will help preserve the specimens.
- (4) Use the museum for displays in conjunction with school programs.

c. Correlations: Agriculture, art, citizenship, geography, health, history, industrial arts, language, literature, reading, spelling

d. Grade Range: 1-8

e. References

- (1) For pupils: 5, 7, 11, 13, 18, 57
- (2) For teachers: 25, 35, 49, 57

28. Differences and Similarities Among Animals

a. Specific objectives

- (1) Understandings to be developed and information to be secured
 - (a) To understand that animals are grouped together into convenient units on the basis of their similarities and differences. There are many sorts of animals. The word "animal" may be subdivided into many groups.
 - (b) To understand the differences distinguishing the five major groups of backboned animals; namely, fish, frogs, reptiles, birds, and mammals

- (c) To understand the characteristics which the back-boned animals have in common; distinguishing them from all other (boneless) animals
- (d) To understand the wide variety of forms covered by the word "animal"
- (e) To understand the position of man as an animal
- (f) To understand some of the miscellaneous habits and life histories of various animals
- (2) Appreciations to be realized and attitudes to be encouraged
 - (a) Attitude of curiosity, rather than fear, toward animals
 - (b) Appreciation of the work of scientists in systematizing our knowledge of animal life

b. Outline

(1) The backboned animals

(a) Fish—

- i. Live in water.
- ii. Breathe air, taken from the water, through gills.
- iii. Usually have scales in an overlapping "shingled" arrangement.
- iv. Have fins.
- v. Usually lay soft eggs, in a jelly-like mass.

(b) Frogs—

- i. Live in water as tadpoles; live on land as adults.
- ii. Breathe by means of gills in the tadpole stage; breathe air directly as adults, by means of lungs.
- iii. Have a rather smooth skin, without scales or other covering.
- iv. Have four legs, with soft toes.
- v. Lay eggs which are much like those of fish.

(c) Reptiles—

- i. Generally live on land, though many kinds swim well.
- ii. Breathe air directly by means of lungs.
- iii. Usually have scales, which generally do not overlap.
- iv. Generally have four legs (though snakes and a few others have none), with sharp claws on the toes.
- v. Lay stiff- (leathery) shelled eggs, though in some cases the eggs actually hatch before being laid.

(d) Birds—

- i. Generally live on land, and fly through the air.
- ii. Breathe air directly.
- iii. Have skin covered with feathers.
- iv. Have two legs (with sharp claws) and two wings.
- v. Lay eggs with very brittle shells.

vi. Are warm-blooded. (The first three groups are cold-blooded.)

vii. Have no teeth. (All others do, except turtles.)

(e) Mammals—

i. Generally live on land. (Many types can swim.)

ii. Breathe air directly. Have a diaphragm (which is lacking in all other animals).

iii. Have skin covered with fur (hair, wool).

iv. Generally have four legs (or two legs and two arms), with claws, hoofs, or nails.

v. Give birth to "living" (shell-less) young, which are fed by the mother's milk glands (breast, udder).

vi. Have an external ear (lacking in the other four groups).

(2) Examples of boneless animals

(a) Insects (grasshopper, caterpillar, beetle), spiders, crabs, worms, snails, sponges

(3) Contrast between backboned and boneless animals:

Backboned Animals—

(a) Have bones.

(b) Usually have four limbs.

(c) Usually (except frogs) have some type of small structure (fur, feathers, scales) covering the skin.

Boneless Animals—

(a) Do not have bones, but may have a tough or stony covering.

(b) May have many limbs or none at all (only rarely have four).

(c) Have skin that is generally bare. (Exceptions: some insects, spiders)

(4) Application of these principles of classification

(a) Have the pupils suggest the names of other animals not previously mentioned, and see if they can classify them into the groups listed above.

(b) Show pictures of different and strange kinds of animals, and treat similarly. Example: Show how the presence of an external ear, as on an armadillo, suggests that the animal is not a reptile, though the skin is scaly, but is a mammal, and therefore could be presumed to be warm-blooded and possess all the other characteristics of mammals.

c. Pupil activities

(1) Observation and handling of as many types of living animals as can be conveniently brought into the school-room; for example, goldfish, frog or toad, tadpole, garter snake, turtle, chicken or pigeon, white rat or rabbit, grasshopper, caterpillar, spider, angle worm, snail, clam

(2) Field trip—observation of any and all available animal life

- (3) Observation and study of preserved specimens such as mounted birds and mammals, dried insects and snake skins, liquid-preserved worms
- (4) Observation and study of charts, mounted pictures, book illustrations
- (5) Reading about animals in text and reference books
- (6) Cutting out pictures from newspapers, magazines, etc.—scrapbook making
- (7) Individual work
 - (a) Visiting neighboring farms, ponds, neighborhood pets, etc., with reports on animals observed
 - (b) Reading assignments on the details of structure and life history of selected animals, such as toads, turtles, moths, rabbits

d. Teaching procedure

As an illustration of method, the section on reptiles can be discussed as follows, after carrying out the pupil activities as listed above:

"Some of the animals we have looked at and know as 'reptiles.' This word originally meant animals that creep on the ground, in contrast to those which raise their body up off the ground on their legs, as do birds and most mammals. What animals that we have studied are of this type? What other examples can you name? (Turtle, lizard, snake, alligator.) Which of these have you seen wild? What others might be found in this country? Do you know of any other reptiles in other parts of the world?

"How do these animals breathe? Do they have gills or lungs? If a turtle wants to rest, where does he do it? Can any of them stay under water indefinitely? Do any snakes live in the water? Have you ever seen a baby alligator?

"Feel this dried snake skin. Can you run your finger easily in both directions along the back? Could you do that on a fish's skin? Could you scrape these scales off with a knife as we did with the fish? What is the difference between the scale arrangement on this snake and on the fish? Notice the scales on the underside of the snake. Is there any difference? Is this more like a fish? What is the reason for this difference on the two surfaces of the snake? We watched the garter snake crawl. How did he do it? What happened when we put him on a smooth piece of glass? Do you think the scales have anything to do with his motion? Can he crawl backwards?

"Are there any scales on a turtle? How are they different from snake scales? Do you find the same type of scales on both surfaces of the turtle? Can you see the scales on the lizard and the alligator in these pictures? Do they look like fish scales, or like those of snakes and turtles?

"How many legs has a turtle? How does he use them? How about a lizard? An alligator? A snake? How differently must a snake live since he has no legs? Suppose you had no arms or legs, could you move as easily as a snake does? Why not? If you were in this relatively helpless condition, what features of the snake might you envy? Do any of these reptiles have claws? Could this baby turtle scratch you? What are the claws used for? Does the frog have claws? Do fish have claws? Why not?"

"Did you ever see any baby snakes? What did they look like? How were they born? Do snakes make nests? Do the parents feed the young? What about turtles? What do turtles do as soon as they hatch out of the egg? Here are some egg shells of turtles. Notice the texture of the shell. How does it differ from the shell of a bird's egg? How does it differ from a fish egg?"

Summarize, as per the outline above.

For the final summary, the outline can be very easily made into a large table on the blackboard, with five vertical columns for the groups of vertebrae.

(The unit can be correlated with other units, such as *Animals of the Circus and Zoo*, *Some Animals of Fields and Ponds*, *Animals and Their Homes*.)

e. Teaching aids

- (1) Living animals in the classroom (See Pupil Activities.)
- (2) Wild animals such as can be found on a field trip; poultry and domestic animals on a farm; zoo, if available; fresh fish from market
- (3) Preserved animals
 - (a) Mounted birds and mammals
 - (b) Dried insects, snake skins, sea shells, sponges, etc.
 - (c) Liquid-preserved (5-8 per cent formalin, or 70 per cent alcohol) worms, etc.
- (4) Charts and mounted pictures (See lists in bibliography.)
- (5) Book illustrations
- (6) Text and reference books
- (7) Newspaper and magazine pictures
- (8) Scrapbooks made by previous classes

f. Vocabulary—new words

g. Evaluation questions

- (1) Did the pupils show a real interest in the materials used? If not, did interest develop during the course of study? Was the interest sustained?
- (2) Would it be possible to substitute other common animals (mouse, canary) for the living ones actually used?
- (3) Was the basic principle of classification (structural resemblances and differences) emphasized sufficiently

(though not directly by name) to enable the pupils to apply it to other types of animals?

- (4) Did the pupils overcome any fears they may have had toward any of the live specimens?
 - (5) Did the scientific attitude pervade the discussions? Did the students progress in their ability to apply known facts in solving new problems of classification?
 - (6) Were worth-while contributions made by the pupils to the discussion? Did every pupil participate? Did the pupils respond in bringing illustrative material?
 - (7) Were the pupils able to select and organize related material?
 - (8) Were the objectives attained?
 - (9) Was the position of man himself, as an animal, brought out?
 - (10) What characteristics separate the backboneed from the boneless animals?
 - (11) What characteristics distinguish fish, frogs, reptiles, birds, and mammals?
 - (12) What is the difference between a snake and a bird? A turtle and a bird? A lizard and a bird? Any reptile and a bird?
 - (13) How could you tell a frog from a lizard? A bird from a mammal?
 - (14) In what way is a frog like a lizard? A bird like a mammal?
 - (15) In what way is a bird like a mammal, but different from a lizard?
 - (16) Why is classification of animals important in scientific progress?
- h. Correlations: Reading, language, agriculture, general program
- i. Grade Range: 1-8
- j. References
- (1) For pupils: 6, 9, 13, 16, 17, 57
 - (2) For teachers: 20, 27, 28, 35, 38, 57

29. Midwinter Bird Census and Catalog

A person who does not know his neighbors is generally considered very unfriendly. However, many of us do not know some of our most interesting neighbors, our winter birds. A midwinter census will help acquaint us with these friendly little creatures who stay in our midst when so few other forms of animal life are active.

- a. Beginning the middle of December, until the first of February keep a list of all birds you see and the number of each.
- (1) Record what the birds were doing. Were they singing? Were they eating? Were they trying to keep warm? Were they loafing?

- (2) Record the chief colors of each bird such as black, white, red, blue, gray, etc.
- (3) After you have determined which color or colors are most common, tell how the birds benefit by having those colors.
- (4) Keep a record of the chief foods of birds at this season.
- (5) Compare foods in winter with those of other seasons.
- (6) Distinguish between those birds that stay with us only during winter and those that stay with us the whole year.
- b. The census will be a summary. Review it at times and tell others about it.
- c. Correlations: Agriculture, art, language, reading
- d. Grade Range: 1-6
- e. References
 - (1) For pupils: 1, 7, 8, 9, 10, 13, 14, 57
 - (2) For teachers: 23, 28, 35, 41, 42, 57

30. Conserving Our Winter Bird Life

Birds that stay with us during the winter do so at great risk to themselves. Many starve or freeze to death unless we help them avoid these dangers. Birds require so little assistance, which children can give, and they repay us so much by their interesting behavior and cheerful song that all can derive pleasure from protecting them.

a. Song birds

- (1) Construct a window sill feeding station.
- (2) Use all kinds of feed: oatmeal, rice, cracked corn, crackers, peanuts, bread crumbs, suet, etc.
- (3) Keep notes on all different kinds of birds that come to the station.
- (4) Keep notes on the number of each kind of bird.
- (5) Keep notes on foods preferred by different birds.
- (6) Record the actions of the birds in relation to one another. Do they fight or are they friends?

b. Upland game birds

- (1) If possible, construct a combined shelter and feeding station close to your school for use by pheasant or quail.
- (2) If pheasant or quail are not present, visit a farm on which shelters for these birds have been constructed.
- (3) If you are able to construct a shelter or visit one, keep notes on all the feeds used, the birds that come to it, and the ways in which they use it.
- (4) Write a story on this project, describing the type of station constructed, how it was made, what the tracks on the snow told, the relation of the birds to owls, hawks, fox, etc.
- (5) If you are unable to do outside work with shelters, construct a model small farm and place model shelters where they would be needed most and would do most good.

- (a) See how many different types of shelters and feeding stations you can construct.
 - (b) List the good and bad points of each.
- (6) If possible, visit a farm which has a permanent food patch of cane or corn, etc. for wild life use during the winter.
 - (a) Make an itemized account of the expense of such a project.
 - (b) Compare maintenance of a permanent food patch with that of any emergency shelter or feeding station. Give good and bad points for each.
- c. Keep a list of birds which use the feeding station and a record of how you care for them. Give an account of the ways that each of these birds helps us.
- d. Correlations: Agriculture, citizenship, geography, industrial arts, language, reading
- e. Grade Range: 4-8; 1-3, simpler parts
- f. References
 - (1) For pupils: 2, 4, 7, 8, 9, 10, 13, 14, 17, 18, 57
 - (2) For teachers: 19, 20, 23, 25, 28, 30, 35, 41, 42, 57

31. Society for Prevention of Cruelty to Animals

Many nature lovers and friends of our domestic and wild animals have banded themselves together into a great organization known as the Society for the Prevention of Cruelty to Animals. The members of this society try to prevent suffering of animals, whether due to cruelty by man or conditions of nature such as unfavorable weather, insufficient food, water, or shelter. A school group can form a society of this kind for its own community.

- a. Make a list of all types of cruel treatment you have seen administered to animals.
 - (1) Why was the animal treated in this manner?
 - (2) How could this treatment have been avoided?
- b. Study various kinds of humane traps.
 - (1) Get a sample trap to examine.
 - (2) Have your local conservation officer explain the workings of the trap and how it is used.
- c. List all ways you know by which animals help us, serve us, make life more agreeable for us. What have you done to be kind to animals and to help other folks to be kind to them?
- d. Correlations: Citizenship, Opening Exercises for Iowa Citizenship Club
- e. Grade Range: 1-6
- f. References
 - (1) For pupils: 4, 57
 - (2) For teachers: 21, 25, 45, 57

32. Trapping, Hunting, Fishing

Most rural boys like to fish and hunt or trap wild animals. Besides being interesting and healthful sports and a source of tasty food, these sports are followed by many as a source of money. Furs may bring in a continuous and sizable income to rural children when wild animals are properly protected and conserved, and if furs are properly handled.

- a. Make a list of animals that are trapped.
 - (1) What uses are made of these animals?
 - (2) Which animals are most numerous?
 - (3) What are the relative prices of various kinds of pelts?
 - (4) Which states produce what furs?
 - (5) What can we do to conserve these animals?
 - (6) Study a fur catalog.
- b. Visit a dealer in raw furs and hides.
 - (1) Learn how various animals are skinned.
 - (2) Learn how the pelt is fleshed and cleaned.
 - (3) Learn how best to stretch different pelts.
 - (4) Learn how to cure and dry pelts.
 - (5) Learn how pelts are graded. What factors give them high quality? Poor?
 - (6) Study a glossary of terms used in the fur trade.
 - (7) Examine any freak colorations or formations of pelts the dealer may have.
- c. Make a list of animals that are hunted.
 - (1) How are these animals used?
 - (2) Which animals are most numerous?
 - (3) Which are considered good? Which bad?
 - (4) How can we conserve the useful kinds?
 - (5) Study the different methods of hunting.
- d. Make a list of fish considered as game fish.
 - (1) Study the habits, sporting qualities, abundance, etc., of each kind of fish.
 - (2) Compare the states as to types of fishing offered.
- e. Make a list of rough fish.
 - (1) Study their habits and relation to the game types.
 - (2) How do we use these fishes?
- f. Have your local conservation officer or some other authority help you with this project.
 - (1) Let him show you how to set various kinds of traps.
 - (a) Study the different sets for different animals.
 - (b) Study the various kinds of baits used.
 - (2) Let him show you how to handle firearms.
 - (a) Learn how to load correctly.
 - (b) Learn how best to carry the firearm so there is least danger to human life.
 - (c) Learn how to aim and fire.

- (d) Learn how to clean and care for the hunting equipment.
- (3) Let him explain fishing tackle and its correct usage.
 - (a) Learn the function of each element of tackle.
 - (b) Learn how to correctly assemble rod and reel.
 - (c) Learn the various methods of casting.
 - (d) Acquaint yourself with elementary terms, such as *fly, plug, lure, backlash, trolling*, etc.
 - (e) Learn how to handle fish so they are unharmed and can be returned to the water, if necessary.
 - (f) Learn how to string fish correctly.
- g. Study, learn, and obey the laws and regulations pertaining to trapping, hunting, and fishing.
- h. Write your own experiences in these fields.
- i. Correlations: Agriculture, health, safety, physical education, language, literature, reading, general programs
- j. Grade Range: 4-8
- k. References
 - (1) For pupils: 4, 5, 13, 18, 17, 57
 - (2) For teachers: 20, 28, 35, 45, 57

33. Keeping a Weather Chart

This activity is very interesting to smaller children who may be permitted to draw a golden sun for a sunny day, etc., on the different calendar dates. It may be modified and more detailed for older children.

