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Curriculum Development in Selected Sciences in the Secondary School

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BY

Norma Grace Hockett Bauer

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CURRICULUM DEVELOPMENT IN SELECTED SCIENCES IN THE SECONDARY SCHOOL

BY

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ABSTRACT OF A FIELD STUDY

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This field study was to help a student write relevant secondary science curricula that (1) may actually be used by the author; (2) used in training other teachers; (3) used as examples in other subjects; and (4) encourage research and innovations to meet changing educational processes. Each of the five selected secondary science curricula shows different development of specialization and adaptation. Aerospace is developed as a mini-course. Basic biology has fifteen units based on specific scientific concepts, with laboratory experiments, along with individualized research. Field biology uses community resources, experiments, local, state, and federal parks or memorials, reference books instead of a basic textbook, guest speakers, two highly qualified educators team-teaching all students during a six-weeks summer school program. The earth science curriculum follows a specific textbook with laboratory manual. Environmental science is a new federal and state mandated program in Illinois with a multidisciplinary approach.

Limitations include: (1) the complete science curricula from Kindergarten through twelfth grade is not included; (2) time and space does not provide for inclusion of all techniques or terminology; (3) each goal, objective and learning activity must be measurable currently; (4) lack of finances for purchase or rental of equipment, supplies, or other scientific necessities for the different units could cause problems in writing and implementing; (5) once the curriculum guide is written, it must be refined: deletion of obsolete materials, addition of new concepts, current bibliography, and used. (6) The curriculum guide will not help students or faculty unless it has accurate expectations, that may change drastically from class to class or from year to year.

Accomplishments include: (1) curricula development has been accomplished to help each student; (2) training of other faculty will be based on understanding and offering valuable suggestions, correct educational language, or individualized concepts for each student; (3) the student's education is relevant, based on individual interests, abilities, and the latest available knowledge on each topic; (4) the curricula can be changed by revision or additions as new knowledge is acquired, or societal-economic changes influences educational goals and needs; (5) the supplemental materials: filmstrips, movies, equipment, or other suitable teaching devices depends on the subject taught, the age of the student, the student's development in completing individualized goals, concepts, and responsibility; (6) adequate financing for purchasing the necessities must be provided; (7) the development of five different science curricula shows diversity in approaches; (8) free and inexpensive materials have been gathered and filed; (9) application for federal grants; (10) a new university major study area has been instigated at Eastern Illinois University; (11) use of local resources and personnel; (12) a valuable addition to the historical and current research on educational innovations and trends in secondary science education during the 1970s.

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CURRICULUM DEVELOPMENT IN SELECTED SCIENCES IN THE SECONDARY SCHOOL

The Field Experience Project

A field study has a major purpose of helping a student accomplish some research on a current educational problem. Since administrators are professionals hired by Boards of Education, it is imperative that the administrator be well qualified in all areas of leadership. The emphasis on curricula development during the 1970s necessitates that a professional educator be able to write curricula and help train others as part of the educational preparation for administration.

This project is to write relevant secondary science curricula that may actually be used by the author, used in training other teachers in selected sciences curricula, or used as examples in other subjects.

The significance of the curricula project is it encourages research and innovations to meet the changing educational processes. There is more emphasis on individualized instruction, with the student accepting more responsibility for his own learning. There is less emphasis on the use of one textbook which an instructor follows from page to page. By this trend the individual student is provided equal opportunities in the educational programs in the school district to develop his interests and capabilities to an optimum degree.

It is valuable because the different science curricula guides provide an organized plan for the student to learn. It will benefit the author as she works with aiding other teachers to complete curricula for their own classes. It is valuable for use by students, faculty, or other interested individuals in teaching these specific science classes. _The Illinois Program for Evaluation, Supervision, and Recognition of Schools_, Circular A, Number 160, issued by the Office of the Superintendent of Public Instruction, Michael J. Bakalis, Superintendent, Revised 1974, "mandate that the schools of the State provide an efficient system of high quality education . . . so that all persons can develop to the full potential of their capabilities". This study is viewed as a valuable contribution in fulfilling this requirement.

Purposes of This Project

The administrator is a professional hired to help the local school district comply with the rules and regulations affecting recognitions standards and the requirement for improved methods of planning and evaluating educational programs. Actual experience in this task will help the administrator to be more competent. This project is viewed therefore at the level of experience rather than academically.

The second purpose is as an administrator, the author must be able to help teachers develop better teaching techniques, relevant materials, individualized teaching methods, and other changes in the educational processes of the future. The administrator must be a leader to help teachers teach as well as to provide other qualitative and quantitative dimensions in the educational program. This field study was designed under such a motivation.

The third purpose is one of specialization and adaptation. Each of the five selected secondary science curricula shows different developments.

<u>Aerospace</u> is developed as a minicourse. Please see Appendix A: <u>Aerospace Education</u> starting on page 33 and finished on page 62.

The <u>Basic Biology</u> has fifteen units based on specific scientific concepts related to many texts, learning through laboratory experiments, along with individualized research. Please study Appendix B: <u>Basic Biology</u> starting on page 63 and ending on page 152 for this biological subject.

<u>Field Biology</u> uses community resources, experiments, local, state and federal parks, memorials, reference books, and guest speakers, along with two highly-qualified educators team-teaching all students. There is no basic textbook used during the six-weeks summer school program. See **Appendices C-2 through C-5 in Appendix C: Field Biology, starting on page 166.**

The Earth Science curriculum follows a specific textbook and laboratory manual; Spaceship Earth: Earth Science, authored by Joseph H. Jackson and Edward D. Evans, copyright 1973, published by Houghton Mifflin Company; the workbook: Laboratory Supplement. Please see Appendix D: Earth Science starting on page 191. There are supplementary teaching aids and specific current emphases.

Environmental Science is a new state-mandated program in Illinois. Materials are beginning to be developed for sale to schools. Sufficient finances are always a problem so the author has been gathering free or low-cost materials from many agencies.

The environmental education is multidisciplinary and its integration into regular school subjects is recommended. Therefore some type of files must be organized so teachers, students, or others interested in the topics may locate the available learning materials. (See file outline on Appendix E, page 323.

Please notice the fieldtrip on environmental soil and water practices on rural Illinois land (based on Bus #9 route of LaGrove Community Unit #206, Farina, Illinois) prepared by a student, Miss Kathleen Diane Kramer, and the author. Exhibit is located in Appendix E: Environmental Sciences, pages 329 through 339.

Also notice the outline the author wrote for the Association of Illinois Water and Soil Conservation State Committee for federal monies grants. (The Exhibit is located on page 342 of Appendix E.) This outline plus subsequent discussion at Eastern Illinois University, Charleston, Illinois, led to the formation of the first environmental education degree program in the nation based on a multidisciplinary approach.

The fourth purpose of this field experience project stems from the thrust of the Illinois Office of Education's circular, Series A, Number 160. The title of this publication is The Illinois Program for Evaluation, Supervision, and Recognition of Schools. The following quote is listed as 6-1, The Instructional Program:

> The instructional program of a school shall be determined by the Board of Education with involvement of parents, students, the professional staff, and the local community. The basic curriculum shall include organized experiences which provide each student ample opportunity to achieve goals which meet the minimum program defined by THE SCHOOL CODE OF ILLINOIS. The program should provide a learning process and educational experiences which enable students to achieve optimum personal growth and to learn the process of inquiry. The resultant knowledge and skills should allow students to function successfully in a worthwhile and rewarding career of their choice and to render valuable service to a free, open, and democratic society.[1]

In May, 1972, the Illinois Office of Education issued a booklet, Action Goals for the Seventies: An Agenda for Illinois Education which discussed the impact of A-160. Various meetings held throughout the state enabled the public, educators, and other interested agencies to

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[1]Michael J. Bakalis, Superintendent of Public Instruction, State of Illinois, issued Circular Series A, Number 160, The Illinois Program for Evaluation, Supervision, and Recognition of Schools, page 15.

help identify goals and to suggest priorities for Illinois education. Educators and citizens responded with enthusiasm and commitment to plan for a "more vital future for Illinois Education".