- a. Record temperatures, wind, and sunshine.
 - (1) Prepare charts and explain how to record temperature, wind, and sunshine.
 - (2) Assign different students to make observations and recordings for a week at a time.
 - (3) Teach students how to read thermometers.
- b. Pupil weathermen
 - (1) Charts may be purchased at the Scott-Foresman Company, Chicago, Illinois.
 - (2) Each child may keep his own personal weather chart.
- c. Summarize records: number of sunny days, cloudy days, rainy days, etc., for a month, a season, etc. Summarize rainy periods, dry periods, etc., and note their alternations.
- d. Correlations: Geography, health, physical education, art
- e. Grade Range: 3-6
- f. References
 - (1) For pupils: 2, 8, 13, 36
 - (2) For teachers: 19, 25, 30, 44

34. Heating Our Schools and Homes

In some parts of the country homes and schools do not have heating plants, but in Iowa no home or school is complete without

some means of heating it. What kinds of heating systems are used and what are the advantages of each?

a. Early heating

- (1) Find myths and legends concerning the origin of fire.
- (2) Trace the development of the use of fire.
- (3) Find facts on the preservation of fire during colonial times.

b. Stoves, furnaces, boilers

- (1) Examine the school heating plant and your home heating plant.
- (2) Place your heating system under the proper classification, as *stove*, *furnace*, or *boiler*.
- (3) Differentiate between the three classifications.

c. Systems: air, water, steam

- (1) Examine and classify the heating systems in the neighborhood.
- (2) Make a diagram of the operation of each system.

d. Conduction, convection, radiation

- (1) Find examples in your daily surroundings of each of these means of heat travel (frying pan, tank heater, greenhouse).
- (2) Contrast conduction, convection, and radiation. Why does a jacketed stove heat a room more uniformly than an unjacketed one? (Less radiation, more convection.)

e. Write or tell, with diagrams and pictures, about the best heating equipment available for school and home.

f. Correlations: Health, language, reading

g. Grade Range: 6-8

h. References

- (1) For pupils: 11, 13, 17, 18
- (2) For teachers: 19, 22, 29, 31, 36, 40, 43, 44, 47, 51, 52

35. How to Fire a Stove or Furnace

People who live in Iowa should become expert in firing stoves and furnaces as protection from our severe winter cold. Older children can learn to be as good firemen as adults. Use caution in experimenting with fire.

a. Kindling temperatures—paper, wood, coal

- (1) Do *not* experiment with kerosene, but try to find out:
 - (a) What is the effect of kerosene on the kindling of substances?
 - (b) What precautions must be observed in using kerosene? Remember that kerosene is dangerous.
- (2) Try to make a fire with flint and steel.
- (3) Experiment with kindling of paper, wood shavings, hard and soft wood, hard and soft coal. (Caution: Do the

experimenting in a safe place, either in the fire box of the stove or furnace, or in an outdoor fireplace.)

(a) With the knowledge gained from the experiment, outline the proper procedure for laying or starting a fire in a stove or furnace and out-of-doors.

(b) Outline procedure for maintaining fires in stoves or furnaces.

b. Small vs. large pieces of fuel. (The greater the surface exposed, the quicker it burns.)

(1) Should small pieces of fuel be used to start a fire? Why?

(2) Why are large pieces of fuel put in a furnace or stove after the fire is well started?

c. Volatile matter—smoke

(1) Notice the differences in the smokes of wood, coal, leaves, gas, and oil.

(2) Observe the amounts of smoke with the different adjustments of the drafts on the stove or furnace.

(3) Read to find what smoke is and the reasons for it.

d. Alternate firing

(1) Place fresh fuel on one side. At the next firing add fresh fuel on the other side. (This prevents smothering fire and ignites new fuel without driving off excess smoke.)

e. Rules for firing the furnace or school heating plant

(1) Never cover live coals entirely with fresh fuel.

(2) Close damper after gases are burned.

(3) Avoid overheating.

(4) Keep a layer of ashes on the grate, with fire on top.

(5) Keep a thick fire in cold weather.

(6) Use care in firing for night.

(7) Keep stove or furnace clean.

(a) Remove ashes from ash pit daily.

(b) Remove soot from heating surfaces and pipes.

(8) Keep water pan filled.

f. Write or tell about proper firing of stove or furnace.

g. Correlations: Reading

h. Grade Range: 4-6

i. References

(1) For pupils: 3, 13, 17

(2) For teachers: 19, 21, 22, 29, 31, 43, 47, 51, 52, 53

Evans, Wainright. *The Thunderbird, Our Changing World*. New York, N. Y.: Thomas Nelson and Sons, 1934.

Olson, Eugene O. and Norris, Paul B. *Heating and Ventilating Requirements for Rural Schools*, Joint Bulletin No. 2. Des Moines: State Department of Health, and State Department of Public Instruction.

36. Keeping Cool in Summer and Warm in Winter

Many children overdress or underdress for different seasons of the year. Not only does this make them uncomfortable, but many people believe it retards them in school work, creates discipline problems, and makes them difficult to get along with. How can we dress for greatest comfort to do our best in our school work? Physical comfort of the child will greatly influence the child's school work. Use this activity to teach children to dress appropriately for the weather.

a. Keeping warm in winter

- (1) The main problem is to keep body heat from escaping through our clothes too rapidly. Dress warmly.
 - (a) Some clothing materials feel "warmer" than others. (Example: Linen or cotton feels colder than woolen materials.) "Warmer" materials are better heat *insulators*. "Colder" materials are better heat *conductors*.
- (2) A second problem is to absorb as much heat as possible from the sun and other heat sources.
 - (a) Darker clothes absorb more heat than lighter clothes; therefore wear darker clothing in winter.
- (3) A third problem is to maintain active blood circulation to keep the body warm.
 - (a) Active outdoor work, sports, and exercise are the best means.
- (4) A fourth problem is to eat high energy foods to furnish the body with more heat energy.
 - (a) Meats, fatty and starchy foods should be consumed in larger quantity in winter.
- (5) Correlate with weekly weather prophecies, and have children dress accordingly.

b. Keeping cool in summer

- (1) Reverse of winter precautions should be followed.
 - (a) Allow body heat to escape (loose, ventilated clothes).
 - (b) Reflect instead of absorb the sun's heat. (Wear light colored clothes, straw hats; seek shade.)
 - (c) Avoid overexertion.
 - (d) Use low energy foods—vegetables and fruits.
- (2) Allow body to cool itself by evaporation of perspiration.
 - (a) Evaporation is nature's method of cooling. Wear loose clothing which allows free passage of air between clothing and body, and which is highly absorbent. (Linen is better than cotton which is better than silk for this purpose.)
 - (b) Open windows briefly after children return from active play at recess.

c. Summarize what you have learned about proper dress in various seasons, with reasons.

- d. Correlations: Geography, health, language, physical education, reading
- e. Grade Range: 4-8
- f. References
 - (1) For pupils: 3, 6, 13
 - (2) For teachers: 19, 22, 29, 40, 43

37. Making a Slide or Skating Pond

An ice slide or skating pond on the schoolground provides a popular play activity during winter months. Its construction can be used as a science activity and offers the occasion to discuss some safety rules.

- a. Locating the slide
 - (1) Safety considerations (Locate away from traffic and equipment which might make running or falls dangerous.)
 - (1) Science considerations
 - (a) Choose a level place, as water surface is level.
 - (b) Freezing takes place on surface first, as ice is lighter than water.
 - (c) Locate on shady side of building, if possible, to protect from thawing.
 - (d) Avoid placing where it will damage lawn. Ice shuts off necessary air from plants, killing them.
- b. Constructing and maintaining a slide
 - (1) Form a shallow dam around the slide to retain the water.
 - (2) Choose cold day to fill with water. Wind hastens freezing. (It carries the heat away more rapidly and cools by evaporation.)
 - (3) Resurface by adding a new film of water when old surface becomes rough or thin. (Ice will evaporate.)
- c. Correlations: Health, playground activities, physical education
- d. Grade Range: 4-6
- e. References
 - For teachers: 25

38. An Airplane Show

Modern children are intensely interested in airplanes. An airplane show will capitalize on this interest and tie in with a unit on transportation and correlate with other subjects.

- a. Invite pupils to bring their model airplanes and airplane pictures to hold an airplane show—either as a hobby exhibit or as a part of the study correlated with a unit on transportation.
 - (1) Have children bring from home their own pictures of airplanes from commercial literature, magazines, newspapers.

- (2) Organize the show into departments, each in charge of a pupil committee whose duty it is to select models and pictures, arrange them for exhibit, prepare display labels, and give floor talks on their "department." In their talks children may mention values, uses, speeds, cruising range, where built, etc.
- (3) Allow children to decide on their own classification of departments. The following are only suggestions:
 - (a) Military and naval: pursuit, fighter or attack, bomber, dive bomber, torpedo transport, observation
 - (b) Commercial: transport, clipper, stratoliner
 - (c) Private: racing, experimental
- (4) Each pupil might prepare a printed sign, written composition, or oral report on his own model or pictures, or on some type of airplane of his own choosing.
- (5) Perhaps a visit to a local airport could be arranged as a follow-up activity where a plane may be inspected and the pilot quizzed.
- (6) If some present or former pupil builds flying models, he might demonstrate a model and tell how he built it.
- b. Correlations: Art, industrial arts, language, reading, and school programs
- c. Grade Range: 3-8
- d. References
 - (1) For pupils: 16, 17
 - (2) For teachers: 25

39. Using Machines to Save Labor

Machines have come to take such a common place in our lives that we use them by habit without realizing their great value as labor savers for us. We all should know some of the simple but important facts about machines.

- a. All machines are combinations of only six simple types.
 - (1) Lever—crowbar, scissors, hammer, auto jack
 - (2) Pulley—block and tackle, hay hoist, pulley on flag pole, window sash pulleys
 - (3) Wheel and axle—hoist on auto wrecker, wheelbarrow
 - (4) Screw—new type bumper jack for autos
 - (5) Inclined plane—cattle loading chute, playground slide
 - (6) Wedge—splitting logs, door stops, axe
- b. Use school teeter-totter to find weight of pupils.
 - (1) Balance two children sitting erect on teeter-totter, one child, A, of known weight. Measure from balance point of teeter-totter to center of each child's position. Apply formula:

$$\text{Weight of child B} = \frac{\text{Weight of child A times A's distance from balance point}}{\text{B's distance from balance point}}$$

c. Discuss machines which save labor.

- (1) In the home—sewing, washing, cleaning, etc.
- (2) On the farm—tractor, plows and cultivators, threshing machines, windmills, pumps, electric motors, engines, etc.
- (3) In factories—elevators, cranes and hoists, woodworking machinery, etc.
- (4) In transportation—bicycles, automobiles, steamships, etc.
- (5) In the schoolroom—door hinges, shade rollers, window weights, pencil sharpeners, duplicators, etc.

Emphasize how much easier and more convenient our work and life are made by these machines. Have children point out as many places as they can where the more complex machines make use of each of the six simple machines.

d. Correlations: Geography, history, industrial arts, language, reading

e. Grade Range: 6-8

f. References

- (1) For pupils: 1, 2, 6, 8, 11, 13, 17, 18
- (2) For teachers: 19, 21, 22, 29, 31, 37, 43, 44, 46, 47, 52, 53

40. Securing Good Water for Our School and Homes

Good water is one of the first needs of any home or school. Science has done much to make it possible and easy for us to secure an adequate supply of good water.

a. Sources of water supply

- (1) Examine the local community to learn the source of the water supply (well, spring, stream, lake, etc.).
- (2) Visit a neighboring town or city to learn how the central water system operates.
- (3) Note the variations of hardness and softness of different water.
 - (a) Test the effect of soap in the different kinds of water.
 - (b) Note the difference in taste.
- (4) Learn how the purity of water is determined.
 - (a) How tests are made.
 - (b) How purification systems operate.

b. Wells, pumps

- (1) Find in your local community and in references the different kinds of wells (deep, shallow, flowing).
- (2) Find in your local community and in references the different kinds of pumps (lift or cistern, force, rotary, centrifugal).
 - (a) Trace the history of pumps, beginning with ancient through pioneer pumps, to the modern ones. (Archimedes screw, windlass, chain)
 - (b) Analyze the action of modern pumps.

- (3) From local observation and references prepare rules for location of wells.
 - (4) Note examples in local community of purity precautions in pump and well location and operation.
- c. Faucets, pressure tanks, gravity system
- (1) If possible, visit and see the operation of a pressure water system; but if this is not possible, learn from your textbooks the function, operation, and care of this kind of water system.
 - (2) Inspect a gravity water system.
 - (3) Visit a plumber or hardware dealer and learn method of installation and cost of a pressure unit that might be installed in a home without connection to a city water system.
 - (4) Make a list of precautions in care of faucets.
- d. City water plant visit
- (1) Prepare for the visit by gathering information from textbooks and encyclopaedias on the operation and functions of the city water plant.
 - (2) On the visit learn from the engineer in charge, the purity precautions, the purification processes, and the softening processes used.
- e. Conservation of water
- (1) Investigate the effect of clearing away forests and trees on the water supply in the ground.
 - (2) Note from geographical features the lack of water in certain areas and the methods used in supplying water to those regions.
- f. Water resources
- (1) Build a miniature water wheel and operate it by a small stream of water from a faucet.
 - (2) Make a miniature steamboat that operates with a candle.
 - (3) Compare the effect and results of water shortage and floods.
 - (4) Note the necessity of dams for supplying power and water for irrigation and drinking purposes in certain areas.
- g. Correlation: Agriculture, citizenship, health, industrial arts, language, reading
- h. Grade Range: 7-8
- i. References
- (1) For pupils: 2, 3, 8, 13, 17
 - (2) For teachers: 19, 20, 22, 30, 35, 36, 40, 44, 46, 47, 48, 51, 52, 53
- Sanitary Standards for Hand Pumped Wells*, State Department of Health, Des Moines, Iowa, August 1940 (Special Engineering Number).

41. What Rural Electrification Is Doing for Farm People

Only a few years ago very few farms had electric service. The Rural Electrification Administration has brought the benefits of standard electric service to hundreds of thousands of farms. Electricity makes possible and economical all sorts of conveniences and labor-saving devices on farms. The electrification of farms is one of the most interesting developments of our present age.

a. How electricity is transmitted

- (1) Electricity is produced at power plants and carried by transmission lines to farm homes.

- (a) Electric energy is carried and distributed to farm homes and buildings by copper wires.

- (2) The rural electrification project known as R.E.A. is a cooperative setup between the users of electricity and the federal government, in order that electricity may be obtained at a reasonable cost to rural users.

- (a) The cost of electricity is based on the kilowatt hour as the unit of electrical measurement. A typical rate schedule is: first 40 kilowatts, \$3.50; second 40 kilowatts, \$2.00; next 120 kilowatts, \$2.40. All over 200 kilowatts used per month are 1¼ cents per kilowatt. How long will a 50-watt lamp burn on one kilowatt hour of electrical energy? (20 hours. One kilowatt equals 1,000 watts.)

- (b) Users are sent an instruction card on which meter readings can be reported. Meters are checked regularly by a cooperative employee. An electric meter could be borrowed from an electric company and used for demonstrating meter reading. A cardboard face of a meter could be constructed by older students using pins for pointers, thus demonstrating meter reading.

- (c) Electricity is used for heating, cooking, lighting, power for operating motors, sweepers, pumps, electric fences and fly killing devices, and for refrigeration plants. The farm has the greatest number of uses for electricity. Almost any mechanical operation around the farmstead can use electricity.

- (d) The coming of electricity to the farm has eliminated one of the great farm hazards—fire. Electricity is much safer than a lantern to light the barn and other farm buildings. It makes possible a force water system for the farm not only to fight fire but for getting water to all buildings.

(e) Electricity relieves the farmer of much drudgery in performing his farm operations.

(f) Better living has taken a long stride forward when the farm has electrical power to use for lighting, refrigeration, and dozens of other uses. Electricity saves time and labor and brings added comforts, conveniences, and safety to farm people.

b. Correlations: Agriculture, citizenship, health, industrial arts, language, literature, reading, spelling

c. Grade Range: 6-8

d. References

(1) For pupils: 2, 6, 8, 11, 13, 17

(2) For teachers: 19, 22, 24, 25, 29, 30, 35, 37, 46, 47, 52, 53

42. Keeping Household Electrical Equipment in Order

More and more people are depending upon household electrical equipment to make life more comfortable and enjoyable. Such equipment costs much money. If properly cared for it will last many years—perhaps a lifetime—and will always be ready to use. If neglected, it is a constant source of needless expense, trouble and danger. All who use electric equipment should know how to take care of it.

a. Decide upon:

(1) Damage that may be caused by faulty wiring of equipment. (Burned out equipment, fire, etc.)

(2) Hazards to people from faulty wiring of equipment. (Shock, electrocution, burns, etc.)

(3) Cautions necessary in protecting electrical equipment from damage. (Keep it from getting wet, protect it from damage by falling objects, etc.)

b. Replacing fuses

(1) New fuses should always replace burned out fuses.

(a) A fuse is a piece of electrical equipment for protecting you and your property by cutting off the electric current when trouble occurs in any attached equipment.

(b) *Never* repair fuses by using a penny in the fuse socket.

(2) Have someone who knows how demonstrate the proper method of replacing a burned out fuse.

c. All electric wiring and equipment such as cords, plugs and the like should always be kept in good repair. *Never* allow bare cord wires to contact metal and cause a short circuit.

(1) Have faulty equipment repaired by an electrician.

(2) Have someone demonstrate the proper method of making an extension cord.

- d. Electric plugs and switches should be kept in good repair.
 - (1) Do not use broken plugs, as short circuits can occur causing considerable damage.
 - (2) Switches should be well protected so that a person cannot receive an electric shock when using them.
- e. Correlations: Safety, fire prevention week, citizenship, industrial arts, language, reading
- f. Grade Range: 6-8
- g. References
 - (1) For teachers: 19, 24, 25, 43, 47

43. Lighting Our Homes Efficiently

Many people are seriously injuring their eyesight, one of their most precious possessions, by poor lighting. Measured in eyestrain and eye injury poor lighting is very expensive and good lighting is very inexpensive—if we know how to get it.

- a. Types of lighting
 - (1) New devices are being developed constantly.
 - (a) Direct lighting (open bulb)
 - (b) Indirect lighting (reflected to ceiling)
 - (c) Fluorescent lighting (long, glowing tubes)
 - (2) Let students compare the effects of light from a candle and from a 25-watt electric bulb.
 - (a) Try placing shades over both lights.
 - (b) Try different colors of shades on an electric lamp.
 - (c) Determine how much effect placing of lights may have as to shadows in a room or on a table. Does light give a glaring effect from a table with a polished surface?
 - (d) Note in magazine advertising and electric equipment catalogs the new developments taking place.
 - (e) Light meters can be obtained and tests made by using different types and colors of shades as well as placements of lights.
- b. Correlations: Health, hygiene, safety, industrial arts, language, reading
- c. Grade Range: 6-8
- d. References
 - (1) For pupils: 2, 6, 8, 11, 13, 17, 18
 - (2) For teachers: 19, 24, 29, 31, 37, 43, 44, 47, 48, 51, 52, 53

44. Finding Out What Makes Things Run

Children as well as adults are fascinated by self-propelled machines, whether they be toys, steam shovels, tractors, or battleships. This natural curiosity can be used as a means of learning about the types of power and energy these machines use.

a. Power for self-propelled toys

- (1) Wind pressure—Pin wheels
- (2) Water pressure—Water wheels, paddle wheels under waterfalls
- (3) Tension in stretched rubber bands—Rubber bands for paddle wheel toy boats and model airplanes
- (4) Tension in wound springs—Springs for "wind-up" autos, boats, trains, tractors
- (5) Electric motors for electric trains
- (6) Steam pressure—Toy steam engines
- (7) Compressed air, as in "ticklers," but also puts the life in basketballs, etc.

b. Commercial applications of power

- (1) Wind power—Farm windmills for pumping water, generating electricity
- (2) Water pressure—Old fashioned flour and lumber mills; mostly used now for generating electricity by hydro-electric power stations such as at Keokuk and Boulder Dam, Niagara Falls, etc. There are many smaller plants in Iowa.
- (3) Springs are still used exclusively as a source of power for watches, alarm clocks, camera shutters, phonographs, etc.
- (4) Electric motors offer endless applications from electric clocks to the motors that drive the propellers of giant steamships and battleships.
- (5) Steam engines—Steam locomotives and steamships, steam shovels, factory power, older type fire engines, "donkey" engines used for hoists in building construction and in lumber camps, etc.
- (6) Compressed air—Air brakes on trains and busses, rock drills, etc.
- (7) Gas and diesel engines—Automobiles, trucks, streamlined trains, ships, small electric power, generating stations, etc.

c. Correlations: Industrial arts, reading

d. Grade Range: 6-8

e. References

- (1) For pupils: 3, 6, 8, 11, 13
- (2) For teachers: 19, 25, 29, 40, 43, 46, 51, 52, 53

45. Making Air Work for Us

Many children think of air as empty space—such as an "empty" box. They do not understand the reality of air as a substance. Consideration of the practical use of air in common machines will help establish its reality and also teach some of the characteristics of air and of air machines.

- a. We live at the bottom of an ocean of air with tons of air pressure upon the average person's body (approximately 15 pounds per square inch of body surface).
 - (1) If it were not for this air pressure a number of common devices would not work. Among them are most pumps, siphons, vacuum cleaners, soda straws, plumber's friend, suction cups, etc. These all work by air pressure, not by vacuum. (Vacuum is only an absence of air pressure.)
 - (2) Demonstrate and decide why suction cups "stick" to smooth surfaces. (Atmospheric pressure holds them on until air leaks under the cup equalizing pressure on both sides.)
- b. Air is made to work for us in various ways.
 - (1) Have children name all the practical uses of air they can think of. Allow them to explain the use and the characteristics of air that make each use possible.
 - (a) Power is obtained from the wind by windmills and air-electric generators.
 - (b) Use is made of the wind and air for transportation as by sailing vessels, airplanes, airships, etc.
 - (c) Recreational uses of air and wind include flying kites or gliders, ice or sail boating.
 - (d) The drying of wash is speeded up by wind.
 - (e) Efficiency of automobiles, air conditioners, and most heat engines depends upon air to cool them.
 - (f) Air is vital to all living plants and animals.
 - (g) Air is needed to make a fire burn.
 - (2) Have children make a study of one or more air machines, such as the tire pump, vacuum cleaner, or the pneumatic door check. Use actual machines for observation and demonstration. (A model or actual door check can be borrowed from a hardware store.)
- c. Correlations: Agriculture, industrial arts, physical education, language, reading
- d. Grade Range: 6-8
- e. References
 - (1) For pupils: 6, 8, 11, 13, 18
 - (2) For teachers: 22, 37, 40, 46, 51, 52, 53

46. Lighting Bicycles and Automobiles, and the Care of Flashlights

Safety rules require good lights on bicycles and automobiles. In addition, one or more good flashlights kept in efficient working condition are needed pieces of safety equipment in every home.

- a. Discuss why flashlights and proper lights on bicycles and automobiles are needed for safety.
- b. Discuss types of light and reflectors needed on bicycles.

- (1) A large red reflector (such as used on trucks) should be displayed on the rear mud guard.
- (2) A dry cell operated light is desired on the front. Discuss the advantages of maintaining the front light on the handle bars or on the frame.
- c. Dry cells are used extensively in flashlights and for bicycle lights.
 - (1) Dry cells "run down" more quickly if used for long periods at a time.
 - (2) When dry cells grow weak the enclosed liquid chemicals eat through the outside zinc case and may corrode the flashlight unless promptly removed.
 - (3) "Run-down" dry cells should be discarded. There is no practical way of making them useful again.
 - (4) Flashlight lamps have different colored beads inside. Each color indicates the proper lamp to use with different battery voltages. Have this investigated at a store selling flashlight bulbs and demonstrated to the class.
- d. Storage batteries are entirely different in principle and can be recharged repeatedly as on automobiles.
 - (1) Storage batteries need pure water (distilled water) added from time to time, corrosion cleaned off, and connections tightened.
- e. Correlations: Language, reading, safety
- f. Grade Range: 6-8
- g. References
 - (1) For pupils: 2, 6
 - (2) For teachers: 19, 43, 46

47. Fighting Fires

The first week in October is Fire Prevention Week. Study this actually at that time, if possible.

Fires cause serious losses every year. No one can be sure of escaping the damage caused by fires, but all may prepare to prevent and to fight fires once they start.

- a. Causes of fires due to:
 - (1) Something that will burn
 - (2) High enough temperature to start it burning
 - (3) Supply of air to keep it burning
- b. Fire prevention consists of keeping inflammable materials where they will not get too hot, or be set afire by carelessness.
- c. Visit the scene of a fire where damage has occurred. Consider amount of damage and possible causes.
- d. Request a fire marshal or fireman to explain causes and methods of fighting fires.
- e. Examine schoolhouse and grounds for possible fire hazards.
 - (1) Spontaneous combustion

- (2) Poor electric wiring
- (3) Defective flues
- (4) Overheated stoves
- (5) Inflammable liquids (kerosene, gasoline)
- f. Examine equipment and practice fire control methods.
 - (1) See that extinguishers are ready for use and know how to use them.
 - (2) Practice fire drills.
- g. Examine homes for fire hazards and correct preventable dangers.
- h. Discuss the following questions:
 - (1) What are some fire hazards of the barn?
 - (2) What fire hazards exist in the forests and woods?
 - (3) Write as many precautions as you can that will prevent fires in (a) the home, (b) the barn, (c) the school, (d) the forests.
 - (4) Investigate and report how a fire extinguisher works.
 - (5) If one's clothing catches fire, what are some things one should do? What are some things one should not do?
 - (6) Why is it a good plan for people in a smoke-filled room to cover the nose and mouth with a wet towel?
 - (7) Why might it be a good idea to crawl on hands and knees when making your way out of a smoke-filled building?
 - (8) How can a fire caused by burning oil be put out?
 - (9) Should farmers burn the grass along the fence rows or roadsides?
 - (10) Besides burning the trees what other things in the forests are damaged or destroyed by fire?
- i. Correlations: Citizenship, health, safety, language, reading
- j. Grade Range: 4-8
- k. References
 - (1) For pupils: 2, 3, 6, 8, 11, 13, 18
 - (2) For teachers: 19, 21, 29, 36, 40, 44, 47

48. Making a Rock and Mineral Collection

A rock and mineral collection is an incentive to explore stream beds and hills. The objects are easily labeled and displayed and last indefinitely. Individual or school collections may be made.

- a. Observing and collecting in the fields
 - (1) Look for marks on rocks such as cracks due to temperature changes, water ripples caused by running water, disintegration by lichens (gray structures growing on rocks), and marks worn by glaciers.
 - (2) Collect some common rocks in the community such as granite, basalt, sandstone, limestone; some common minerals such as quartz, chert, calcite.

- (3) Watch for any markings on rocks with a definite pattern—fossils.

b. Classifying in the schoolroom

- (1) Test for limestone by adding a few drops of hydrochloric acid to see the effervescence.
- (2) Observe with hand lens the crystals making up granite, etc.
- (3) Notice the cleavage displayed by some minerals. As an example, break up a large piece of calcite. It will break into small pieces of the same shape as the large pieces.

c. Compiling a list of articles in the room which have come, at least in part, from rocks or minerals

Examples:

- (1) Iron on desks
- (2) Sand in window glass
- (3) Copper wires for electricity
- (4) Asbestos in stove insulator
- (5) Slate in blackboard

d. Distinguish between rocks, minerals, and metals.

- (1) Arrange an exhibit with rocks, minerals and metals in separate groups.

e. Summarize ways in which rocks and minerals may be grouped as to crystalline structure, colors, outlines, utility, etc.

f. Correlations: Geography, language, reading, play activities

g. Grade Range: 3-8

h. References

- (1) For teachers: 13, 19, 23, 24, 30, 49, 53

49. Mapping the Sky

The mysteries of the stars make a strong appeal to children and may develop lifelong interests in the ever-changing but eternal star patterns. Certain constellations are easily recognized and aid in telling directions. Many interesting stories and myths are associated with the stars.

a. Common constellations

- (1) Study star maps in textbooks or magazines as to:
 - (a) Shape of constellation
 - (b) Position with reference to other constellations
- (2) Make drawings on blackboard or paper showing the shape of each of the following constellations:
 - (a) Big Dipper (Ursa Major)
 - (b) Little Dipper (Ursa Minor)
 - (c) Cassiopeia
 - (d) Dragon
 - (e) Cepheus

- (3) Make a constellation map showing both the shape and positions of the above named star groups with reference to the North Star and each other.
 - (a) Use blue or black construction paper about 12 x 20 inches for the sky.
 - (b) Punch out discs of white or yellow paper with a paper punch, or use white or yellow crayon.
 - (c) Mark positions of stars first with lead pencil.
 - (d) Paste or glue the white or yellow discs over the pencil marked spots for the stars.
 - (e) Make the North Star of different color than the other stars.
 - (f) Place the North Star in the center of the page. (This is the star at the end of the Little Dipper.)
 - (g) Complete the Little Dipper, locate the Big Dipper, and place Draco the Dragon, Cassiopeia, and Cepheus.
- (4) Have pupils observe the northern sky at night to find these five constellations. Notice the changing positions of them as they swing about the North Star.
- (5) Read the myths that explain how the early people accounted for these constellations and allow pupils to report in class.

b. Winter constellations

- (1) Have pupils use a star map to point out the constellations: Orion and his dogs, Taurus the Bull, Leppo the Hare, Pleaidis, and the Southern Cross.
- (2) Read the myths about these constellations.
- (3) Locate these star groups in the sky.
- (4) Find information about the brightest star of Orion and his dogs, and report in class what you have read about them.
- (5) Make a constellation map of Orion and his dogs.
- (6) Have children find other constellations in the sky than those mentioned and learn their names and stories.

c. A diagram of sun and planets. This diagram made by pupils gives them a better idea of the proportionate size of the sun and the nine known planets and the relative distance between them.

- (1) Cut discs representing planets from colored construction paper.
- (2) Make Mercury one-fourth inch in diameter from reddish-yellow paper.
- (3) Make other planets proportionate in size to Mercury.
- (4) Make Venus of white paper, Mars of red, Jupiter of yellowish-white, and Saturn of reddish-yellow. Earth, Uranus, Neptune and Pluto may be made from gray, brown, green, and black paper.

- (5) Cut from orange paper a sun in proportion to the planets. (Refer to a textbook for correct proportions.)
 - (6) Cut this disc representing the sun into fourths.
 - (7) Mount one quarter of the sun in the upper left hand corner of 12 x 20 inch blue construction paper.
 - (8) Arrange discs representing planets in their order of distance from the sun. (See diagram.)
 - (9) Show paths followed by each planet with dotted lines made with white or black ink.
 - (10) Use white or black ink for lettering the names of planets.
 - (11) Use white or black ink for expressing in small numbers the distance in miles from the sun.
 - (12) Combine this diagram and all star maps into a booklet with an appropriate and attractive cover.
- d. Correlations: Art, geography, language, literature, reading, spelling
- e. Grade Range: 5-8
- (1) For pupils: 2, 3, 5, 6, 8, 11, 12, 13, 14, 16, 17, 18
- f. References
- (2) For teachers: 19, 22, 23, 24, 25, 31, 32, 37, 40, 41, 43, 44, 46, 48, 51, 52, 53

50. Making a Tree Exhibit

At least some phases of the exhibit are enjoyed by every pupil. A tree exhibit has practical value in manual arts with boys and furniture selection with girls.

- a. Observing trees in the field
 - (1) Notice the twigs and contour of trees in late winter, such as the stout twigs of catalpa, fine and lacy twigs of elm, vase shape of entire elm tree.
 - (2) Bring in branches to watch buds develop in schoolroom.
 - (3) Observe which trees follow water courses, ridges; are popular as shade trees.
 - (4) Keep a record of the dates when the various trees flower
- b. Making a closer study of trees in the schoolroom
 - (1) Find out how buds differ (flower, leaf, mixed).
 - (2) Examine leaf scars such as the raised, round one of the catalpa, the lobed one of the black walnut.
 - (3) Select some twig specimens to shellac and mount.
 - (4) Make a collection of samples of lumber.
 - (5) Use fruits of trees collected last fall.
- c. Preparing the exhibit
 - (1) Mount on a piece of heavy cardboard a twig, tree picture or sketch, tree flower, leaf, fruit, and lumber sample of one species. Each cardboard should be devoted to one species. Material should be fastened to the cardboard by strips of tin cut in the shape of brads.

- (2) Write brief descriptive statement about twig, picture, lumber, such as long horizontal lines (lenticels) of the birch or regular furrowed bark of the ash.
- (3) Make an enlarged sketch of a leaf scar and bud.
- d. Visit the local lumber yard.
 - (1) Find out what lumber is in greatest demand in the community.
 - (2) Learn uses of various woods, such as hickory for pitchfork handles.
- e. Summarize distinguishing and useful characteristics of woods together with products to which they are best adapted.
- f. Correlations: Art, industrial arts, language, reading, spelling
- g. Grade Range: 4-8
- h. References
 - (1) For pupils: 7, 8, 13, 57
 - (2) For teachers: 39, 54, 57

Bode and MacDonald, *A Handbook of the Native Trees of Iowa*, Iowa State College, Ames, Iowa, 1941.

King, Julius, *Talking Leaves*, Harter Publishing Co., Cleveland, Ohio, 1934.

Jaques, H. E., *How to Know the Trees*, Mt. Pleasant, Iowa, 1940.

Iversen and Brogue, *Our Friends—The Trees*, Mason City, Iowa, 1937.

51. Making and Using an Electric Bird Identification Chart

This device is a game which some pupils will like to construct and all will like to play. It combines several branches of science.