In November 1973, the Second Edition of Action Goals for the Seventies: An Agenda for Illinois Education arrived with revised goals and additional data.

In 1974 A-160 was revised and school personnel began to implement the mandates for curriculum updating and improvement. This project is an outgrowth of such effort by one science educator.

Design of the Project

This science curriculum revision was initiated by the author's attendance at a series of educational conferences and science seminars, designed to encourage educators in professional growth and development. Additional graduate credits were earned by enrolling in valuable graduate courses at Eastern Illinois and Southern Illinois Universities. The author also won and attended a one-year Earth Science Seminar sponsored by the National Science Foundation.

The knowledge and inspiration obtained from these background efforts, coupled with learnings gained from prior teaching experiences, were influential in fixing directions for the project undertakings. Realizing that science students possess varied potentials, abilities, interests and attention spans, the author decided to embark upon an action approach to curricular revision. These attempts should provide an empirical basis for making judgments concerning the advisability in continuing additions for future revisions.

One basic assumption underlying this action approach was the premise that the scientific concepts selected were to be taught through reference to a variety of textbooks and by utilization of a wide assortment of supplemental materials and learning aids.

Development of Learning Objectives

An early effort of the action approach focused on the development of a variety of learning objectives. These are commonly referred to as constituting performance, laboratory science behaviour, verbal and language development, motor behavior, discriminations and judgmental behavior along with other objectives. The author highly recommends Designing Effective Instruction[2] as a resource for a practitioner of curriculum improvement.

The Selected Sciences

For the first integrated effort at curriculum redevelopment the author chose Aerospace science. This area was selected for several reasons. First, it was highly relevant to current science events; and,

[2]General Programmed Teaching, Designing Effective Instruction Workbook, Commerce Clearing House, Inc. Quail Hill, San Rafael, California, 94903, 1970.

secondly, it seemed feasible for development as a minicourse. This attempt projected the writer into suggestions for motivation, an identification of objectives, a listing of learning activities, the formulation of specific unit contents, and the development of a guide to instructional resources and materials.

This minicourse is designed to enable individualized instruction and learning. Each student makes choices relative to his or her own learnings, interests, and time control. Such decisions apply to selection of materials, activities, and laboratory experiments. It is assumed that each learner will be guided by his own interests and wise control of time. No one student is expected to use all the resources or to do all the activities listed in the minicourse. Exhibit A in the appendix contains this short-course formulation.

Basic Biology was the first full-year subject to be redesigned under the action approach. The writer simply chose this out of her own interest in and commitment to the life sciences.

In developing this curriculum guide the first major decision required the specifications of course content. Ultimately the designer's analysis of biology programs and her perceptions of the realities of the typical school year limitations induced her to conclude that course content should be adapted to fifteen units of study. These are viewed as minimum or essential contents areas covered by many authors in all different textbooks and workbooks of Basic Biology.

In the next step the author identified the biological concepts which related to each unit. Following this, goals, performance objectives, and learning objectives were formulated. Then followed the selection with listing of materials and other resources available. These were specified in relation to each unit. In practice each student may choose a preferred textbook for each particular concept. Some textbooks are better than others in explanatory discussions, drawings, pictures, or vocabulary. Some textbooks are issued at different reading levels and are simpler or easier for students to understand. Other students like the technical, highly scientific explanations. Each basic biology textbook regardless of authorship, company that published it, the copyright date, or other criteria has its own strengths. The student may use only one textbook but usually will read in more than one. Some authors include more discussion on specific topics than other authors. Exhibit B in the Appendix illustrates the writer's design for Basic Biology.

The third phase of this field experience arose outside of the writer's own teaching assignment. Effingham Community Unit School District Number 40, Effingham, Illinois, obtained a special grant for the development of an innovative Field Biology program adaptable to the high school summer session. The author was employed to aid in the development of this program and to be one of two instructors assigned to this six-weeks learning project.

To enable the granting of one Carnegie Unit of credit the class members meet for four hours per day, five days per week, for the summer session of six weeks. Fifty students above grade nine level were permitted to elect this course.

Sufficient funds were permitted to obtain the use of a school bus with well-qualified driver for three or four days per week for trips away from the classroom and laboratory. No textbook was assigned to each student, but each learner was required to keep a field notebook for recording observations, lecture notes, speakers' comments, or specimens during these explorations. These notes and specimens were later transcribed into the student's permanent notebook or notebooks for the course. Topics introduced included:

Aquatics: plants, animals, conservation and pollution;

Botany: plant communities, plant diseases, edible and medicinal plants, identification, flowering and non-flowering plants;

Careers: all types plus educational needs;

Conservation: air, soil, minerals, metals, wildlife, water, environment;

Energy: resources, conservation, cost, benefits, and liability;

Entomology: beneficial or harmful insects, characteristics, control, economic importance;

Environment: conservation, pollution, economic importance, healthful benefits;

Geology: rocks, minerals, soils, economic importance;

Forestry: hardwoods, softwoods, research, conservation;

Herpetology and amphibians: beneficial, harmful, control;

Ornithology: bird study, control, economic importance;

Zoology: harmful or beneficial animals, domestic or imported, conservation, classification.

For a more complete review of Field Biology, note Exhibit C of the Appendix.

A change in the educational program in 1974-75 provided the fourth opportunity for experience in curriculum development. For that year Earth Science was to be added to the science curricula. A basic decision was made to adopt a standard textbook with accompanying workbook. The publication selected from all available was Spaceship Earth - Earth Science authored by Joseph D. Jackson and Edward D. Evans.

The writer then developed a curriculum guide designed to relate to the six major units which structured the earth science course content according to the authors, Joseph D. Jackson and Edward D. Evans. These units are:

a. Earth in the Universe

b. The Earth's Atmosphere

c. The Earth's Crust

d. The Changing Crust

e. The Earth's History

f. Importance of Earth Science.

The design of the curriculum guide followed the action approach of citing goals, performance objectives, learning activities, and selected resource materials. Details may be noted by referring to Exhibit D of the Appendix.

The fifth project in science curricula development relates to the State of Illinois mandated program. The Environmental Education Act of 1970 dictates that schools are to follow environmental education guidelines as established by the Illinois Office of Education. This agency published new guidelines in 1976 in their Environmental Education Handbook, and Environmental Beginnings for Elementary Schools. These guides are referred to in the writer's Exhibit E in the Appendix.

Current efforts are centering upon an expansion of environmental science files to have available a greater range of free or inexpensive materials and other teaching aids. Particular thought is being given to the possibilities of implementing a request for federal financial aid grant.

After obtaining more materials the curriculum development will probably use the major themes of interdependence, impact, maintenance, quality of life, and improvement as recommended. All teachers, K-12, will be involved in the development. In-service teacher education programs for our district and neighboring schools' personnel with resourceful university personnel may be implemented. The teachers' interests, education, and implementing the curriculum as devised will profoundly influence the students' attitudes, knowledge, and hopefully their behavior relating to their environment.

Limitations

The complete science curricula from Kindergarten through twelfth grades is not included. Other teachers teach and are involved in writing the K-8, physical science, general science, chemistry and physics curricula. The author, science department head, assisted with unit personnel meetings about A-160 and curricula writing and made recommendations. However since the other teachers wrote and are rewriting their specific science classes the author did not include any of their work as examples.

Another limitation is that time and space does not provide for inclusion of all techniques or terminology necessary to write curricula for different subjects at various grade levels. The excellent books along with many educational articles in numerous magazines about current school problems include pros, cons, as well as methods of curricula planning, writing, testing effects on students' learning, finances, or community responses will provide the necessary data. A selected bibliography is included and is located after the curricula discussion on page 19.

One of the problems in curriculum development and planning is each goal, objective, and learning activity must be measurable currently. No leeway is given for positive attitudes, interest and support towards the subject; enjoyment, humanistic mannerisms towards others or other desirable traits that may be valuable but hard to measure adequately at the moment. For example:

Does he read a newspaper article or watch a television program on space exploration because of his interest in scientific milestones?