- a. Material needed: About four square feet of wallboard; light copper wire, about three feet for each bird; a short stove bolt (about 1 inch) for each bird and name card; 50-100 small colored pictures as in ten-cent books; small flashlight bulb, socket and battery, two ice picks
- b. Construction: Fasten all birds' pictures on upper portion of wallboard with photo corner clips; place names close together below; put a stove bolt beneath each picture and beneath each name; connect picture's bolt and correct name's bolt with wire at back of board, and preferably solder the connections; arrange flashlight bulb, light, and ice pick wires so that when one pick is placed on a picture's post and the second pick on the name's post, the bulb flashes.
- c. Play the game to become rapid and accurate in associating pictures and correct names of birds.
- d. Correlations: Art, industrial arts, reading
- e. Grade Range: 6-8
- f. References
 - (1) For pupils: 1, 9, 10, 13, 14, 57
 - (2) For teachers: 23, 28, 33, 35, 41, 57

52. Painting and Interpreting Bird Portraits

Birds have always been attractive subjects to people with artistic tendencies. Children will enjoy making their own bird portraits, learning thereby some of the distinguishing characteristics of the different birds.

a. Read or investigate the life of some famous bird painters such as Audubon, Fuertes.

- (1) Study their paintings from several points—accuracy, habitat, naturalness, characteristics of the bird in question, medium of paint used, whether drawn as seen in field or in hand.

b. Make outline drawing and bird portraits. (See references.) Do not use commercially prepared outline drawings. This work should be based on individual observation and drawing.

- (1) Look up color markings including color of legs, feet, bill, wing bars, and eye marks.
- (2) Write a caption under the portrait which will give range of bird, general habitat, and family to which the bird belongs.
- (3) Color the outline drawings.

c. Use bulletin board to display pictures of birds.

- (1) Arrange painted portraits according to families such as grouping robin, thrush, bluebird together.
- (2) Secure some photos of birds, preferably those showing more of the habitat than the portraits did for contrast.

d. Visit a bird museum.

- (1) Look for those which are most lifelike.
- (2) Study habitat groups.

e. Which paintings and painters are best and in what respects? Which birds are most beautiful and in what respects?

f. Correlations: Art, language, literature, reading

g. Grade Range: 1-6

h. References

- (1) For pupils: 7, 8, 9, 10, 13, 14, 18, 57
- (2) For teachers: 41, 42, 57

Taylor, Ethel Bonney. *Birds, Flowers, Animals Coloring Book*. Racine, Wisconsin: Whitman Publishing Company, 1938. 10 or 20 cents.

Rourke, Constance. *Audubon*. New York, N. Y.: Harcourt, Brace and Company, 1936.

53. A Bird Day Program

Statutes of Iowa require a lesson on birds in all schools on March 21 each year. A bird day program will meet this requirement.

a. Exercises

- (1) Invite parents and other citizens to attend and to take part.

- (2) Select poems and stories to be read.
- (3) Tell about original observations on birds, birdhouse use, etc.
- (4) Exhibit colored pictures and charts of desirable birds of the vicinity.
- (5) Listen to special radio broadcasts—especially from WOI, Iowa State College—and local stations.
- (6) Initiate spring bird chart; summarize winter bird chart.
- (7) Initiate spring bird story and picture column in local paper. Write to Extension Service, Iowa State College, for mats of pictures and stories, and ask local editor to run them.
- b. Discuss at end of program or some time after it the extent to which you have stimulated bird study among yourselves and others.
- c. Correlations: Art, citizenship, language, reading, literature
- d. Grade Range: 1-8
- e. References
 - (1) For pupils: 1, 5, 6, 7, 9, 10, 14, 16, 18
 - (2) For teachers: 23, 28, 34, 35, 41, 42

54. Holding a Birdhouse Show

The handiwork of pupils always interests parents and friends. Gaudy and impractical houses have never been amusing or novel, but tend to distract from the main features of the activity.

- a. Construct birdhouses, feeders, and waterers to take to community or school show.
 - (1) Judge houses with respect to usefulness to birds for which they were built as well as workmanship.
 - (2) Provide judges with instructions on judging, at least with description of good useable houses for each kind of birds.
- b. Record throughout the summer successes and failures of houses and other devices to help you do better next year.
 - (1) A series of photographs of successful houses together with written statements of elements of successes may be part of the next birdhouse show.
 - (a) Exhibit photographs and stories of the summer's experiences.
- c. Correlations: Art, citizenship, geography, industrial art, language, reading, general programs, P.T.A.
- d. Grade Range: 6-8
- e. References
 - (1) For pupils: 1, 5, 7, 8, 9, 10, 13, 14, 16, 17, 18, 57
 - (2) For teachers: 23, 24, 28, 30, 35, 41, 42, 53, 57

55. Attracting Birds to Our Neighborhood

Birds with color and song are a most enjoyable part of home and school grounds. Children need little more than the teacher's

permission to talk about birds, but instructive things to be done for birds need the teacher's guidance.

a. Houses and nesting shelves

- (1) Construct martin, wren, bluebird, and other birds' houses, and hang several of each in order that birds may have a choice. (Houses may have been made in winter.)
- (2) Put shallow, open boxes under eaves at sides of buildings for robins to place nests on. If a few nails are driven part way into upper side of the box, the robins will use them to keep the nest from falling out.

b. Protection from enemies

- (1) Study nesting habits and behavior of desirable birds, and construct and place houses in accordance with these habits.
- (2) Place tin collars around trees and posts to prevent enemies, particularly cats, from climbing to houses.

c. Feeding stations and platforms, and bird baths and waterers.

- (1) Continue feeding started in winter.
- (2) Arrange bird baths and waterers several to a yard and observe their use; keep filled with water.

d. Plant trees and shrubs to attract birds.

e. Summarize needs and responses of birds and what you have done to best care for birds.

f. Correlations: Citizenship, industrial arts, language, geography, reading

g. Grade Range: 3-8

h. References

- (1) For pupils: 1, 4, 7, 8, 9, 10, 13, 14, 16, 18, 57
- (2) For teachers: 23, 28, 35, 41, 42, 48, 53, 57

56. Making a Bird Calendar and Itinerary

The pupils enjoy this activity very much. It gives purpose to the chasing in the fields and enables the teacher to guide pupils' community behavior.

a. Arrange a large ruled sheet of paper on wall of school.

- (1) Have columns for names of birds seen, names of first observers, where seen, birds' actions, dates when seen first and repeatedly.
- (2) Let other pupils challenge the observer's accuracy in reporting records as the observer goes to the front before his classmates to make an entry. (Provides easy informal discussion and appearances before groups.)
- (3) Small colored pictures may be pasted near bird's name.
- (4) Columns for dates of first nests, first young seen, and first back from North in autumn may be added to be filled in after summer.

b. From year to year charts can be summarized to give average dates of yearly arrivals, etc. Such charts may be compared with weather conditions from year to year.

- c. Correlations: Art, geography, language, literature, reading, common nature hikes, play activities
- d. Grade Range: 3-8
- e. References
 - (1) For pupils: 1, 5, 7, 8, 9, 10, 13, 14, 23
 - (2) For teachers: 23, 28, 30, 33, 35, 41, 42

57. Charting Bird Migrations

Bird migrations are one of the mysteries of nature which man does not yet thoroughly understand. The regularity of time, route, and destination of the migration of different kinds of birds, as well as the great distances covered, can be made more real and clear to pupils by means of the chart suggested in this activity.

a. Materials

- (1) Make an outline map of the western hemisphere on a large piece of wrapping paper or cardboard.
- (2) Procure small pictures of common birds in catalogs, bulletins, old magazines, 10-cent bird books, etc.
- (3) Procure low-priced colored ribbons or string and pins, thumb tacks or Scotch tape.
- (4) Obtain U. S. Department of Agriculture Circular 363, *Migration of North American Birds*, from Superintendent of Documents, Washington, D. C., or any bird book listing winter and summer ranges.

b. Procedure

- (1) Assign a different common bird to each pupil to look up its summer and winter homes and path of migration when the bird appears in your neighborhood in the spring.
- (2) Ask each pupil to fasten picture of bird at its winter home or summer home and fasten a ribbon along the path of migration to its other home.
- (3) Discuss probable reasons for migration of birds.

c. Each pupil should learn the winter and summer ranges and paths of migration of 15 to 25 common birds, and 5 which go far north in summer.

d. Correlations: Agriculture, language, reading

e. Grade Range: 6-8

f. References

- (1) For pupils: 1, 7, 9, 10, 13, 14, 57
- (2) For teachers: 23, 28, 33, 35, 41, 42, 51, 57

58. Securing Good Seed for Field and Garden

We are dependent for food and in some cases for income on the success of crops grown from seed. If the seed is not good the crop cannot be good. Good seed is therefore a particularly important need.

a. Objectives

(1) Teacher's:

- (a) To make pupils aware of nature's lavishness in the production of seed but of the inability of many seeds to grow
- (b) To acquaint pupils with the great potential capacities within a seed in spite of its minuteness
- (c) To help pupils realize that certain very definite factors are necessary for seed germination

(2) Pupil's:

- (a) To become acquainted with various types of seeds
- (b) To learn best methods of planting for various seeds in question
- (c) To become acquainted with viability differences among seeds
- (d) To learn some of the important structures within the seeds so as to be able to discuss seed germination intelligently
- (e) To realize why it is well to recognize some of our bad weed seeds

b. Procedure

(1) Getting material ready.

- (a) Gather seed in the fall—lima bean, corn, sunflower, zinnia, bottle gentian, etc. Supplement this with radish and pea seeds from the store.
- (b) Fill shallow wooden trays with a sandy loam soil (half sand, half dirt).
- (c) Make three plantings of each type of seed—each planting one week apart.

(2) Studying results (after lapse of 3 or 4 weeks)

(a) Questions to be asked:

- i. As you have been watching these seeds grow what do you consider the necessary requirements for seeds to germinate?
- ii. Is light necessary?
- iii. Define germination.
- iv. What are the two stages of germination?
- v. If it had been possible for you to look into a germinating seed, what changes do you suppose would have been going on?
- vi. From your observation of a young pea and a young bean plant, which do you think should be planted deeper and why?
- vii. What are the functions of roots to a plant?

(b) Dissecting and drawing

- i. Dissect a kernel of corn. You will find a yellow food material rich in protein and a white food material rich in starch. The embryo oc-

cupies only a small space in the lower end of the kernel. Can you find it? Draw the interior of a kernel.

- ii. Next, take a germinating seed and examine it. What is the first thing to appear? What is the second structure to emerge from the kernel? Draw this early stage.
- iii. Last, examine a corn seedling. Define a seedling.
- iv. Examine a pea. Look for any marks on the seed coat. Find the scar where the pea broke away from its attachment in the pod. Look for a tiny hole. The young root will poke through this hole.
- v. In a germinating pea look for a young root tip, a plumule or growing point, and a pair of seed leaves.
- vi. Study a pea seedling. Note whether the seed leaves come above the ground. Have they changed in appearance?
- vii. Examine a germinating bean seed. Note two thick spongy structures, the seed leaves. Between these structures appears the shoot that will develop true leaves, flowers, etc. How are these seed leaves different from those of the pea?
- viii. Draw a germinating bean seed and a young seedling.

(3) Further experiments

(a) Bring in samples of clover or timothy seed that are not pure to determine what foreign bodies are present.

- i. Examine them with a hand lens.
- ii. Learn to recognize some common bad weeds. Example: The docks have seeds with large fluted wings and the seed itself is three sided. Bull and Canada thistle seeds are long, oblong and curved like a banana. Velvet weed and other mallows invariably have a notch in one side of the round flattened seed. Many of the mustards have a reticulate coat pattern. Pigweed looks like tiny, shiny, black clams (ridged).
- iii. How do weeds get into supposedly pure alfalfa or timothy seed? Fence rows often harbor weeds that are not cut before seed maturity. Note some of the weeds' excellent means of growth and dispersal.
 - a. Growth in the worst of environs
 - b. Abundance of seed produced

- c. Parachute of the dandelion and saw thistle, down of the milkweed, hooks on the sticktite and cocklebur

(b) Testing the viability of seeds

- i. Look for seeds gathered from the home garden a few years back such as cucumber, muskmelon, beans, corn, peas. Plant in sandy loam under the same conditions as the new seed to find out the length of viability among various ones.
- ii. Start saving enough seed of some plant you are interested in so that you can plant a few seeds every year for some time. You may prove to have a valuable piece of information.
- iii. Look up authentic reports on seeds with a long viability period. What do you think about the seeds purported to be growing now in the tombs of the Egyptian mummies?
- iv. Prove that some seeds need an overripening period by planting corn, rose, pine or spruce seeds immediately after gathering. Plant again in the spring, preferably having kept them in a moist cool place. With which do you have best results? How does nature after-ripen seeds?

(c) Study delay in germination due to hard seed coats.

- i. Members of the legume family have this trait. Find out something about the following methods of aiding germination:
 - a. Use of hot water
 - b. Use of sulphuric acid
 - c. Filing
 - d. Passing through abraiding machine
- ii. Relate the hardness of seed coats to the fact that after years of intensive cultivation, certain weeds continue to appear.

c. Correlations: Agriculture, geography, language, reading, spelling

d. Grade Range: 6-8

e. References

(1) For pupils: 2, 11, 13, 16, 17, 18

(2) For teachers: 25, 30, 35, 36

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59. Starting Seeds Under Glass

Plants such as tomatoes, cabbages, and garden flowers may be started at school and taken home as gifts to parents for one's own garden. Such an activity adds greatly to interest in the home garden.

- a. Build a school hotbed on the south side of the building.
 - (1) Use old storm windows.
 - (2) For needed information or demonstration visit your local greenhouse.
 - (3) Cold frames or window boxes may be used indoors for seeds.
 - (4) Raise windows for ventilation on hot days.
- b. Germination requirements
 - (1) Explain proper soils and needed amount of moisture.
 - (2) Explain how to care for seedlings.
 - (a) Keep hotbed open a few days before transplanting seedlings.
 - (3) Explain how and when transplanting should be done.
- c. Summarize with a list of plants produced in numbers, and best practices with reasons why used.
- d. Correlations: Agriculture, industrial arts, language, reading, spelling
- e. Grade Range: 5-8; 1-4, simpler parts
- f. References
 - (1) For pupils: 1, 11, 13, 17, 18
 - (2) For teachers: 25

60. Making Plant Notebooks

Well-kept notebooks bring much satisfaction to many pupils. Such notebooks permit some systematic plant study without destruction of the plants.

- a. Gather source material, such as plant catalogs, little flower booklets from the dime store, and smooth grade of white construction paper so that one can write in ink.
- b. Introducing the plant world
 - (1) Look up the history of herbs. Search homes or a city library for an old herb book. Why has there been a revival in herb gardens in recent years?
 - (2) Get acquainted with plant groups, such as families.
 - (a) Bring in a lily, a mint, and a composite, and point out certain "ear" marks of each such as the plan of

three among the floral parts of the lily; the square stem of the mint; the many tiny flowers clustered together in the composite.

(b) Bring in examples of nonflowering plants such as the moss, mushroom, algae, etc.

(c) Impress upon pupils the exactness of characters appearing for each individual plant. Example: A mustard almost always has four petals. Also have them note the regularity with which plants blossom. Example: The trillium appears the first of May in our latitude and the goldenrod in autumn.

c. Preparing the booklet

(1) Draw pictures of plants from source material and arrange according to families. As an example, the buttercup, columbine, marsh marigold, delphinium are in the buttercup family.

(2) Write statements about each plant in the form of a description—an interesting habit or something of its economic importance.

(3) Make an attractive cover using a conventionalized plant design. Linoleum block work is quite effective.

d. Correlations: Agriculture, art, geography, history, health, physical education, language, reading, spelling

e. Grade Range: 5-8

f. References

For teachers: 23, 40

61. Making Individual and School Gardens

Every child at some time is interested in having a garden of his own. Each child may not be so prompted every year. Perhaps several will wish to garden together. The many problems which arise are settings for teaching about plants in general and their care. Help the pupil to select readings to answer his many questions.

a. Have children bring seeds and plants to school and dig and care for a school garden.

b. Making a vegetable garden

(1) Children may bring home-grown plants and seeds.

(2) Penny seed packets may be purchased.

(3) Try out new varieties.

c. Children may make their own individual gardens at home.

(1) The following gardens are interesting: rock, formal, herb, old-fashioned flower gardens, vegetable, and rose gardens.

(2) Display seed and plant catalogs.

d. Summarize with list of products and amounts and best practices used in care of gardens and products.

- e. Correlations: Agriculture, citizenship, geography, health, language, reading, spelling, art
- f. Grade Range: 3-6
- g. References
 - (1) For pupils: 2, 3, 5, 6, 8, 11, 13, 17
 - (2) For teachers: 22, 23, 35, 44, 48, 51

62. Beautifying the School Grounds

The child is prone to respect and use public property in proper ways when he realizes that it is in part his. Some working part in its planning, planting, and care develops that possessiveness and hence the proper attitude.