Can he chose a correct insecticide spray based on his knowledge of the food habits and mouth parts of an insect?

Does he use another natural predator to control a harmful insect?

Does he understand the correlation between the production of energy, pollution versus costs versus the cost of the energy for the consumer?

Is weather modification justified for political, socio-economic or crop production to feed the world's hungry population?

What conditions and controls should influence space exploration, nuclear, or solar energy?

There needs to be space allowed for future usage of the knowledge gained throughout the student's lifetime in making wise and necessary decisions for survival of mankind. Man's fertile brain will be able to solve any problems of today or the future, if each individual uses his talents, interests, and capabilities.

Lack of finances for purchase or rental of equipment, supplies or other scientific necessities for the different units could cause problems both in writing and implementing the excellent curricula.

Once a curriculum guide is written, it must be refined: deletion of obsolete materials, addition of new concepts, current bibliography, and used. A curriculum guide will not help students unless it has accurate expectations, that may change drastically from class to class or from year to year.

Summary and Conclusions

A field study is to help a professional research a pertinent educational problem and to help his or her development into a leader of educational administration. The capable administrator must be able to lead school board members, parents, interested citizens or irate taxpayers, certified or non-certified personnel in educating today's youth for the twenty-first century world. Curricula development has been and is a current problem affecting recognition standards and the requirement for improved methods of planning and evaluating educational programs. Actual writing experience will help an administrator be more effective.

It will help the administrator understand and offer valuable suggestions for other teachers developing curricula guides using the correct educational language, individualized concepts for each student. The student's education is relevant and is based on individual interests, abilities, and the latest available knowledge on each topic.

The field study shows the development of secondary science curricula programs because of A-160 impact on Illinois education. The mandated curricula development programs show that interested citizens, educators, and students along with parents can work together for major goals.

Other teachers can use these as aids in the development of curricula for their own elementary or secondary classes. The work fulfills mandated high quality instructional education for Illinois Youth. It can be changed by revision or additions as new knowledge is acquired, or societal-economic changes influences educational needs and goals. The supplemental materials, filmstrips, equipment or other suitable teaching devices depends upon the subject taught, the age of the student, and the student's development in completing individualized goals, concepts and responsibility. Adequate finances for purchasing necessities gives added dimensions to the activities available to the individual student.

The development of five different sciences curricula shows diversity in approaches depending upon the subject materials, and teaching adaptations can be used by other teachers in their science classes in their respective districts.

Accomplishments

Curricula development has been accomplished and should help each student involved in current or future classes. Training of other teachers will be more competent and this will help meet the "mandate that the schools of the State of Illinois provide a system of high quality education . . . so that all persons can develop to the full potential of their capabilities".

Free or inexpensive materials have been gathered from many sources and filed so other individuals can locate and use them.

Application for federal monies grants for Illinois Youth encouragement in Soil and Water Conservation; a new university major study area has been instigated at Eastern Illinois University, Charleston, Illinois, from a concept about environmental science; use of local resources including personnel to help students learn, emphasis on wise use of soil and water including conservation by area landowners and farmers shows students and other interested individuals that the concepts are a reality and practical in their own environment. All these accomplishments will help others be more competent in providing unique educational opportunities for the youth of Illinois schools.

The project has been very successful and should aid the author and others in becoming better administrators in Illinois and other states' schools. It may be a valuable addition to the historical and current research on educational innovations and trends in science education during the 1970s. The author has been unable to locate any specific examples of curricula developments by current teachers in Illinois secondary science education in Illinois university libraries.

The administrator's talent in helping each and all teachers develop effective curricula that is used for their classes will vastly improve the quality of education for the students and help lessen administrative problems for herself. The students, parents, teachers, administrators, school board members, and others will have a positive attitude towards the schools and the tremendous impact of educated persons on civilization. Man's fertile brain will be able to solve any problems of today or the future if each individual uses his talents, interests, and capabilities. Any idea, concept of instructional media that improves education for the student will help the administrator fulfill his or her role and be more successful as an educational leader.

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APPENDIX A

AEROSPACE MINICOURSE

Minicourse: Aerospace Education

A Brief Introduction

I. The needs of man have changed through the ages as more knowledge, tools, machinery, technology and travel broaden the horizons.

A. Schools have been given the task of fulfilling man's needs so their curricula needs to be flexible and change with the advances.

B. The Astronauts, who will travel to other planets and throughout space, are in our classrooms today.

II. Aerospace education is a fusion of many subject areas which reinforces learning in all.

A. Aerospace is a subject that will arouse an interest in reading, how to study with good habits, to search and research beyond the minimum requirements.

B. It includes astronomy, biology, earth science, environmental education, mathematics, geography, social sciences, physics, language skills, speech, aeronautics, business and vocational education classes.

III. Multitudinous career opportunities.

A. Employment: responsibility to prepare students for participation in the industry that will employ a great percentage of them.

B. National security: Students need to acquire an elementary knowledge of aeronautics, of the military uses both for offense and defense, and to realize the extreme necessity for airspace power in national security.

IV. Aerospace education can:

A. Motivate the college-capable students to develop their talents, abilities and interests for their own and the good of mankind.

B. Give job placement opportunities for the student who goes to work immediately after graduation.

Objectives for Students

I. Instructional objectives.

A. Know the history of space achievements, military and national influences.

B. Recognize the value of research in Aerospace as it spinoffs to earth industries, better food and medicinal aspects.

C. Understand principles of space flight.

D. Demonstrate ability to do research problem related to space.

E. Appreciate U.S. opportunities and related career possibilities.

II. Judgmental behavior objectives.

A. Explain the history of space achievements in exploration, spacecraft.

B. Evaluate the values of expenditures for space.

C. Plan and compare scientific project results versus controls.

D. Formulate laws of space flight in coorelation of spacecrafts for specific jobs.

III. Language and behavior objectives.

A. Articulately speak and write with punctuation space language.

B. Read, learn and recite space knowledge.

C. Edit report on own project.

IV. Laboratory Science behavior objectives.

A. Reproduce laboratory experiments to learn fundamental principles.

B. Record, note, or chart results.

C. Compile current information on space exploration.

D. Search and sort career opportunities in correlation to own abilities and interests.

A List of Learning Activities

I. Demonstrations. (Reference: Aeronautical Science Course of Study.)

A. Archimedes principle.

B. Bernoulli principle.

C. Wind tunnel to measure drag.

D. Gyroscope.

E. Parts of an airplane, rocket, satellite.

F. Atmospheric pressure.

G. Space hazards--micrometeoroids.

H. Rocket vehicles.

I. Construction of action-reaction engines.

J. Temperature control on rocket vehicles.

K. Orbit velocity.

L. Biological sensors.

M. Laboratory testing of representative freeze-dried foods.

N. Good insulating materials. (Reference: Space Resources: Biology)

O. The effect of vibration on human performance and reaction.

P. Oxygen insufficiency.

Q. Determination of environment temperature using radio telemetry.

R. The vestibular effects of acceleration and rotation on human performance.

S. Problems of isolation and confinement.

T. Biological rhythms.

U. The survival of earth microbes in a simulated Martian environment.

II. Individual student activities and project ideas.

A. Biology students (Reference: Space Resources for Teachers: Biology)

1. Algae cultures for human consumption.
2. Research on plant growth in tissue culture.
3. Food packaging for spaceflight.
4. Germicides added to food, wastes or drinks.
5. Chromatography of rat or mouse feces, as diets are altered.
6. The effect of heat or cold on the metabolic rates or motor activities of small animals.
7. A study of the chemical analysis of sweat (chlorides, lactic acids, etc.).
8. Investigate long-term effects of low residue diets on small mammals.
9. Investigate the effect of a "space diet" on the normal intestinal microflora of an organism.
10. Investigate the growth rates of algae when cultured in various media.
11. A routine study of hair, beard, and fingernail clippings to show the routes of nutrient loss from the body as well as waterloss from the body.
12. Investigate if "beefsteak" could be grown in tissue culture.
13. Investigate enclosing an ecological system--a Microterella.