- a. Legal requirements
 - (1) Statutes of Iowa require 12 growing shade trees on each public school grounds.
- b. Help to select, plant and care for trees, shrubs, lawn, and preferably perennial flowers on school grounds.
 - (1) Assist the teacher in formulation of rules against trespassing on lawn and flower beds.
 - (2) Send to landscape specialist, Iowa State College Extension Service, for plans, assistance, and demonstrations in school ground beautification; or see county agricultural agent to secure specialist's services.
- c. Summarize the characteristics of a pleasing school ground.
- d. Correlations: Art, citizenship, language, reading
- e. Grade Range: 3-8
- f. References
 - (1) For pupils: 4, 5, 17, 18
 - (2) For teachers: 44

63. Building a Nature Trail in a Park

Individual or class participation in this activity may continue beyond the school year. Older pupils may help to teach others, and thus learn better themselves. (Most suitable for schools near public parks.)

- a. Identify and catalog major features: trees, wild flowers and other plants and animals.
 - (1) Draw a plan to show paths, streams, and major features.
- b. Place signs near a path which point to major features and tell short, catchy, interesting sentences about each. Use heavy paper or cardboard, waterproof black ink, and paraffin over the whole sign to waterproof it.
 - (1) Change signs each week or two.
 - (2) Volunteer to act as a guide on a nature trail.
- c. Correlations: Art, citizenship, health, industrial arts, language, physical education, reading, spelling
- d. Grade Range: 5-8

e. References

(1) For pupils: 1, 4, 5, 13, 57

(2) For teachers: 28, 39, 41, 45, 54, 57

64. **Tree Planting—Arbor Day**

"When we plant a tree we are doing what we can to make our planet a more wholesome and happier dwelling place for those who come after us, if not for ourselves."—Oliver Wendell Holmes. Arbor Day observance may serve as a climax for work done throughout the school year on conservation of trees. This special day is set, usually in April, by a proclamation of the governor of the state and published in newspapers.

a. Encourage and assist pupils to organize into several reports the combined information acquired during the year's study in geography and science about uses, abuses, structure, beauty, care and need of conservation of trees.

b. Special program

(1) Select some appropriate songs and readings.

(2) If other material is wanted for a program write to the State Department of Public Instruction, Des Moines, Iowa; Extension Forester, Iowa State College, Ames, Iowa; or U. S. Forest Service, Washington, D. C.

(3) Arrange for appropriate slides which will furnish entertainment and information without trouble of preparing a program. Obtain them from the Visual Instruction Service, Iowa State College, Ames, Iowa.

c. Arrange to plant trees with or without a special program at home yards, school grounds and public parks (town, city, county and state).

(1) Arouse previously interest of pupils by devoting some time to discussions on the following points: need of a tree, pleasure for future, suitable location, and best kind for its location when mature.

(2) Pupils may get information by reading and observing different kinds of trees as to size, shape, longevity, and usefulness.

d. Correlations: Agriculture, citizenship, history, language, literature, music, reading, special programs

e. Grade Range: 1-8

f. References

(1) For pupils: 5, 7, 13, 57

(2) For teachers: 23, 25, 30, 35, 39, 41, 54, 57

65. **Using Our Public Parks**

Public parks are chosen most frequently because they are naturally scenic and attractive to leading citizens in the vicinity. The beauty of nature like the beauty in music, literature, and art must be pointed out to many, and such is best accomplished with youth.

a. Local

- (1) Observe all rules in cleanliness in the use of the park.
- (2) Observe which trees leaf out first, which last, which leaf most and least, which give best shade, and which are most sturdy.
- (3) Observe and enjoy animals of the park, such as birds and squirrels.

b. State

- (1) Visit a state park to observe and enjoy plants and animals.
- (2) Observe all rules posted for the park.
- (3) Follow nature trails, if any.
- (4) Obtain from Conservation Commission, Des Moines, or park custodian information about the history of the park.
- (5) Ask for the services of the Park Naturalist stationed in the summer at each of several larger state parks.

c. Suggest improvements and better uses for parks which may be carried to commissions in charge.

d. A pupil-made map or chart of the local park may be prepared with important features, kinds of trees, etc., indicated. Such a map might be mounted or painted on the park bulletin board.

e. Correlations: Art, citizenship, health, history, language, literature, reading, spelling

f. Grade Range: 3-6

g. References

- (1) For pupils: 4, 5, 57
- (2) For teachers: 25, 28, 36, 45, 57

66. Kite Day

Children enjoy making and flying kites. Get ready for some warm, windy spring days by assembling kites. Use the kite-flying experience as a means of teaching about the wind and its use by man.

a. Making and flying kites

- (1) Purchase kite kits (unassembled).
- (2) Use a handwork or art period for assembling the kites.
- (3) Urge the children to follow the printed instructions.
- (4) Explain about the suitable places to fly kites and uses of the wind.
- (5) Plan a kite day with the first suitable wind.
- (6) After kites are in the air fasten the strings and allow them to sail all day.

b. Uses of kites

- (1) Determining the direction of wind and wind velocities
- (2) In Japan the boys' birthdays are celebrated with kites.
(This story may be read to the children.)

c. Wind, power of wind, windmills

- (1) Explain what wind is and the uses of wind; also the harm wind may do.

- (2) Explain how wind is used for power.
- (3) Visit a windmill at some farm and have the children observe its operations.
- (4) Have children make lists of all the uses and benefits of wind.
- d. Sailing vessels
 - (1) Children may make small sailing vessels.
 - (2) Explain uses of sails and how the wind moves the boats by blowing into the sails.
 - (3) Small sailboats may be sailed on water tanks.
 - (4) Sailboats may be purchased or made in the vocational or art period.
 - (5) Stories may be read of famous sailing vessels.
- e. Correlations: Geography, art, industrial arts, play activities, language, literature, reading, spelling
- f. Grade Range: 1-5
- g. References
 - (1) For pupils: 8, 13
 - (2) For teachers: 36

67. Mixing Corn to Improve It

Corn is Iowa's most important grain crop because it is ideally adapted to our soil and climate. Because of its value we are constantly trying to improve it. The Indians themselves did much to develop this crop. The following summary includes major points to be brought out in discussion of the latest improvement method; namely, hybridization.

- a. Corn is naturally cross-pollinated; that is, the pollen from different plants makes the seeds develop on other plants.
- b. Scientists found by self-pollinating; that is, placing the pollen from one plant on the silks of the same plant, "inbreds" were produced.
 - (1) All plants that grow from that seed were more alike, but
 - (2) They were not as strong or heavy yielding.
- c. Scientists found further by cross-pollinating *certain inbreds*, producing "hybrid corn,"
 - (1) That all plants were almost identical in the first generation (first crop from that seed) and
 - (2) Yields were greatly increased.
- d. More than 90 per cent of all corn raised in Iowa is now hybrid.
- e. Invite some local hybrid grower or salesman to bring samples and explain how it is produced, or visit a grower to study it first hand.
- f. Correlations: Agriculture, language, reading, spelling
- g. Grade Range: 6-8
- h. References
 - (1) For pupils: 7, 18
 - (2) For teachers: 35

68. Hatching and Raising Baby Chicks

In addition to occupational and money values involved, the pupil is curious to know about the origin of new individual animals. This activity helps to supply a dignified and intelligent approach to the important questions concerning reproduction.

a. Selecting fertile eggs

- (1) Discuss proper feed, care, and management of a breeding flock.
- (2) What is an egg? (The fertile egg at laying is a new creature, plus a food supply adequate to its needs during the development of organs necessary to its successful independent existence, with coverings which protect it during this development.)
- (3) Discuss selection and care of eggs for hatching.

c. Incubation of eggs

- (1) Have interested pupils set a hen at home, demonstrating the natural method of hatching eggs.
- (2) Visit a hatchery and have hatchery operator explain incubation process.

c. Making a brooder

d. Feeding and care of chicks

- (1) Discuss brooders, best brooding, sanitation, and food.

e. Correlations: Agriculture, art, health, language, reading, spelling

f. Grade Range: 4-8

g. References

- (1) For pupils: 6
- (2) For teachers: 19, 23, 35

69. Making a Sundial

Aside from being an interesting historical timepiece, the sundial may be used to teach changes in sun elevation, earth rotation, length of day in various seasons. It may also serve as a schoolyard ornament and a center of interest for a landscape plan.

a. Studying the principle of the sundial

- (1) Use a flashlight as a source of light.
 - (a) Show how long and short shadows are produced.
 - (b) Show how time can be told from shadows.
- (2) Secure a small object such as a paste bottle which will cast a shadow.
- (3) Relate this with the actual positions of the sun.
 - (a) Show how the shadows change with the changing seasons.
 - (b) Demonstrate with flashlight the sun's behavior and shadows cast at the equator; in the southern hemisphere.

b. Constructing the dial

(1) Securing materials

- (a) A post about 30 inches high which will support the dial is necessary.
- (b) The pointer may be round heavy wire or a triangular piece of flat sheet metal.
- (c) The dial face may be a square piece of lumber on which a circle can be drawn.

(2) Building the dial

- (a) Set post in ground in a sunny situation at all times of the day.
- (b) Nail dial face to post and draw circle on it. (Circle can be painted.)
- (c) Set pointer on dial with high end pointing north. Which direction should it point? Why? Why should the four points of the compass be known? How would a sundial in the southern hemisphere differ from one in the United States?
- (d) Calibrate by means of an accurate watch, marking on the dial face where the shadow is cast at 7 a. m., 8 a. m., etc.
- (e) Drive nails or large brass headed tacks at the hour marks and small tacks at the half hour.
- (f) Paint the numerals on the dial face, using a different color.

c. Making practical applications of study

- (1) Window arrangements in your home
- (2) Location of shade trees on the lawn
- (3) Location of sun and shade-loving garden flowers
- (4) Using poles or fence posts as sundials when in the field without a watch

A south fence post may be used. When the shadow points due north or perpendicular to the fence line, it will be noon. When the shadow points east or parallel with the fence it is 6 p. m. Explain how this method may be used with posts in other directions, too.

d. Correlations: Art, geography, history, industrial arts, language, literature, reading, spelling

e. Grade Range: 6-8

f. References

- (1) For pupils: 2, 3, 6, 7, 8, 13, 18
- (2) For teachers: 19, 22, 37, 40

70. Caring for Small Animal Pets

Almost everybody enjoys pets of one kind or another. Some like dogs, or cats, or a pig, or a calf; others, a rabbit or a bird. Some time in life almost every child is attracted to a wild animal

as a pet. At that time he can learn most about animal life and behavior by caring for his pet.

a. Select or capture a small animal or two such as a white rat, rabbit, field mouse, guinea pig, ground squirrel, garter snake, or toad.

(1) To capture wild animals use a box trap with a trip door and visit it several times a day after setting it in a grassy field with runways. (Observe state game conservation laws.)

(2) Animals often are captured without bait. (Corn, oatmeal, apple, peanut butter and bacon grease are attractive bait to many small mammals.)

(3) Study locality where animal was found.

(4) Read about food, homes, other needs and habits of the animal selected or captured, and talk about such with other children and adults to learn that which may not be in books.

(5) Provide bedding and sleeping quarters, place for exercise and running, and food and water.

(6) Help the animal keep its quarters clean. Scrupulous cleanliness will help greatly in prevention of "travel" disease, of which some pets die.

(7) Observe feeding, behavior, and general condition of the animal. A healthy, well-cared for mammal is alert, quick in movement and has a smooth coat.

(8) Because any wild or tame mammal may bite you, whether handled or not, playfully or maliciously, be cautious in handling it.

b. Summarize the needs of your pet and how you best met those needs.

c. Correlations: Agriculture, citizenship, health, industrial arts, language, literature, reading, spelling

d. Grade Range: 1-6

e. References

(1) For pupils: 2, 3, 8, 9, 17, 18

(2) For teachers: 27, 28, 32, 45

71. Keeping Milk and Cream Cool

The problem of keeping milk and cream cool is still an urgent one on many farms not yet equipped with adequate refrigeration. Too often children form a distaste for milk because the home milk supply is not properly cooled and are handicapped by improper nutrition. Well-done daily tasks at home have underlying scientific principles. A knowledge of these principles makes tasks more meaningful, less tedious, and furnishes grounds for intelligent adaptation.

- a. Discuss relations between temperature, bacteria, and food spoilage. Foods spoil rapidly at warm temperature due to greater bacterial activity. A solution is to keep foods at low temperature (well below 60 degrees) and restrict bacterial action.
- b. Discuss methods in common use for keeping food cool.
 - (1) Caves, wells, or cellars are fairly satisfactory when better methods are not available.
 - (2) "Iceless" refrigerators, which depend on evaporation of moisture for cooling (such as earthen crocks), are useful in summer camps.
 - (3) Ice, "mechanical" or electric refrigerators are most satisfactory because they maintain the lowest temperature.
- d. Summarize basic principles involved, such as:
 - (1) Cooling results from evaporation of liquids. (Example: Chilling in a wet bathing suit on a hot day)
 - (2) Most bacteria do not grow well at temperatures of 40° F. and below. (Example: Storing meat in unheated buildings during winter)

Also discuss concrete present-day uses of these principles.
- e. Correlations: Health, language, reading
- f. Grade Range: 3-8
- g. References
 - (1) For pupils: 13, 17, 18
 - (2) For teachers: 19, 35

72. Rearing Young Game Birds

Despite all man can do in some years severe winter weather or sultry summer weather decreases numbers of game birds very greatly. Yearly, trees and shrubs are planted in some localities to aid the game birds, and the state supplies breeding birds. Older boys and girls do very well with this activity.

- a. Cooperate with local conservation and sportsmen's organizations.
 - (1) Help in building brooders for young birds.
 - (2) Volunteer to help in care of young birds.
 - (3) Work with other boys and girls; particularly have town pupils work with rural pupils in selection of territory, its improvement, and watching liberated birds.
 - (4) Through county agricultural agent ask for forestry and wild life specialists' services from Iowa State College.
 - (5) For advice in regard to details, assistance, and legal aspects, consult with local state conservation officer. Your county superintendent of schools can give you his name and address. Or write to Iowa State Conservation Commission, Des Moines, Iowa.

- b. Periodically summarize your results; i. e., successes in increasing population of game birds, and failures, together with reasons and desirable improvements.
- c. Correlations: Agriculture, citizenship, industrial arts, language, reading
- d. Grade Range: 4-8
- e. References
 - (1) For pupils: 1, 4, 9, 10, 14, 17
 - (2) For teachers: 23, 28, 33, 35, 36, 41, 42

73. Bird Nesting Census

This summer assignment which continues spring bird study will be enjoyed by a few pupils and should be recommended for all as inexpensive summer recreation in a home community.

- a. Visit all trees of a certain kind, such as elm, in a town or in a farm grove. Without disturbing birds or nests, but by sight of birds and nests, or from songs of males, estimate numbers of nesting birds.
- b. Visit all trees and possible nesting places in town, or on a farm, or a section of land, to count nests of singing birds. Farm fields may be visited.
- c. Continue throughout the summer and summarize numbers and kinds, birds and nests to a certain kind of tree, a certain situation as in all kinds of trees or shrubs to the block or acreage, etc. Analyze in which trees most kinds of birds nest, and in which given kinds of birds nest the most.
- d. Correlations: Summer activity
- e. Grade Range: 3-8
- f. References
 - (1) For pupils: 1, 6, 7, 13, 18, 57
 - (2) For teachers: 23, 24, 28, 41, 42, 57

74. Protecting Plants from Damage

Plants grown by pupils are frequently attacked by destructive insects and exposed to natural destructive forces. Not every destructive insect need be identified, but principles underlying control are needed.

- a. Discuss types of insect damage.
 - (1) Insects that chew leaves, etc.—cabbage worm and potato beetle (Control with internal poison as lead arsenate.)
 - (2) Insects that suck juices—plant lice (Control with external spray as nicotine sulphate.)
- b. Discuss plant diseases, such as blights, rusts, mildews, and chemical controls.
- c. Discuss animal damage and protection with fences, trapping, etc.

- d. Discuss possibilities in coverings, barriers, hedges, etc., to protect against wind, frost, and hail.
- e. Summarize basic principles and concrete general control methods, such as insects with biting mouth parts are killed by stomach poisons, etc.
- f. Correlations: Agriculture, health, language, reading, spelling
- g. Grade Range: 4-8
- h. References
 - (1) For pupils: 2, 6, 13
 - (2) For teachers: 37

75. Taking a Census of Insect Pests in the Community and Studying Methods of Control

There are so many thousands of different kinds of insects that only those that are important in the community need be given attention in this census. Methods of control are based on relatively few and simple principles which can be learned by everyone.

- a. Collecting specimens
 - (1) Mount 3 or 4 of each species, when available, for the school collection (extra ones for exchange) such as grasshopper, milkweed beetle, cricket, squash bug, etc.
 - (2) Record date and habitat. Example: Carolina or Roadside Hopper along dusty roadside, September 6, 1943.
 - (3) Keep individual pupil collections in cigar boxes.
- b. Estimating how numerous different species are
 - (1) From observations on field trips, reports from the community, and the number brought into the school, rate as—
 - (a) Few
 - (b) Moderately abundant
 - (c) Prolific
 - (2) Arrange the record in the form of a chart.
- c. Preparing an exhibit showing the value of birds in insect control
 - (1) Rose-breasted Grosbeak pictured with a potato beetle
 - (2) A crow beside the white grub and grasshopper
- d. Studying how insects can be controlled
 - (1) Searching for examples of destruction
 - (a) Secure a pest-ridden house plant being overcome with mealy bugs.
 - (b) Look for web worms in wild plum thickets.
 - (c) Bring in a wormy apple or cabbage head.
 - (2) Why is it necessary to know the type of mouth parts possessed by an insect to use poison effectively?
 - (3) What harm is done by leaving stagnant pools near homes? Does this mean that all such places should be drained? Why?
 - (4) Have you seen sticky bands around the elm trees? Find out why they are there.