14. Study Amoeba or other protozoans growth rates in a closed system.

15. Study the effect on the red blood cell count of rats living continuously in a low pressure, low humidity environment.

16. Study the role of sunlight and the energy involved in hydrolysis.

17. Study the recovery of potable water from human urine.

18. Investigate hypothermia induced drowsiness or sleep.

19. Investigate how hypothermia might provide relief from the psychological and physiological problems associated with long term confinement and boredom.

20. Investigate the ways forced astronaut hibernation could be beneficial for long space flight.

21. Subject both reflective and plain surfaces of insulating materials to as many varied types of heat sources as can be devised. (Infra-red lamps, Bunsen burner flames, flood-light heat, sunlight, electric hot plate, electric barbecue starter.)

22. Investigate development aberrations in Frog and aquatic insect embryos as a result of abnormal gravity orientation during early cleavage.

24. Subject fruit flies, Drosophila melanogaster to mechanical vibrations of 10-80 cps. and study comparative mutation

rates against normally reared control flies.

25. Algae, bacteria, slime molds, yeast molds, ciliates, flagellates, copepods, arachnids, annelids, many species of insects, or other animals and plants may be exposed to varying amounts of radiation.
26. Investigate lighting, visibility, and legibility in the design and arrangement of instruments.
27. Investigate the factors that might influence the time period of vertigo (fatigue, hunger, lighting, etc.).
28. Investigate how man's abilities to miss, manipulate, maneuver, and walk are affected by rotation.
29. Study the effects of rotation on skilled performance.

B. Chemistry students (Reference: Space Resources for Teachers: Chemistry.)

1. Henry's Law for partial pressure calculations.
2. Rate of diffusion, by loss of gas by leakage.
3. Carbon dioxide removal with a silver oxide system.
4. Activated carbon form contaminant removal.
5. Chemical synthesis of carbohydrates.
6. Heat of reaction for the catalytic oxidation per Ethanol.
7. Effect of temperature and molecular weight on specific impulse.

8. High temperature cell.

9. Low temperature cell.

10. Hydrogen-oxygen fuel cell.

11. Flame ignition.

12. Flame stabilization.

13. Diffusion and pre-mixed flames.

14. Flame velocity.

15. Comparison of frictional forces and coefficients of static friction.

16. Determination of frictional forces and coefficients of sliding friction.

17. Experiences with optical surfaces.

18. Qualitative comparison of optical coatings.

19. Spectrophotometers and optical properties of coatings.

20. Preparation of a char-forming ablative materials with insulative properties.

21. Chemical synthesis of proteinaceous material.

22. Production of microspheres.

23. Using dye absorption to detect micro-organisms.

24. Using turbidity to detect micro-organisms.

III. Outline.

A. Prologue to space achievements.

1. 2d Century Ptolemy of Alexandria formed concept of sun and planets about earth; Lucien of Samosata wrote of flight to moon.
2. 13th Century Chinese at Kai-fung-fu (1232) and Tatars in Europe (1241) made reports of rockets used.
3. 16th Century Nicholas Copernicus described motions of planets about sun; tycho Brahe described elliptical orbit of Mars and comet about the sun.
4. 17th Century Isaac Newton formulated laws of motion; Johannes Kepler wrote Somnium and described elliptical orbits; Grancis Godwin wrote Man in the Moone.
5. 19th Century Jules Verne wrote From the Earth to the Moon; K. E. Tsiolkovski found fundamental principles of space flight; Edward E. Hale wrote the Brick Moon (describes satellites).
6. 1900-1935 -- 1900 H. G. Wells published First Man in the Moon. 1903 Wright Brothers advanced by first airplane flight. 1919 Robert H. Goddard published A Method of Reaching Altitudes. 1923 Herman Oberth published The Rocket into Planetary Space. 1926 Robert H. Goddard first liquid propellant rocket. 1927 German space flight society formed. 1930 American Interplanetary Society was formed.

1931 German rocket society developed 110 lb. thrust liquid propellant rocket. 1932 USSR Tsander and others 110 lb. thrust rocket. 1934 Wernher Von Braun tested 660 lb. thrust A-3 rocket in Germany. 1935 Robert H. Goddard's gyro-stabilized rocket reached an altitude of 7,500 feet.

B. 1942-1955.

1. 1942 First A-4 (V-2) rocket successfully test-fired to 53 miles (Germany). 1945 WAC Corporal Rocket (U.S. Army,) JPL/CIT fired 43.5 miles.
2. 1946 U.S. Air Force "World Circling to Spaceship" study began; 1947 first of captured German V-2's fired as sounding rockets in New Mexico.
3. First launching of U.S. Navy Viking sounding rocket; reached 244 miles altitude.
4. First Congress of International Astronautical Federation.
5. 1954 Project Orbiter was organized (U.S. Army and Naval).
6. U.S. announced Vanguard Satellite Program for International Geophysical year (IGY).

Space Age

C. Development of space craft and life supporting systems.

1. Unamnned - Biosatellite, Echo, Explorer, Lunar Orbiter, Mariner, Nimbus, NASA's Orbiting Astronomical Observa-

tories, Orbiting Geophysical Observatories, Orbiting Solar Observatories, Pegasus, Pioneer, Rangers Surveyor, Syncom, Tiroes, Vanguard.

2. Manned - Apollo, Gemini, Mercury.

D. Principles of space flight.

1. Cosmology, solar system, location of moon, stars and planets.

2. Travelling in space.

a. vehicles--spacecraft design, lift support system, speed.

b. flight patterns--launching, earth orbital flight, orbital period, velocity, planetary flight, re-entry with landing safety, space stations, space laboratories.

c. navigation--inertial guidance; tracking and communications.

d. other related problems--weightlessness, temperature and pressure settings, radiation, meteorites, isolation, deconditioning phenomena (physiological changes, sometimes called space adaptive state) on respiration rate, heart action, lowered blood pressure, changes in the blood, loss of calcium, fluid and muscle mass, urine and feces disposal, eyes; space medicine includes drugs, exercise and sleep; space food; space suits and available movable space in the spacecraft.

E. Beneficial spin-offs from space exploration and space flight achievements.

1. Construction of manned and unmanned spacecraft.
2. Effects of weightlessness and lack of Earth's 24-hr. rhythm on biological specimens.
3. Precision tracking of spacecraft provided additional information about density of upper atmosphere.
4. Information on micrometeorites, temperature in space, radiation, magnetic fields, gamma rays, weather, photography, sun, moon, planets, solar winds, soil, rock and water analysis.
5. Construction of space suits worn by astronauts, designed restraining couch, and other equipment to withstand forces of acceleration, or deceleration which they experience during take-off, re-entry, and landing.
6. Telemetering devices and procedures for monitoring bodily activities as heart action, respiration, brain waves, and other functions which are useful in management of chronically ill individuals which contribute to medical progress in general.
7. Development of better alloys in metals for industry.
8. Development of fire resistant materials that is used in industry as well as the space program.

9. Development of new foods and better food packaging.

F. Aerospace careers.

1. Scientists, engineers, and specified technicians to solve needs for aircraft missiles, rockets, and spacecraft.
2. Manufacturers, universities, independent research agencies, governmental organizations to solve aerospace, electronics, electrical, chemical, nuclear, industrial and mechanical problems.
3. Professional and technical occupations. Examples: production planners, physicists, mathematicians, chemists, metallurgists, psychologists, physiologists, astronomers, aerospace engineers, draftsmen, laboratory technicians, research mechanics, research electricians, technical writers, or illustrators.
4. Administrative, clerical, and related occupations. Examples: accountants, public relations, advertising, industrial relations, sheet metal workers, power brake operators, power hammer or shear operators, punch press or profile press operators, jig and fixture builders, tool and die makers, riveters, welders, heat treaters, painters, platters, clerks, secretaries, typists, stenographers, tabulating machine or computer operators.