- (5) Find out why introduced insect pests (from the old world) cause more havoc than our own native pests. Look up something on the Japanese beetle, public enemy No. 1, in the insect world.
 - e. Correlations: Art, by making motifs or conventionalized drawings as border designs for booklets, etc. Examples might be the beetle, wasp, butterfly, etc. Also arithmetic, citizenship, health, language, reading, spelling.
 - f. Grade Range: 4-8
 - g. References
 - (1) For pupils: 7, 13, 15, 16, 17, 18, 57
 - (2) For teachers: 23, 28, 35, 38, 57

Jaques, H. E., *How to Know the Insects*, 708 Main, Mt. Pleasant, Iowa.

Readers Digest, *Hunting the Pest-Killers*, January, 1940.

Grasshopper Control in Iowa, Bulletin, Iowa State College Extension Service, Ames, Iowa.
- 76. Stocking a Farm Pond or Garden Pool**
- This study calls attention to water conservation and use. Farm watering ponds are practical and advisable in eastern and southern Iowa. Garden pools are possible in all sections of the state.
- a. Farm pond
 - (1) By measurement, learn area of pond, depth of water, stability of water, i. e., whether or not it is suitable for pond fish.
 - (2) Select with advice of local conservation officer kind of fish to stock. If it is to be open to the public, fish may be obtained through him: if private, write to U. S. Fish and Wild Life Service, Merchants Mart, Chicago, Illinois.
 - b. Garden pool
 - (1) Clean pool thoroughly in spring.
 - (2) Purchase or find suitable plants to place in pool.
 - (3) Keep fish (goldfish most suitable) in tubs in winter, or purchase in spring.
 - c. Correlations: Agriculture, arithmetic, art, geography, health, industrial arts, physical education, reading, spelling
 - d. Grade Range: 4-8
 - e. References
 - (1) For pupils: 8, 9, 13
 - (2) For teachers: 28
- 77. Staging a Pet Show**
- Humaneness in treatment of animals can best be taught through pupil's proper care and enjoyment of his own pet. Pet shows, which many towns and communities have yearly, emphasize this opportunity.

- a. Select a pet, preferably one which you may teach to do tricks, to dress up, to handle or in general make more entertaining to others.
 - (1) Study how to care for and train the pet.
 - (2) Enter your pet in a community pet show.
 - (3) Talk with other people about what they like in pets.
- b. Study reasons for success of the winners and how you may improve as an entrant next year.
- c. Correlations: Agriculture, school program
- d. Grade Range: 1-8
- e. References
 - (1) For pupils: 11, 13, 17, 57
 - (2) For teachers: 23, 28, 30, 35, 45, 57

C. Bibliography

The following bibliography is divided into two parts—(1-18) Pupil References, and (19-54) Teacher References. In most cases references have been keyed to the particular activities for which they are suited. Where library funds are restricted, a careful selection of a limited number of references will be seen to cover a wide range of suggested activities. Pupils' interest will usually be stimulated and greater educational values result, however, when a larger variety of references sources is used.

Pupil References:

1. Beauchamp, W. L., Crampton, G., Fogg, H. M., and Gray, W. S. *Science Stories* in "Curriculum Foundation Series," Books I, II, III. New York: Scott, Foresman and Company, 1939.
Grade Range: 1, 2, 3, respectively. Reading Difficulty: Easy.
Bk. I: Activities 1, 3, 6, 9, 11, 12, 15, 22, 26, 29.
Bk. II: Activities 2, 3, 12, 22, 26, 39, 63.
Bk. III: Activities 9, 12, 22, 39, 51, 53, 54, 55, 56, 57, 59, 72, 73.
2. Beauchamp, W. L., Blough, G. O., and Melrose, M. *Discovering Our World*, Books I, II, III. New York: Scott, Foresman and Company, 1937, 1938, and 1939, respectively.
Grade Range: 5-8. Reading Difficulty: Average.
Bk. I: Activities 6, 49, 58, 69, 70.
Bk. II: Activities 16, 17, 26, 33, 39, 47, 74.
Bk. III: Activities 17, 20, 30, 40, 41, 43, 46, 47, 49, 58, 61.
3. Carpenter, H. A., and Wood, G. C. *Our Environment, How We Adapt Ourselves To It*, Books I, II. Chicago: Allyn and Bacon, 1937.
Grade Range: Junior High. Reading Difficulty: Average.
Bk. I: Activities 33, 35, 36, 44, 47, 61.
Bk. II: Activities 17, 19, 23, 24, 33, 40, 49, 61, 69.
4. Clarke, F. E., et al. *Our Animal Books Series*, Primer, Books I-VI. Chicago: D. C. Heath and Company, 1937-1939.
Grade Range: 1-6. Reading Difficulty: Difficult.
Primer: Activity 70.
Bk. I: Activity 70.

- Bk. II: Activities 31, 70.
 Bk. III: Activities 5, 31, 55, 72.
 Bk. IV: Activity 31.
 Bk. V: Activities 30, 55.
 Bk. VI: Activities 12, 22, 32, 53, 62, 63, 65.
5. *Compton's Pictured Encyclopedia*. Chicago: F. E. Compton and Company, 1939.
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6. Craig, G. S., et al. *New Pathways in Science Series*, Primer, Books I-VI. Chicago: Ginn and Company, 1940.
 Grade Range: 1-6. Reading Difficulty: Average.
 Primer: Activities 22, 27, 30, 37, 44, 49.
 Bk. I: Activities 10, 12, 28, 39, 45, 61.
 Bk. II: Activities 4, 9, 22, 26, 41, 46, 56.
 Bk. III: Activities 12, 21, 22, 45, 47, 49.
 Bk. IV: Activities 16, 44, 49, 53, 61, 68.
 Bk. V: Activities 22, 26, 33, 36, 49, 53, 56, 61, 69, 73, 74.
 Bk. VI: Activities 5, 39, 41, 43, 44, 45, 49.
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 Bk. III: *Our Animal Friends and Foes*. Activities 1, 11, 12.
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 Primer: Activities 9, 55, 70.
 Bk. I: Activities 8, 9, 11, 12, 29, 30, 45, 54, 66.
 Bk. II: Activities 3, 6, 9, 10, 12, 26, 29, 30, 44, 48, 49, 52, 70.
 Bk. III: Activities 5, 12, 29, 49, 50, 54, 55, 68.
 Bk. IV: Activities 10, 11, 12, 16, 23, 41, 42, 43, 61, 69.
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Bk. II: Activities 11, 18, 22.
Bk. III: Activities 34, 39, 45, 58, 74.
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BIOLOGICAL SCIENCE

Primary, Grades 1, 2, 3

Doing Work. 39.

Water Appears and Disappears. 33.

An Aquarium. 10, 28.

Animals Round the Year. 12, 22, 28, 29, 30, 55, 73.

The Insect Parade. 5, 17, 18, 27, 28.

Plants Round the Year. 22, 24, 59, 61.

Intermediate, Grades 4, 5, 6

Air About Us. 44, 45, 46.

Clouds, Rain, and Snow. 19, 26, 33.

The Earth a Great Storehouse. 27.

Fire. 47.

Gravity. 40.

Machines. 39.

Magnets. 39, 44.

The Sky Above Us. 49.

Stories Read from the Rocks. 27, 48.

Thermometers. 33, 34, 71.

Animals of the Seashore. 12, 27, 28.

Animal Travels. 22, 28, 29, 30, 55, 57, 73.

Animals of Yesterday. 27, 28.

Birds. 12, 28, 29, 30, 51, 54, 55, 57, 73.

Fishes. 10, 12, 28, 32, 76.

Flowers, Fruits, and Seeds. 24, 27, 50, 58, 61.

The Garden and Its Friends 9, 17, 61, 74, 75.

Garden Indoors. 6, 7, 8, 59.

Insects and Their Ways. 4, 5, 12, 18, 27, 28.

Living Things. 27, 28.

Reptiles. 12, 27, 28.

Seeds and Seed Travels. 24, 27, 58.

Spiders. 12, 28.

Toads and Frogs. 12, 28, 76.

Trees. 2, 3, 17, 50, 64.

You as a Machine. 20.

Junior High, Grades 7, 8, 9,

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| <p>Ask the Weatherman. 19, 26, 33.
 Beyond the Solar System. 49.
 The Earth's Changing Surface. 62.
 Fire, Friend and Foe. 47.
 Heat. 33, 34, 36, 71.
 Light. 43, 44.
 Our Ocean of Air. 44, 45.
 The Sun and Its Family, 49, 69.
 The Ways of the Weather. 19, 26, 33.</p> | <p>Balance in Nature. 28, 74.
 Insect Friends and Enemies. 4, 5, 17, 27, 28, 74, 75.
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 Bk. III: Activities 5, 9, 28, 38, 55, 58, 75.
 Bk. IV: Activities 22, 49, 53, 54.
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- | No. | Titles |
|-----|--|
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| 151 | <i>How Animals Travel.</i> 54. |
| 152 | <i>The Story of Seeds.</i> 58, 59. |
| 154 | <i>Animal Families.</i> (Kinds of Animals.) 28, 77. |
| 155 | <i>Birds and Their Babies.</i> 72. |
| 203 | <i>The Story of Milk.</i> 71. |
| 204 | <i>Plants that Give Us Food.</i> 61. |
| 208 | <i>Animals and Their Babies.</i> (Kinds of Animals.) 28, 77. |
| 251 | <i>Where Animals Live.</i> 12. |
| 254 | <i>Sun, Moon and Stars.</i> 49. |
| 255 | <i>Simple Machines.</i> 39. |
| 302 | <i>The Story of Flying.</i> 38. |
| 305 | <i>The Story of Heat.</i> 34. |
| 308 | <i>The Story of Coal.</i> 34, 35. |

- 351 *The Story of Frogs.* 70.
 - 352 *Protection in Nature.* 75.
 - 354 *How Birds Live.* 30.
 - 355 *What Animals Eat.* 28.
 - 407 *The Story of Time.* 9.
 - 408 *The Story of Light.* 43.
 - 451 *Electricity and Magnets.* 41.
 - 452 *Indoor Gardens.* 62.
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| (1) Airplanes | (45) Japan |
| (3) Animals | (42) Light |
| (8) Astronomy | (18) Mexico |
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| (12) Boats | (33) Music |
| (25) Books | (47) National Parks |
| (31) Character Education | (16) Natural Resources |
| (34) Christmas Customs | (10) Old World Gifts |
| (35) Christmas Music | (37) Our Schools |
| (15) City Life | (20) Pioneer Life |
| (26) Clothing | (39) Plant Life |
| (50) Colonial Life | (27) The Post Office |
| (2) Communication | (5) Rocks and Minerals |
| (46) Community Life | (24) Safety Education |
| (41) Desert Life | (28) Sea Creatures |
| (4) Eskimos | (7) Shelter |
| (11) Exploring the World | (22) South America |
| (30) Family Life | (43) Switzerland |
| (14) Farm Life | (21) Thrift |
| (40) Fire and Fuel | (17) Transportation |
| (13) Fishing | (9) Trees |
| (6) Food | (19) Weather |
| (23) Holland | (36) Wild Flowers |
| (40) Indians | (29) World Peace |
| (44) Insects | (38) World Trade |

III. SUGGESTIONS TO TEACHERS

A. Activities Involving Direct Contacts with Nature

1. Scientific Observations

Careful observation is one of the essential steps in scientific investigation. All people should attempt to improve their powers of observation in order to make more intelligent use of their surroundings. The habit of careful observation not only aids in planning one's activities to work in cooperation with nature rather than in opposition to it, but also adds to one's enjoyment of his surroundings. Thus the careful observer recognizes the signs of changes in weather, which helps him plan his work, his play and recreation, and the clothes he should wear. In this way his outdoor work and recreation are less often spoiled by weather changes.

Children can be trained to make more specific observations of their surroundings. The following lists of "things to look for" will suggest a variety of specific observations to be made. One or two questions may be raised with the children, discussed briefly, and assigned as "something to look for" during the week end, after school, or during the current week. Another possible use would be to copy parts of the lists in notebooks with a challenge to pupils to record their observations and report them to the class or school.

a. Fifty Interesting Things to Look for in Fall

- (1) Where do the flocks of blackbirds spend the nights?
Which direction do they fly in the morning?
- (2) What do you see blackbirds eating?
- (3) Did your wren nest box have wrens in it this summer?
If not, compare its location and structure with that of a box that the wrens used.
- (4) Does the color of the goldfinch aid them while feeding on sunflowers?
- (5) How does a redheaded woodpecker act as he flies from his perch on a post?
- (6) How many English sparrows do you see in a flock?
- (7) Look for the spotted sandpiper near streams. Notice how he teeters up and down. Can you learn his call?
- (8) What do crows mean by two, three, four and five "caws"?
- (9) When did you see the first young cock pheasant with his new white collar?
- (10) Do you see any small birds flying southward in the day-time?

- (11) Look for flocks of hawks flying high in the air. Where are they going?
- (12) Where do you see flocks of swallows?
- (13) Instead of snaring ground squirrels try to see one catching a grasshopper.
- (14) How does a squirrel carry the nuts to its hiding place?
- (15) When do you see the last bat flying in the fall?
- (16) Can you find the burrow of a cottontail?
- (17) Does the skunk hunt for its feed during the day or the night?
- (18) Look for mouse nests in shocks of corn fodder. Of what are the nests made?
- (19) What is the color of the fur of muskrats now?
- (20) Do you see any tadpoles now? The tadpoles of green frogs and bullfrogs live through the winter.
- (21) If you see something that looks like a small piece of a twig in a pond and it moves, take it up with a net or a wire strainer. It may be the cabin of a caddis fly larva.
- (22) Look closely at the roots of weeds and other plants for plant lice. How do they differ in color from the plant lice seen above the ground?
- (23) Upon younger milkweeds you may find the caterpillars of the monarch butterfly. They are striped crosswise with yellow, green and black.
- (24) Gather different kinds of cocoons this fall and keep them until spring.
- (25) At the tip ends of ears of corn on stalks, and on sunflowers, you may see small green beetles. They are the adults of the northern corn root worm.
- (26) Along the roadside the Carolina locust, with yellow-bordered black wings, flies ahead of you with a crackling call. Which way does it face when it alights?
- (27) Which flowers do you see bees visiting?
- (28) Do flies stay long in darkened rooms?
- (29) Place a grasshopper on the web of a large spider. What happens?
- (30) The day after a rain is a good time to look for toadstools. How many colors other than white do you see?
- (31) Try to find some pond scum, algae, that looks like a hairnet.
- (32) As you walk through ragweeds do you sneeze? The yellow dust, pollen, you see on your clothes may aggravate hay fever. What other plants make you sneeze in this manner?
- (33) In lawns, gardens, and fields you may see a purplish grass with slender, finger-like projections at the top. It is called crab grass. How does it spread?

- (34) Keep a list of flowers you see in gardens and flower beds. Which would you like to see in the schoolyard next September?
- (35) Look for a plant with flowers like a sunflower, and its opposite leaves forming cups. After a rain you may be able to find the use of these cups to the cup plant.
- (36) The prairie blazing star is a tall plant with pinkish purple flowers clustered along a stiff, erect stalk. Does it please you enough to find a place in a wild flower garden?
- (37) Look for the painted leaf with the upper leaves quite red.
- (38) Can you find a buttonbush, a shrub with smooth leaves opposite or whirled in threes, and its fruits clustered in round balls about three-fourths of an inch in diameter? Where can you place such a shrub in your schoolyard?
- (39) What trees shed their leaves first?
- (40) Do you see yellow or red leaves first?
- (41) Look for good shade trees that you would like in your schoolyard. You may care to find small trees like them to transplant next spring.
- (42) Do you see trees that shed large pods, large amounts of leaves, or many small twigs? Would you like such trees for shade?
- (43) Look for the woodbine or Virginia creeper. It has five leaflets, smooth bark, and blue fruit. How does it cling to the surface it climbs?
- (44) Find an acorn whose cup has a fringe at the top. What kind of leaf has the tree, the bur oak?
- (45) Do you know where there is an evergreen that sheds its leaves? The larch and tamarack shed their needles each fall.
- (46) Was it windy or still, cloudy or clear, the night of the first frost?
- (47) What kind of weather do we have the day after a heavy rain?
- (48) Look for the first year's growth of mullein with its light green, very woolly leaves. How is it protected for winter?
- (49) What kind of soil in your playground dries most quickly after a rain?
- (50) What kind of soil in your schoolyard has the best growth of grass?

b. Fifty Interesting Things to Look for in Winter

- (1) Bush clover is an erect plant with leaves like clover, and brown flower heads. Does it make a pretty bouquet?
- (2) Look for the mitten-shaped, light green, woolly leaves of the mullein.