5. Assembly and installation occupations. Examples: final assemblers, missle assembly or rocket assembly mechanics, class armament assembler, power plant installers, electrical assemblers, inspectors and testing fabrication inspectors, crew chief, assembly, receiving or machine parts inspectors.
6. Materials handling, maintenance, and custodial occupations. Examples: truck drivers, crane operators, shipping clerks, stock clerks, tool crib attendants, maintenance mechanics, millwrights, welders, guards, firemen, janitors.
7. Qualifications. College degree--many need a doctorate in a specific area. Semi-professional experience, or on-the-job training..
8. Income. Higher earnings than comparative workers in other industries.
9. Prospects for employment. U.S.A. has 1,300,000 people involved in aerospace jobs. 20,000 to 30,000 replacement workers are needed yearly due to retirement, or leave for various reasons. Prediction for a high rate for research and development.

The Instructional Materials and Bibliography

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Map of the Heavens, with monthly star charts, National Geographic Magazine, Washington, D.C., 1970.

Official Map of the Moon, along with Rand McNally Moon Globe, P. O. Box 9873, St. Paul, Minn. 55177, June 30, 1970.

II. Fieldtrip.

Scott Air Force Base, Belleville, Illinois.

McDonnell's Planetarium, St. Louis, Missouri (Forest Park).

Trips to Illinois Junior Academy of Science fairs, Science Fairs, International fairs, and Future Scientists of America fairs, at Charleston, Illinois, Evansville, Indiana, and Urbana, Illinois, (State winners attend fairs located in Baltimore, Maryland, Cleveland, Ohio, and Washington, D.C.), Youth Science Congress by NASA.

III. Films: (Reference: NASA: Manned Spacecraft Center film catalog.)

NASA, Lewis Research Center, 2100 Brookpark Road, Cleveland, Ohio.

Information Office, U.S. Atomic Energy Commission, Chicago Operations Office, 9800 South Cass Avenue, Argonne, Illinois 60439.

Air Force Film Library, 8900 South Broadway, St. Louis, Missouri 63125.

McDonnell Aircraft Corporation, Box 516, Dept. 92, Room 167, Bldg. 1, St. Louis, Missouri 63166.

Society for Visual Education, Inc., 1345 Diversay Parkway, Chicago, Illinois 60614.

IV. Filmstrips.

"Flight to the Moon," Parts I and II, 2878A and 2878B, VEC, Madison, Wisconsin.

"Space Travel," No. A-484-4, Society for Visual Education, Inc.

V. Transparencies.

"The Moon," Science No. 22, 3M Company, Education Services, Box 3100, St. Paul, Minnesota 55101.

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APPENDIX B

BASIC BIOLOGY

Basic Biology

Units of Study

I. Importance of Biology

II. Scientific Method of Thinking*

III. Microtechnique: Microscope Use*

IV. Vocabulary, Terminology, Definitions*

V. Awareness of the Environment

VI. Historical Developments in Science*

VII. Career Possibilities*

VIII. Entomology: Native Illinois Insects

IX. Botany with Forestry: Identification of Local or Naturalized Trees, Shrubs, Creeping Vines, Leaves

X. Ornithology: Birds of Austral Zone, Illinois

XI. Own Research on Plants or Animals

XII. Botany: Plant Kingdom; Zoology: Animal Kingdom

XIII. Anatomy, Eugenics, Euthenics, Genetics, Health, Heredity, Physiology: The Human Body

XIV. Evolution: Time/Change, Use and Preservation of Natural Resources, Conservation, Ecology, Earth Science, National and Illinois State Parks and Memorials

XV. Aerospace

*This information may be interspersed in each unit throughout the school year as it appears in the reading materials and specific topics.

Basic Biology Unit I--Importance of Biology

Goals

1. Through the use of identification or writing/quoting the student will be able to illustrate reasons that biology influences his life and environment.
2. The student will be able to select relationships that exist between man, plants and animals, soil, water, minerals, crop production for food, air and fossils.
3. The student will better comprehend the relationship between humans, and all organic and inorganic substances found on our planet, Earth.
4. The student will identify the specialized branches of biology.
5. The student will select how the biologist works.

Performance Objectives

1. Given a choice, the student will identify or list 10 reasons biology influences his past, present and future life with 85% accuracy.
2. The student will be able to select 8 relationships that exist between man, plants and animals, soil, water, air, crop production for food, minerals, fossils with 75% accuracy.
3. The student will write or quote 10 relationships between humans and

all organic or inorganic substances found on our planet, Earth, with 75% accuracy.

. The student will write, quote, or match the twenty-five branches of biology with 81% accuracy.

. The student will enumerate the 10 steps of how the biologist works with 81% accuracy.

Learning Activities

1. Teach via lecture and demonstration the importance and reasons biology greatly influences everyone's past, present, and future life.
2. Use filmstrips: Life Filmstrips, 9 Rockefeller Plaza, New York, New York 10020

    Filmstrip Series: The World We Live In

    Filmstrip Part I: The Earth Is Born

    Filmstrip Part XIII: The Starry Universe

    Filmstrip (no number on can): The Atom
3. Lecture, discussion, student special report assignments on twenty-five specialized branches of biology.
4. Use textbook, Chapters 1, 13, 16; workbook, pages 1-5, 15-26, and 315-342.
5. Lecture about characteristics of a biologist including scientific method of thinking, hopes, aspirations, frustrations, disappointments, and awards.

5. Field trip around rural community to see specific characteristics.

(If it is not possible, discuss and list.)

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Basic Biology Unit II--Scientific Method of Thinking*

Goals

1. The student will be able to recite or write the five steps of the scientific method of thinking.
2. The student will be able to differentiate between cause and effect, can illustrate the analysis of scientific truth from rumor, facts versus theory. This includes the ability to analyze data in publications, develop ability by summarizing materials, and identifies decision making.
3. Using plant and animal specimens be able to differentiate between observation, inference, recording, comparisons, contrast, and classifying in the scientific method of thinking and testing.
4. The student will detect, define and spell new vocabulary.

Performance Objectives

1. The student will be able to recite or write the five steps of the scientific method of thinking with 85% accuracy.
2. The student will be able to differentiate between cause and effect, scientific truth from rumor, facts versus theory when fifteen examples are given with 75% accuracy.
3. The student will be able to solve twelve biological problems presented via the scientific method of thinking with 80% accuracy.

4. The student will use the scientific method of thinking in his own individual project, with 94% accuracy.

5. The student will match, write or quote correct spelling and definitions for new vocabulary with 81% accuracy.

Learning Activities

1. Teach via lectures and demonstration the five steps of the scientific methods of thinking.

2. Use transparencies:

   64--Introduction to Listening

   65--Introduction to Discussion

   66--Persuasion and Argument

3. Use textbook, Chapter 1, workbook page 5.

4. Use current magazines and newspapers to read news articles critically.

5. Drill on cause and effect so student can differentiate. Drill on scientific truth versus rumor, facts versus theory.

6. Assign vocabulary, have definite assignment about spelling vocabulary, with definitions and drill.

Materials and Resources

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*In Vance and Miller, Biology for You, each unit includes scientific problems for students to solve so the practice drill continues throughout the year.

Current newspapers and magazines with scientific articles as: Science, Science News, Science World, Science Digest, Scientific American, Today's Health, and other magazines.

Basic Biology Unit III--Microtechnique: Microscope Use*

Goals

1. The student will be able to name and describe functions of parts of the microscope.
2. The student will be able to properly care and operate a microscope.
3. The student will be able to prepare temporary and permanent slides.
4. The student will be able to focus a microscope and differentiate between magnification and specific slide contents.

Performance Objectives

1. The student will name and describe functions of microscope parts with 90% accuracy.
2. The student will demonstrate proper care and how to operate a microscope safely with 100% accuracy.
3. The student will prepare five temporary slides and five permanent slides with 84% accuracy.
4. The student will focus three different microscopes using the different magnification and drawing specific slide contents showing the variation of magnification with 75% accuracy.

*Microscope work is completed in many units.

Learning Activities

1. Teach with demonstration of five different microscopes parts and their functions, how to handle microscopes properly and focus under different magnification with clear images.
2. Teach with demonstrations the making of temporary slides and permanent slides.
3. Use textbook and drill.
4. Students practice handling and manipulating microscopes correctly while explaining parts of the microscope and their functions.
5. Student assemble supplies and manufacture temporary slides.
6. Student assemble supplies and manufacture permanent slides.
7. Student move microscope and supplies safely.
8. Student focus microscope correctly and differentiate between magnification.
9. Student draw picture after correct selection and label correctly, while completing workbook pages 6-14.
10. Students that are capable work independently to free teacher to help slower students.

Materials and Resources

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Heimler, Charles H. and J. David Lockard, Focus on Life Science, Columbus, Ohio, Charles E. Merrill Publishing Company, 1969, pp. 13-16, 232, 95, 244, 395.

Holden, Alan and Phyllis Singer, Crystals and Crystal Growing, Garden City, New York, Anchor Books, Doubleday & Company, 1960.

Kroeber, Elsbeth, Walter H. Wolff and Richard L. Weaver, Biology, Boston, D. C. Heath and Company, pp. 30, 40.

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Moore, Harold A. and John R. Carlock, The Spectrum of Life, Evanston, Illinois, Harper & Row Publishers, Inc., 1970, pp. 20-26.

Morgan, Ann Haven, Field Book of Ponds and Streams, New York, G. P. Putnam's Sons, 1930.

Otto, James H. and Albert Towle, Modern Biology, New York, Holt, Rinehart, and Winston, Inc., 1965, pp. 3-5, 13-16, 22, 56.

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Vance, B. B. and D. F. Miller, Biology for You, Philadelphia, J. B. Lippincott Company, 1963, pp. 40-45.

Vance, B. B., C. A. Barker and D. F. Miller, Biology Activities, Philadelphia, J. B. Lippincott Company, 1963, pp. 17-23.

Weinberg, Stanley L., Laboratory Manual: Biology, Boston, Allyn and Bacon, 1969:
- "Animal Cells: How Are Animal Cells Alike; How Do They Differ?", pp. 15-17;
- "Bread Mold: What is the structure of bread mold and how does it develop?", pp. 59-61;
- "The Compound Microscope: How Can the Compound Microscope Be Used Most Effectively?", pp. 7-13;
- "Daphnia (called water flea, is not a flea, but is a successful genus of crustaceans): How does Daphnia maintain itself?", pp. 75-77; "How does temperature affect the heart rate in Daphnia?", pp. 117-119;
- "Observing Bacteria: What do bacteria look like?", pp. 89-92;
- "Paramecium: How does paramecium carry on the metabolic functions necessary for life?", pp. 83-86;
- "Plankton: What kinds of microscopic organisms can be found in a fishtank?", pp. 53-57;
- "Plant Cells: How Do Plant Cells Compare with Animal Cells?", pp. 19-21;
- "Soil Organisms: What kinds of microorganisms live in the soil?", pp. 225-226;

"Yeast: How does yeast make dough rise?", pp. 29-31.

Microscopes and permanent slides owned by LaGrove Community Unit #206, Farina, Illinois.

Basic Biology Unit IV--Vocabulary, Terminology, Definitions*

Goals

1. The student discerns that all areas of science, including biology, have a stock of words with specific meanings, relevant to that subject.
2. The student will be able to identify scientific terms with correct meanings pertaining to each specific topic.
3. The student will be able to use the word correctly in his discussion via writing or verbally quoting including the correct meaning for the topic discussed.

Performance Objectives

1. The student will be able to recognize scientific terms with definitions with 80% accuracy on each unit in biology.
2. The student will be able to identify biological terms with correct meaning for each unit with 75% accuracy.
3. The student will be able to use vocabulary correctly in quoting or writing information about the topic. Correct spelling is imperative so the meaning is correct.

*Correct vocabulary, terminology and definitions along with spelling will be taught in each unit.

Learning Activities

1. Important new vocabulary words are italicized in the textbook and listed in the workbook in each section. Student should separate them for special attention in learning. Teacher includes them in discussion and drill.
2. Have students write a notebook of vocabulary with definitions. Drill on spelling along with definitions.
3. The students may complete or match terminology.
4. Students that are capable to work independently to free teacher to help slower students.

Materials and Resources

Gregory, William H. and Edward H. Goldman, Biological Science, Revised Edition, Boston, Ginn and Company, 1971, pp. 718-732. Entire text, glossary.

Heimler, Charles H and J. David Lockard, Focus on Life Science, Columbus, Ohio, Charles E. Merrill Publishing Company, 1969, pp. 534-544.

Rasmussen, Frederick A., Paul Holobinko and Victor M. Showalter, Man and the Environment, Geneva, Illinois, Houghton Mifflin Company, 1971.

Smith, Ella Thea, and Thomas Gordon Lawrence, Exploring Biology: The Science of Living Things, Sixth Edition, Chicago, Harcourt, Brace & World, Inc., 11. 697-727.

Vance, B. B. and D. F. Miller, Biology for You, Fifth Edition, Philadelphia, J. B. Lippincott Company, 1963, pp. 623-646.

Webster's New World Dictionary of the American Language, College Edition, Cleveland, Ohio, The World Publishing Company, 1968.

Weinberg, Stanley L. and Abraham Kalish, Biology: An Inquiry Into the Nature of Life, Boston, Allyn & Bacon, Inc., 1971, pp. 619-628.

Weisz, Paul B., The Science of Biology, Third Edition, St. Louis, McGraw-Hill Book Company, 1967, pp. 823-854.

Basic Biology Unit V--Awareness of the Environment

Goals

1. The student will be able to identify some chemical and physical processes of life, raw materials of life, and adaptations of living plants and animals in their environment.
2. The student will be able to quote or write data on the basic units of living matter, cells.
3. The student will be able to quote or write correct spelling of terminology with definitions, chemical symbols and formulas.

Performance Objectives

1. Given fifteen examples, the student will be able to choose eight most appropriate non-living influences on the environment with 75% accuracy. (Examples: chemical substances; elements, compounds, mixtures, oxidation, osmosis and diffusion.)
2. The student will be able to identify, quote or write the raw materials of life which includes O_2-CO_2 cycle, N cycle, balance between plants and animals with 75% accuracy.
3. The student will select via quotes, or writing adaptations of living plants and animals to kinds of environments and relationship among

organisms (examples: parasites, saprophytes, symbiosis, commensalism, balance of life) with 81% accuracy.

4. The students will detect and write the basic units of matter including: What are Cells? Living processes of cells, how do living things (plants and animals) respond to their surroundings with 81% accuracy.
5. The student will match, write, or quote with correct spelling terminology with definitions, chemical symbols, and formulas with 84% accuracy.

Learning Activities

1. Teach via lecture and demonstration some chemical and physical processes of life, raw materials of life, and adaptations of living plants and animals in their environment. Minerals, chemicals, lab specimens, permanent slides and living specimens, will be included.
2. Use textbook, Chapters 2, 3, and 13; Workbook 27-46, 81-106.
3. Use transparencies, filmstrips, and/or movies.
4. Field trip over different areas of school grounds to show plant and animal adaptations in our local area.
5. Drill on correct spelling, terminology with definitions, chemical symbols, formulas.

Materials and Resources

Filmstrips: Society for Visual Education, Inc. Div. 1345 Diversey Parkway, Chicago, Illinois 60614:

A431: Earth Science Series
A431-2 "Up Through the Coal Age"
A431-3 "Mammals Inherit the World"
A431-1 "When Reptiles Ruled the World"
A431-4 "How We Know About Life Long Ago"
A431-5 "Hunting Fossils"
A431-6 "Stories That Fossils Tell"

A443: Our Ever-Changing Earth
A443-3 "Work of Ground Water"

Filmstrips: Visual Education Corporation, Madison, Wisconsin
Filmstrip Number 3016: The Trash Explosion

Bagby, Grace, Harold U. Cope, C. S. Hann, and Mabel B. Stoddard, Discovery Problems in Biology, 1960, College Entrance Book Company, 104 Fifth Avenue, New York, New York 10011, pp. 27-46, 81-106.