- (3) In some front yard you may see a shrub with white berries. Is "snowberry" a good name for it?
- (4) The basswood now has gray or red twigs and red buds set a little toward one side and above the leaf scars. Can you find a small tree to plant next spring?
- (5) If you look at the buds of apple trees you may see two sizes. Watch to see what comes from the larger buds.
- (6) Which direction do the leaves of geraniums face after standing on the window sill a week or two? Why?
- (7) Cut the upper 3 or 4 inches of new growth from a geranium, and place it in moist sand. Try the same with older growth. Which develops roots more quickly? Which will you use to secure a number of plants to place in a flower bed in front of the schoolhouse next spring?
- (8) Have you seen the leaves of the plant in a kernel of corn? What does the white part of the kernel resemble? Of what use is the outside covering? Can you now define seed?
- (9) The white pine is an evergreen with its needles in bundles of five. Would it make a good windbreak for your school?
- (10) Sweeping and dusting are hard, tedious, and regular tasks. If you will place a piece of moist bread in a saucer, sprinkle a little dust from the sweepings on the bread, cover with a second saucer, and place in a warm place a few days, you may find a reason for enjoying the cleaning of rooms.
- (11) Follow the tracks of a rabbit. What has he eaten? Does this make an interesting composition?
- (12) Have you seen a muskrat swimming under the ice? Is his home in a mound or hole in a bank?
- (13) Can you hop like a squirrel? Ask a classmate to run like a dog while you go ahead of him like a squirrel. What can the squirrel climb for safety? Let the other children guess the names of the animals you imitate.
- (14) What tricks can your cat perform?
- (15) Why are cattle placed in stanchions, and horses tied with halters and ropes? Watch these animals lie down and get up.
- (16) Meadow mice tracks are somewhat like rabbit tracks, but are only about one-fourth as large, and from one to eight inches apart. If the tracks seem to end without a hole or other place of refuge near, what may have happened? Perhaps other marks in the snow furnish a clue, and you may be a fine detective.
- (17) What are mink hides worth? What is the price of a mink coat? Can you profit more by having the hides made into a coat to be sold by yourself?

- (18) A pamphlet sent out by the Iowa State Conservation Commission places the skunk on the protected list. When may it be taken? Does the skunk deserve and require protection?
- (19) In the November, 1923, American Magazine, William Finley tells about an interesting "string and nut" game played by chipmunks. Will fox squirrels play this game?
- (20) Have you seen snakes, turtles, or frogs in the winter?
- (21) Tie suet to strings and hang it near the schoolroom windows or just outside so you may see the downy woodpecker, about six inches long, chiefly black and white, come to feed. What food seems to attract most birds in winter?
- (22) During winter walks you may see gray birds with several white tail feathers, and about as large as English sparrows fly ahead of you. Do you like their winter songs?
- (23) Have you a winter robin?
- (24) Have you seen the nuthatch, a blue-gray bird with a black cap, run down a tree?
- (25) Perhaps you have seen the chickadee, a gray bird with a black cap and a black necktie, hanging downward from an upper branch of a tree.
- (26) Crow tracks are about three inches long, about five inches apart, and show the print of a rear toe. As he walked in the snow, what did he find to eat? What evidence have you to show the crow is useful, or harmful?
- (27) Pheasant tracks are about three inches long, and show only three toe marks. Follow the tracks. Do you find any evidence of harmful feeding?
- (28) How does the tree sparrow, a gray-brown bird with a small dark spot on its gray breast, help you fight the weeds?
- (29) If you make bird nest collections now, you need not trouble the nesting birds to find what birds you have near in summer. Chipping sparrows' nests are shallow and contain many long hairs.
- (30) In *Far and Near*, among other interesting things about winter birds, John Burroughs says he suspects bluejays of hiding food taken from feeding stations. How do your jays behave?
- (31) Bluebirds in the wilds use hollows of trees, or old woodpecker holes as nesting places. Can you construct a box that will be about as large and resemble the natural site?
- (32) On the twigs of trees you see the small brown eggs of the katydid. They are placed in a row, and overlap somewhat like shingles of a roof.

- (33) Have you a fly in the house?
- (34) At the ends of willow branches you may find scaly, bulb-like galls. What is inside of one of these galls?
- (35) Under leaves and rubbish you may find beetles that are red, brown, or black with or without red, brown, or black spots. They are the ladybird beetles.
- (36) In the crevices of the bark of apple trees, the codling moth larvae may be seen resting in their cocoons.
- (37) Some of the gray, hairy cocoons of tussock moths found attached to the bark of trees have small white objects fastened to them. What are they?
- (38) Look for the paper nests of hornets. What is inside of a nest?
- (39) What do you find in the clay nests of wasps?
- (40) Have you seen the silken egg cases of spiders under boards, rocks, and in the crevices of bark?
- (41) How many shapes of snow crystals have you seen fall upon your coat sleeve?
- (42) Is the lawn or the sidewalk first covered with snow? Why?
- (43) If puddles of water freeze in the school yard, look to see the effect upon the grass when spring has come.
- (44) Where are the snow drifts in the yard? What arrangement of buildings might be made to avoid such drifts?
- (45) Is the ice from dirty rivers clean?
- (46) Do you go to skate on ponds or creeks first?
- (47) Why is sawdust packed around ice?
- (48) Are the weather reports in daily papers correct?
- (49) From which direction does most snow come?
- (50) How do the clouds appear before a snowstorm?

c. Fifty Interesting Things to Look for in Spring

- (1) The pasque flower, which you may know as the crocus, will probably be the first wild flower you find. Why is it so fuzzy?
- (2) The bloodroot has a palmately lobed, nearly circular leaf. The juice of the rootstock is red. The petals of the flowers fall so soon after picking that you will not enjoy the flower in a bouquet. Where shall we enjoy it?
- (3) Adder's tongue sends up one or two brown mottled leaves early in the spring. It does not bloom before it is seven years old. What care shall we provide for it?
- (4) Are the bouquets as fresh on Friday as they were on Monday? A pinch of salt or a few drops of ammonia in the water aids in keeping some flowers fresh.
- (5) If you find a flower that looks like a lady's slipper do not molest it. A sign reading "Please save the lady's slipper" may help to protect this rare flower. Have you a wild flower garden?

- (6) Morels are edible mushrooms found in the woods. They look very wrinkled, pitted, and creased.
- (7) Grow a few tomato and cabbage plants at school to surprise your mother.
- (8) Is there room at one side of the schoolhouse for the geraniums you have had indoors this winter?
- (9) Would you like to see a bed of asters in front of the schoolhouse next September? Who will plant the seeds?
- (10) Do you notice any bare spots in the school lawn? Who will scatter a few lawn grass seeds on these spots, and cover them with the aid of a garden rake?
- (11) Elms bear flowers and fruit before the leaves. The American elm is a desirable street tree. The fruit is circular in outline, flat, about one-half inch in diameter, smooth on each side, but has a few hairs around the margin. Gather a few seeds to rear a few trees for the schoolyard.
- (12) Shrubs planted around the corners of the buildings are very attractive. Perhaps there are many lilac, mock orange, bridal wreath, and barberry shrubs in the neighborhood that have grown so large the owners would be pleased to have you ask permission to divide these shrubs and remove parts of them to the schoolyard.
- (13) Which tree is best to look for if you wish to make a whistle? If you need a fishpole? If you desire a handle for a slingshot?
- (14) What kind of wood is readily obtained, easily worked, and satisfactorily employed in making birdhouses?
- (15) "The Planting of the Apple Tree" by William Cullen Bryant will teach you how to transplant a tree properly.
- (16) Where are the blossoms borne on an apple tree? Which wood should be pruned to increase fruit-bearing of the apple?
- (17) Which tree furnishes shade first? Has it any objectionable features?
- (18) Do you see any trees with gay colors in the spring?
- (19) The blue spruce with its outer bluish-green needles is a very interesting, decorative tree. The needles are four-sided, sharp, stiff, and about three-fourths of an inch long.
- (20) Toad eggs are often found in several double spirals. The toad is so helpful in protecting our gardens that we should protect it. How many eggs shall you take to school to see the tadpoles?
- (21) The spotted salamander, the black lizard with yellow spots, will not hurt you and does much good in eating insects and slugs. Why should you kill it?

- (22) The leopard frog, green with two irregular rows of black spots on the back and spots on its sides and legs, destroys many harmful insects. Shall we let these live longer, or kill them for the small amount of food we may get from the legs?
- (23) The green snake is not poisonous, and it eats many harmful insects. If you do not care to handle it, do not strike it. Let it go on its way doing good. You should do the same.
- (24) The snapping turtle, with the under shell covering but a small part of the body, is a destroyer of fish and waterfowl. Many people like snapping turtle soup. Many are shipped out of the state at good prices.
- (25) What bait is good to catch bullheads? How deep should the hook sink in the water? At what time of day do they bite best?
- (26) Early every spring conservation officers seine some ponds and creeks for fish that may perish later when the water evaporates. They are always glad to have volunteer help. One may learn much about the appearance, habits, and number of fish by aiding the wardens. Help! Put the fish into good streams.
- (27) If you start an aquarium, place in it insects and minnows from still water, unless you can arrange for running water in the container. Which insects live longest?
- (28) The dragonfly nymph has prominent eyes, six legs, short thick abdomen, and a lower lip that may be extended as an arm. It lives in ponds. Place one in the same jar with some mosquito wrigglers, and observe which disappear.
- (29) If you like to collect insects, hang a lantern in front of a screen near a tub of water in such a position that the June beetles and moths striking the screen at night fall into the water.
- (30) One often finds the eggs of insects fastened to the twigs of trees. These may be taken in the schoolroom, permitted to hatch and grow until large enough to tell the kind of insect. The leaves of the tree upon which the eggs were found are usually suitable as food for the young insects.
- (31) Honey bees may be found working around the flowers of maples and willows. Are they always at the flowers or do you see them elsewhere on the plants?
- (32) With a knife, split open some of the swellings on the stems of goldenrods. What do you find within?

- (33) Do you wish to have a flyless summer? Then learn that flies lay their eggs in decaying rubbish and filth. What is your duty?
- (34) Watch about brush for a sparrow with spotted breast and streaked face. What words fit his song? Is "song sparrow" an appropriate name?
- (35) Try to attract flickers to nest boxes. If the boxes imitate their natural nesting places you may be successful.
- (36) Among the upper branches of trees one may see a bird about as large as a house wren wearing white bars on each wing and a gay colored topknot. What does the kinglet eat?
- (37) What is the food of swallows? When may we expect them? When do they come?
- (38) Does the mother or father robin build the nest? Or do they both work at it? The father robin has the brighter breast.
- (39) The marsh hawk is mostly bluish, or brown, with a large patch of white on the tail. It spends much time sailing low over the fields looking for mice. Do you ever see it come near the chicken yard?
- (40) Before you condemn the noisy bluejay observe many of his actions. Do you find him doing more harm than other birds?
- (41) Cats are in the habit of hunting at night. Are the nesting boxes protected against these rovers?
- (42) Before you snare, drown out, or shoot another striped gopher try to determine how much corn it has destroyed, how many insects it has eaten, and perhaps you will have had as much or more fun.
- (43) Why does a mouse sit up to eat small pieces of food?
- (44) In some towns houses are put up for bats. They are built with sides like the wooden cupolas on barns. Bats eat many mosquitoes.
- (45) You may notice the trail of muskrats beside a stream. Beside the feet tracks there is a winding trail. What makes it.
- (46) When does the sun shine on the north side of the building?
- (47) How much later does the moon rise each night?
- (48) Does the ungraded or graded road dry out more quickly in the spring?
- (49) If you live near a stream, you may notice new banks of sand and gravel. Where did the material come from, and how did it get that far?
- (50) Did it turn cold or warm after the first thunderstorm?

References:

- Nature study books and magazines.
- Nature Study Landscapes and Life History Charts, E. L. Palmer. (Comstock Publishing Co., Ithaca, New York, \$1.00.)
- Handbook in Nature Study, Mrs. A. B. Comstock. (Comstock Publishing Company, Ithaca, New York, \$4.00.)
- Audubon Bird Leaflets and Pictures. (National Audubon Society, 1006 Fifth Avenue, New York.) Write for membership conditions and prices.
- Bird Book, Flower Book, Animal Book, Thornton Burgess. (Cross and Company, Cedar Falls, Iowa. Each \$3.00.)
- Nature Magazine. (American Nature Association, Baltimore, Maryland, \$2.50.)
- Outdoor American. (Izaak Walton League of America, 536 Lake Shore Drive, Chicago, Illinois. Membership \$2.00, Magazine \$1.00.)

2. Nature Hikes

Nature hikes may be made very interesting if conducted properly. A good time to take them is during noon hours, the last periods on Fridays, or on Saturdays. If taken on Saturday, plan a picnic lunch with the children. Divide the children into groups and assign a definite task to each group, such as: one group may gather leaf specimens, another insects, another weeds, stones, etc. Constantly call pupils' attention to everything interesting along the way, such as birds, bird calls, wild flowers, moss, stones, erosion, etc. This will help to develop keen observation in children and a greater appreciation of nature, which in turn will tend toward desirable pupil behavior on the way to and from school as well as during out-of-school periods. Later the specimens may be mounted and used or discussed in the science lessons.

On nature hikes call individual and group attention to:

- a. Trees, flowers, weeds, and plant life
- b. Brooks, creeks, streams, meandering deposit of sand and silt
- c. Soil erosion and soil not eroding
- d. Types of soils—glacial, water carried, wind blown
- e. Rocks and minerals
- f. Birds and nests
- g. Small animals
- h. Small animals' homes, burrows
- i. Animal tracks
- j. Pond life
- k. Finding echoes
- l. Trying the speeds of sound and light
- m. The sun, moon, stars, clouds, and sky
- n. Wind and weather signs

3. Science and Nature Hobbies

The field of science and nature study provides an unending source of hobby activities. Each child needs the mental stimulation of a challenging hobby and the experience of achievement which a well-selected and energetically pursued hobby provides. Encourage nature hobbies by allowing pupils time to work on their selected hobbies during certain periods each week when other assigned work is finished.

Some appropriate hobbies are:

- a. Collections of various kinds: seeds, weeds, insects, butterflies, pictures of birds, flowers, animals, airplanes, automobiles
- b. Constructive hobbies, in which things are made: drawings, paintings, silhouettes, birdhouses, feeding stations, model airplanes, "inventing," photography
- c. Active hobbies: hunting, trapping, fishing, tracking, hiking, flower growing, cocoon hunting

Encourage pupils to study and read in connection with their hobbies, keep scrapbooks or notebooks, arrange exhibits, give reports and demonstrations, etc.

4. Home and School Experiments

Many simple experiments may be carried on by pupils. Such personal experiences usually result in more thorough and more lasting knowledge of the material involved.

Among the simple experiments pupils may carry on are the following:

- a. Experiments for young scientists
 - (1) Why do things burn?
 - (2) Do magnets push as well as pull?
 - (3) How does heat travel?
 - (4) Making magnets with electricity and with magnets.
 - (5) Reading light beams.
 - (6) Why do small, irregular openings make round images in sunlight?
 - (7) Judging distance by sound and light.
 - (8) Why do passing train whistles and auto horns change tone?
 - (9) Heat from light and light from heat (magnifying glass).
 - (10) How cream is separated.
 - (a) Shallow and deep pans—gravity
 - (b) Cream separator—centrifugal force overcoming gravity
 - (11) How do spinner-type clothes driers operate?
- b. Experiments for young naturalists
 - (1) How do plants begin growth? (Seeds, rootstocks, bulbs, cuttings)
 - (2) Water permeability of soil types
 - (3) How do plants breathe?

c. Home experiments and pupil reports

- (1) Relation of steam and vapor (teakettle)
- (2) Density studies (milk and cream)
- (3) Sympathetic vibration (piano sounding board, guitar, violin, resonance chamber)
- (4) Use of lever principles (scissors, wheelbarrow, pump handle, hoe)

B. Activities Arising from Direct Contacts with Nature

1. Bulletin Board Projects

The bulletin board displays should supplement current science and nature study topics. Thus, when leaf collections are being made, strange leaves, neatly mounted leaves, attractive and accurate leaf drawings, tree pictures, newspaper clippings on trees, etc., should be displayed.

A display table might be a part of the bulletin board project, offering a better opportunity to exhibit specimens and larger objects.

One part of the bulletin board may be kept for "current events" in science and nature study. The entire bulletin board and its committee may be organized like a newspaper with an editor, reporters, news department, features, etc.

2. Scrapbook Suggestions

The typical child enjoys working on scrapbooks. Have each pupil develop one in connection with a special interest of his own; for example, fur-bearing animals or automobiles for boys, and garden flowers or kitchen equipment for girls; song birds of the home yard for small children, and birds of fields and woods for older children. Give attention to sex, age, experience, and special interest levels.

Divide the scrapbook into sections and number the pages, using each section for some definite purpose. Fix a "Table of Contents" on the first page. Make the scrapbooks a yearly project and put them on display at the school programs.

3. Oral Reports

"Oral reports" are excellent to use in the "For Iowa" citizenship club program. Choose different topics each month and have all the children from the third through the eighth grade participate in the program. Encourage the children to invite their mothers to visit school on "Club" days. This provides an audience and encourages the children to give better reports, besides developing poise and confidence in the child. The president of the club may cooperate with the teacher in selecting the topics and assigning them to the children.

a. Topics for reports

- (1) Interesting experiments and collections made by pupils, interesting articles uncommon in the pupils' locality, animals, plants, rocks, minerals, astronomy, facts on scientific inventions and discoveries, aviation, museum specimens.
- (2) Biographies of scientists: Franklin, Edison, Pasteur, Leeuwenhoek, Newton, Galileo, Davy, Koch, Gorgas, Jenner.
- (3) Travel reports. During vacations, holidays or week ends pupils often take trips with their parents. Observations and experiences on such trips make interesting travel reports. These reports given by the children are excellent to use for opening exercises. Urge the children to bring pictures, post cards, photographs, specimens and souvenirs they have gathered on their trips. Display these as they give a report of their trips. Besides being very interesting to the other children and creating an added interest in correlated subjects, these oral reports develop the ability to speak before an audience.

To assume increased benefits it is well for the teacher to assist the pupil in organization and preparation before the report is given. Such assistance need not be formal; rather it may be merely an informal visit.

Some children never have a chance to travel and lose prestige in the eyes of other pupils unless they, too, have something interesting to report. They may be encouraged to report on other topics or to report on someone else's trip. The National Geographic Magazine is an excellent source of material.

4. Nature Diaries

A diary is interesting to every child at times and should be encouraged. Often the child puts the diary aside because he finds so little to record. A nature diary may interest many children. From noted naturalists such as Thoreau and Burroughs diaries have been published and serve as excellent literary as well as nature observation examples. Advise pupil.

- a. Procure some permanent means for records, looseleaf or bound notebook.
- b. Choose to observe nature: at a given center, along a certain stream, beside a marsh or lake, along a certain road or path, etc., daily or periodically for a month or longer.
- c. Observe in nature all objects and activities as one's attention is drawn to them in succession, or select a bird or other animal, a plant or group of related animals or plants to observe intensively. Colors, kinds, and times of flowering and fruiting, rate of growth, locations as to soil types, etc., are interesting with plants. Sizes, colors, numbers, nesting and rearing of young, homes, such as dens, burrows, etc., and

activities in feeding, playing and protection are interesting with animals.

- d. Record measurements of distance (namely, number of feet a ground bird's nest is from a fence, etc.) and brief notes in the field on rough paper to transfer with added thoughts and impressions to permanent book at home or summer residence.

C. Reading to Extend One's Own Nature Experiences

1. Science Readers

There are a number of excellent series of science readers available from different publishers. While reading should not constitute the entire science study program, neither should reading be neglected in the study of elementary science. If a systematic science reading program is to be organized and conducted in the periods allotted to this subject, then a set of science readers might be used for the purpose. To supplement this reading program the pupil activities in the foregoing list could then be selected. Wide use of reference and free-reading material should be encouraged.

2. Building a Science Vocabulary

Pupils' understanding of the science and nature study principles involved in the suggested activities will be facilitated by adequate concepts and correct usage of the words in the following lists.

SCIENTIFIC VOCABULARY

- | | | |
|-----------------|----------------|--------------------|
| 1. absorbent | 26. erosion | 50. lungs |
| 2. algae | 27. ferment | 51. mammals |
| 3. alkaline | 28. fuses | 52. meteorologist |
| 4. alloy | 29. galls | 53. minerals |
| 5. aquarium | 30. germinate | 54. mold |
| 6. barometer | 31. gills | 55. mulch |
| 7. beet | 32. glaciers | 56. organic |
| 8. blight | 33. grate | 57. paraffin |
| 9. brooder | 34. gravity | 58. perennials |
| 10. calibrate | 35. herb | 59. photosynthesis |
| 11. candling | 36. hibernate | 60. propagation |
| 12. cane | 37. humidity | 61. protein |
| 13. conduction | 38. hybrid | 62. pupae |
| 14. contour | 39. immunize | 63. putrefaction |
| 15. convection | 40. incubate | 64. radiation |
| 16. corrode | 41. injections | 65. seedlings |
| 17. culling | 42. insulate | 66. slips |
| 18. cuttings | 43. kilowatt | 67. smut |
| 19. damper | 44. larvae | 68. species |
| 20. defoliate | 45. layering | 69. stagnant |
| 21. dissect | 46. legume | 70. starch |
| 22. domesticate | 47. life cycle | 71. viability |
| 23. effervesce | 48. loam | 72. volatile |
| 24. electrocute | 49. lobes | 73. voltage |
| 25. embryo | | |

GENERAL VOCABULARY

1. awl	11. fertile	21. myths
2. battery	12. festival	22. prolific
3. blueprinting	13. fluted	23. shellac
4. census	14. generate	24. silhouettes
5. corrugated	15. humane	25. slough
6. diesel	16. hydro-electric	26. specimen
7. elevation	17. itemize	27. stile
8. emboss	18. maturity	28. temperate
9. exhibit	19. miniature	29. thong
10. famine	20. museum	30. velocity

D. Science and Nature Games

Science and nature games combine learning with the fun of play.

Every school should, and does, have its "For Iowa" citizenship club. At the close of each club meeting twenty or thirty minutes may be reserved for these games. One suggestion for choosing the games may be from the science and nature work studied during the last month. Another suggestion for choosing the games is to allow each child who has had a birthday the past month to assist in choosing the games, making it also a joint birthday party. This method helps to avoid birthday party interruptions during the month. At the close of the meeting seasonal fruits or foods may be served by the children who have had birthdays.

1. Science Vocabulary Game

Make a list of scientific words used in recent or current science lessons, such as *mollusks*, *insect*, *vertebrate*, *quadruped*, *mammal*, *reptile*.

Write one of these words on the board. Pronounce it and explain its meaning. Then give an example used in a sentence, such as: The cow is a *quadruped*. Give pupils an opportunity to make a sentence using the word correctly. Call attention again to the spelling and the meaning of the parts of the word. Be sure pupils can spell the word and pronounce it correctly.

On the following day review the old word before taking up a new word, which could be *vertebrate*. Present it as in the preceding lesson and combine it in a sentence with quadruped, such as: The cow is a *vertebrate* quadruped.

Each pupil may suggest an animal other than cow to be correctly used in the sentence.

After several of the words have been learned a guessing game may be introduced in which the leader may say, "I am thinking of an animal that is a vertebrate, carnivorous, quadruped, that is a nocturnal hunter. What animal am I thinking of?"

Pupils learn these words readily in this way, which is a welcome change from dictionary work. The information is valuable in reading nature stories and pupils will soon be using these terms in their conversation with a great deal of pride.

2. Animal-Vegetable-Mineral Game

This is an aid to classification, with reference to the three kingdoms.

Choose sides, as for a spelling match, or remain in seats. The leader pronounces a word from a previously prepared list of animals, plants and minerals. The pupil must quickly tell whether the word pronounced represents a specimen from the animal, vegetable, or mineral kingdom. For example, if *sardine* is pronounced, the pupil's answer should be "Animal kingdom." If *maple*, the correct answer would be "Vegetable kingdom," etc.

The fun and success of the game depend on quick thinking by pupils, which will be greatly stimulated by the leader's rapid pronunciation of a new word as soon as the former is considered correct.

Later the game may be varied by the leader mentioning one of the three kingdoms and the pupil naming a specimen that belongs to it.

One error, or more, as agreed upon before the game starts, puts a pupil out of the game.

3. Bird, Beast, or Flower Game

The leader mentions one of the above names, and while pointing to a pupil quickly counts aloud to ten. The pupil designated must quickly mention a specimen of that group before the leader has reached ten. If the pupil fails to give a correct answer in that time he must serve as leader. If he correctly answers in his allotted time the leader must again call a name, point to a pupil, and count to ten.

To vary the game one leader may serve and opposing groups of pupils previously selected may count points earned and lost. The leader may change the game by calling the name of the specimen and allowing the player to classify it. He could mention "Rose" and the child should respond with "Flower."

4. Bird Game

In this game, the leader mentions the name of a bird. If the players are in line, number one should name a bird whose first letter is the same as the last letter of the word mentioned by the leader.

This continues down the line, or across the lines if there are two rows of players. Those unable to name a bird beginning with the correct letter should drop out of game or lose a point, if points are counted.

5. A Nature Study Game

Place on a table a dozen natural specimens with which the pupils are familiar, such as pieces of coal, quartz, granite, shale, limestone, sand, a dandelion, a walnut, a leaf, a clover blossom, a shell, a bone. Cover the table. Pupils should take paper and pencils and when the table is uncovered, they should walk

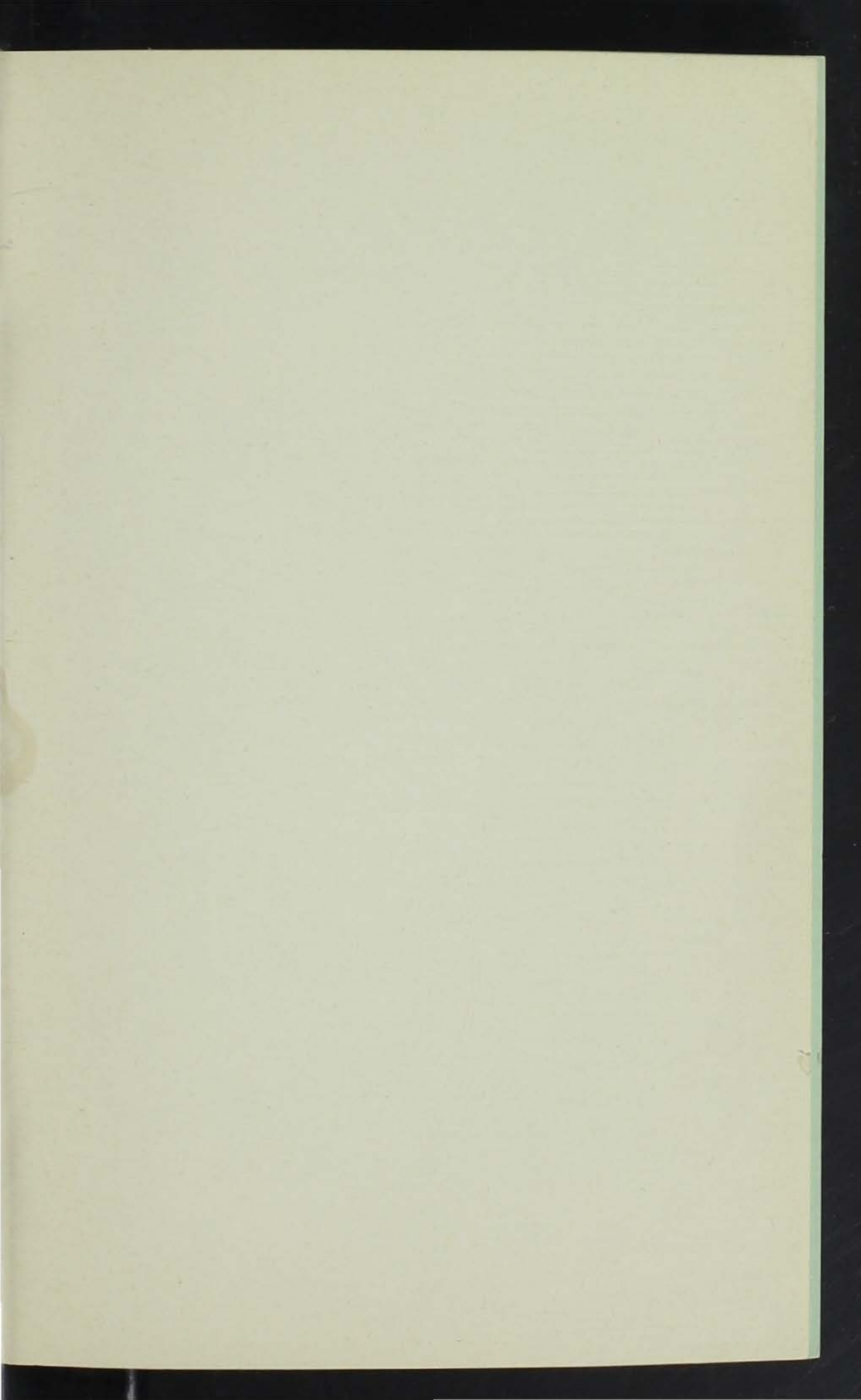
around the table once, looking carefully and quickly at all objects. Keep all pupils moving, and as soon as they have all been around cover the table quickly. Pupils are to write the names of all objects they can remember having seen. The pupils having the greatest number right may uncover the table and name each object and show it to the other pupils.

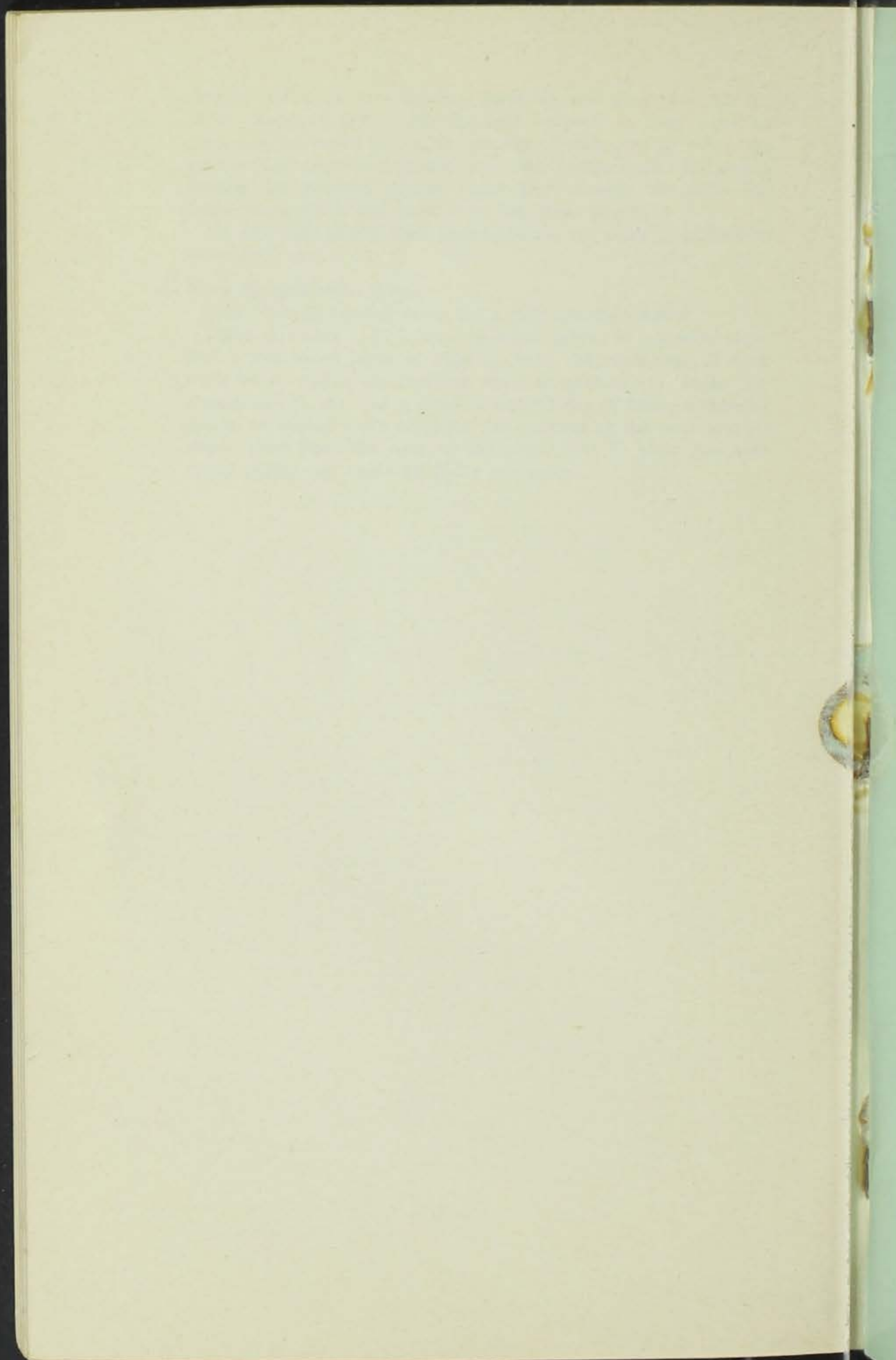
Be sure the pupils understand before the table is uncovered what they are to do.

6. Rock Identification Game

After having studied rocks try a rock naming contest.

Place numbers 1, 2, 3, etc., on small pieces of adhesive tape. Put a numbered piece of tape on each different kind of rock with which pupils are familiar, such as granite (1), shale (2), limestone (3), etc. As a pupil is handed one of these numbered rocks, he should write on paper the number of the rock and its name, then pass the rock to the pupil next to him. See how many pupils can name all rocks correctly.







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