Biological Science Curriculum Study (BSCS), Biological Science: Molecules to Man,. Third Edition (Blue Version), Geneva, Illinois, Houghton Mifflin Company, 1973, pp. 87-93, 118-123, 181-189, 190-195, 438-439, 448, 450, 641-663, 457-463, 494-496.

Biological Science Curriculum Study (BSCS), High School Biology, Green Version), Chicago, Rand McNally & Company, 1968, pp. 338-392, 453-455, 315, 387-388, 489, 445.

Energy and Our Environment, (free pamphlet), Corporate Communications Department, Union Oil Company of California, Box 7600, Los Angeles, California 90051.

Gregory, William H., Biological Science: Laboratory Manual, Revised Edition, Boston, Ginn and Company, 1971, pp. 30-38.

Harris, Jacqueline L. and Erwin A. Steinkamp, Ecology: Man Explores Life, Xerox Education Publication, 245 Long Hill Road, Middletown, Connecticut 06457, 1970, pp. 1-48.

Hawkins, Mary E., Vital Views of the Environment, 1970, National Science Teachers Association, 1201 16th Street, N.W., Washington, D. C. 20036.

Heimler, Charles H. and J. David Lockard, Focus on Life Science, Columbus, Ohio, Charles E. Merrill Publishing Company, 1969, pp. 53-73, 40, 474, 384-386, 240-248, 393-394, 266, 275, 256, 269, 275, 98-108, 291-293, 98-99, 95-96.

Hopson, Janet L., "All Eyes on Arthropoda," Science News, Vol. 110, August 28, 1976, p. 139.

Lauby, Cecilia J., James C. Silvan, and Gordon M. A. Mork, Biology, Cincinnati, American Book Company, 1958, pp. 28-39, 438, 252-279, 565-566, 25, 194, 365-369, 362-365.

McElroy, William D. and Carl P. Swanson, Foundations of Biology, Englewood Cliffs, New Jersey, Prentice-Hall, Inc., 1968, pp. 18-35, 194-201, 202-301.

Miller, David F. and B. B. Vance, Science of Biology, Philadelphia, J. B. Lippincott Company, 1965, pp. 30-78, 604-659.

Oram, Raymond F., Paul J. Hummer, Jr., and Robert C. Smoot, Biology: Living Systems, Second Edition, Columbus, Ohio, Charles E. Merrill Publishing Company, 1976, pp. 36-58, 60-82.

Oxenhorn, Joseph M. and Michael N. Idelson, Pathways in Science: Book I: The Materials of Life; Book II: Built for Living, Laboratory Workbook, New York, Globe Book Company, Inc., 1969.

Rasmussen, Frederick A., Paul Holobinko, and Victor M. Showalter, Man and the Environment, Geneva, Illinois, Houghton Mifflin Company, 1971, pp. 275, 322, 368, 87, 278, 23, 79-83.

Reynolds, "The Almighty Rhythms of Climate," Furrow, September/October, 1976, pp. 2-5.

Smallwood, William L., Challenges to Science: Life Science, St. Louis, McGraw-Hill Book Company, 1973, pp. 13, 59-78, 60-66, 106, 127, 275-276, 128-134, 201-202.

Speer, Henry L., "Using Lettuce Seeds to Demonstrate Osmosis," The American Biology Teacher, Vol. 38, No. 3, March, 1976, pp. 174-175.

Vance, B.B. and D. F. Miller, Biology for You, Fifth Edition, Philadelphia, J. B. Lippincott Company, 1963, pp. 39-106, 489-522.

Vance, B. B., C. A. Barker, and D. F. Miller, Biology Activities, Philadelphia, J. B. Lippincott Company, 1963, pp. 22-56, 207-226.

Weinberg, Stanley L., Laboratory Manual: Biology, Boston, Allyn and Bacon, 1969:

"Carbon Dioxide in Photosynthesis: Does Cabomba use CO_2 in photosynthesis?", p. 47;

"Chromatography of chlorophyll: What pigments does a spinach leaf contain?", pp. 43-45;

"Element and Compound," pp. 23-24;

"Indicators: How is measurement of pH useful in biology?", pp. 25-27;

"Mitochondria (Mitochondria are called the powerhouses of the cell.): How may the structure and function of mitochondria be observed?", pp. 35-36;

"Tonicity: How do salt solutions of varying concentrations affect living onion skin cells?", pp. 93-94.

Zeichner, Irving and Paul Berman, Laboratory Activity Manual for Biology, New York, College Entrance Book Company, 1971, pp. 157-160.

Records: 136: The Sea, The Earth, The Sky
85: Heat and Cold: Low and High Temperatures
86: Effect of Heat: Heat as Radiant Energy
87: Conversion of Heat, Basic Theory
88: Factory . . . Landscapes: Gypsum Dunes
89: Cahr. of Seawater: Currents
90: Study of Oceans: Oceans Basins
91: Limestone Canyon: Cinder Cone
92: Glacial Valley: Evolution of a Butte
93: Life of the Sea: Open Seas

Chemicals and minerals, lab specimen, permanent slides, and living s specimens available.

Basic Biology Unit VI--Historical Developments in Science*

Goals

1. The student will be able to recognize historical developments in science with the scientist, who made the contribution.
2. The student will be able to list historical developments.
3. The student will be able to describe orally or in writing the realization that scientists who have made many contributions to mankind are from many countries throughout the world.

Performance Objectives

1. Given a choice, the student will identify, match or list 25 scientists who made outstanding contributions to mankind (43 are summarized on workbook pages 375-376) with 80% accuracy.
2. Given the 17th, 18th, 19th and 20th centuries, the students will be able to match historical developments during each century with 77% accuracy.
3. Given different nationalities, the student will be able to match their own scientists and their outstanding contributions with 75% accuracy.

*This information may be interspersed in each unit throughout the year as it appears in the reading materials or specific topics.

Learning Activities

1. Teach via student reports about each outstanding scientist and his or her contribution.
2. Teach via lecture outstanding scientists during 1960's and 1970's and each contribution.
3. Accumulate scientists and contributions from each chapter in textbook as well as Chapter 16.
4. Use movies, filmstrips, current news articles on new scientific discoveries and the scientists involved.
5. Complete and drill on workbook pages 375-376.

Materials and Resources

Bagby, Grace, Harold U. Cope, C. S. Hann, and Mabel B. Stoddard, Discovery Problems in Biology, Fourth Edition, New York, College Entrance Book Company, 1960, pp. 375-376.

Gregory, William H. and Edward H. Goldman, Biological Science, Revised Edition, Boston, Ginn and Company, 1971, pp. 71, 121, 51, 107, 571, 38, 537, 72, 420, 233, 563, 149, 424, 182, 95, 97, 619, 699, 44, 516, 156, 611, 616, 128, 488, 72, 80.

Hall, Mark A. and Milton S. Lesser, Review Text in Biology, New York, AMSCO School Publications, Inc., 1966, pp. 415-418.

Haskel, Sebastian, Fundamental Concepts of Modern Biology, New York, AMSCO School Publications, Inc., 1972, pp. 131, 626, 447, 473, 621, 240, 446, 477, 702-706, 281, 570.

Miller, David F. and B. B. Vance, Science of Biology, Philadelphia, J. B. Lippincott Company, 1965, pp. 8, 497, 582, 554, 592, 117, 9, 19, 454d, 30, 98, 422, 451i, 452, 31, 232, 566, 24, 97, 117, 566, 119, 560.

Oram, Raymond F., Paul J. Hummer, Jr., and Robert C. Smoot, Biology: Living Systems, Columbus, Ohio, Charles E. Merrill Publishing Company, 1973, pp. 647, 541, 188-189, 133, 24-25, 305-306, 327, 552, 683, 599-600, 300, 207-208, 546, 89, 70, 72, 530, 302, 109, 684, 595-596, 603, 333, 612, 209-210.

Rasmussen, Frederick, Paul Holobinko, and Victor M. Showalter, Life Science Investigations: Man and the Environment, Geneva, Illinois, Houghton Mifflin Company, 1971, p. 136 (Japanese botanist: Dr. Ichoro Ohga, seed germination, life span).

Vance, B. B. and D. F. Miller, Biology for You, Philadelphia, J. B. Lippincott Company, 1963, pp. 587-622.

Movies, filmstrips, or other available materials on scientists.

Basic Biology Unit VII--Career Possibilities*

Goals

1. Through the use of different areas of biology, the student will explore career possibilities, scientific vocations or avocations.
2. The student will be able to differentiate the value of education including technical, vocational, or requiring college credits for the professions.
3. The student will be able to select different scientific workshops, or summer institutes to participate in pre-career training.

Performance Objectives

1. Given thirty examples of career possibilities, student will be able to place each example in the correct career for science, vocations or avocations, with 80% accuracy.
2. The student will be given opportunities to attend JETS summer training programs, American Heart Association or American Cancer Society workshops, earth science and conservation workshops or other available seminars for high school students.

*Career possibilities will be stressed throughout the year in all areas or units.

Learning Activities

1. Teach throughout the year during each unit the career possibilities, including education needed and opportunities.
2. Have speakers from scientific fields to talk to class members or Hi-Sci-Ki science club members.
3. Attend Illinois Geological Survey field trips whenever any are close enough to be available to our school students.
4. Attend seminars at different colleges, universities, industries or wherever available when possible.

Resources and Materials

Eli Lilly Company movie, How Much Is A Miracle?

Filmstrips from Trainex Corp. on nursing, nurse's aides and related health fields.

Movie--"Good Ship, Hope"

Illinois Department of Conservation movies, JETS - University of Illinois, Urbana, Illinois; Illinois Natural History Survey, Illinois Water Survey, American Heart Association, American Respiratory Association, American Cancer Society.

Careers In Biological Sciences, Announcement: WA-7-36, issued September 19, 1967, Executive Secretary, Interagency of U.S. Civil Service Examiners, Room 1322, 219 S. Dearborne Street , Chicago, Illinois 60604.

Careers: Science Education for You? National Science Teachers Association Stock #471-14688, 50¢, 1975.

"The Great Change Machine: Women--Change--Future," The University Woman, No. 175, March, 1976, p. 1. (Topic explored at the 24th Biennial NEC Regional Conference, April 29-May 1, 1976, at the Sheraton O'Hare North Hotel in Rosemont, Illinois. The subdivisions were: "Women as Idea Inventors," "Women as Conservers," "The Women as Molders and Shapers," and "Women as Decision Makers".)

Minetree, Harry, "Cooley: The Career of a Great Heart Surgeon," Science Digest, November, 1973, pp. 61-66.

Ross, Dr. Irwin, "Enos Mills: Columbus of the Rockies," (miner, prospector, guide, innkeeper, world-famed naturalist), National Wildlife, Vol. 9, No. 1, December/January, 1971, pp. 26-28.

"Whatever Happened to Independent Investors?", Science News, Vol. 110, July 24, 1976, pp. 60-62.

Basic Biology Unit VIII--Entomology: Native Illinois Insects

Goals

1. Through the use of one hundred and twenty-five insects (of over 775,000 species) the student will be able to identify characteristics and common names of common beneficial and harmful insects.
2. The student will collect, preserve and identify 125 different native insects including orders with common names in phylum Arthropoda.
3. The student will dissect an insect (usually Eastern Lubber Grasshopper) to study external and internal characteristics.
4. The student will be able to discriminate between the relationship that exists between insects and plants (plant pollination), insects and other animals including man.
5. The student will be able to write or quote interesting facts, beneficial and harmful insects, outstanding characteristics of each order.

Performance Objectives

1. Given fifty native Illinois insects, the student will identify each insect and order with 75% accuracy on lab test.
2. Given a whole and a dissected specimen Eastern Lubber Grasshopper specimens the student will be able to name the parts with 81% accuracy.

3. The student will be able to write interesting facts, beneficial and harmful insects, outstanding characteristics and pertinent vocabulary with 75% accuracy.

Learning Activities

1. Teach demonstration on insect specimens and (NB) insect collection.
2. Make insect killing jar, insect collecting net and take as many field trips as possible to different environments: garden, yard, running water, lake, forest, a woods, pasture; catch, preserve and identify insects with labels including order, genus and species (common name) in collection box.
3. Use insect slides and transparencies.
4. Use textbook, Chapter 7; use workbook, pages 348-355.
5. Dissect grasshopper to learn internal structure as well as external characteristics.

Materials and Resources

American Biology Teacher, Vol. 38, No. 4, April, 1976, includes all the following articles on insects:

Arnett, Ross H., Jr., "Six-Legged Guinea Pigs," pp. 250-253;
"Carolina Entomounts," pp. 225-228;
Gray, Alice, "Terrestrial Arthropods in the Elementary Classroom," pp. 211-215;
Lattin, John D., "Insect Diversity and Systematics," pp. 231-234;
Mimmick, D. R., "Integrated Pest Management," pp. 242-245;
Plapp, Frederick W., "Chemical Insecticides," pp. 239-241;
Ritcher, Paul O., "Insect Abundance," pp. 235-238;
Sauer, Richard J., "Rearing Insects in the Classroom," pp. 216-225;

Skelton, Thomas E., "Insects and Human Welfare," pp. 208-210;
Smith, Edward D., "Entomologists at Work," pp. 246-249;
Stoffolano, John G., Jr., "The Tools of the Entomologists," pp. 222-224, 229;
Taylor, Ronald, "Butterflies In My Stomach," (world hunger: insects used as food), pp. 254-256.

Bagby, Grace, Harold U. Cope, C. S. Mann, and Mabel B. Stoddard, Discovery Problems in Biology, Fourth Edition, New York, College Entrance Book Company, 1960, pp. 348-355.

"Bee Traps for Picnic Pests," Science News, Vol. 110, July 31, 1976, p. 73.

Biological Science Curriculum Study (BSCS), Biological Science: Molecules to Man, Third Edition (Blue Version), Boston, Houghton Mifflin Company, 1973, pp. 610-611, 429, 745, 468, 448, 477, 706, 419, 421, 53, 500, 404-405.

Biological Science Curriculum Study (BSCS), High School Biology, Second Edition (Green Version), Chicago, Rand McNally & Company, 1968, pp. 493, 796-797, 127-128, 568-569.

Clausen, Lucy W., Insect Fact and Folklore, New York, The MacMillan Company, 1967.

Craeger, Joah G., "Why Entomology?", The American Biology Teacher, Vol. 38, No. 4, April, 1976, p. 203.

Fischang, William J., "Another Wasted Resource," (insects), The American Biology Teacher, Vol. 38, No. 4, April, 1976, p. 204.

Garino, David P., "Fireflies Help the Ill and Give Children Extra Net Income," Wall Street Journal, October 18, 1976, pp. 1, 25.

Goodden, Robert, All Color Book of Butterflies, London, W.I., Octopus Books Limited, 1973.

Gregory, William H. and Edward H. Goldman, Biological Science, Revised Edition, Boston, Ginn and Company, 1971, pp. 367, 379-394, 690.

Gregory, William H., Laboratory Manual, Biological Science, Revised Edition, Boston, Ginn and Company, 1971, pp. 171-176.

Hall, Mark A. and Milton S. Lesser, Review Text in Biology, New York, AMSCO School Publications, Inc., 1966, pp. 81-84, 217, 292-294.

Haskel, Sebastian and David Sygoda, Fundamental Concepts of Modern Biology, New York, AMSCO School Publications, Inc., 1972, pp. 70-72, 790-793, 382, 422, 559.

Herbert, Hiram J., Wonder Workers of the Insect World, New York, E. P. Dutton & Company, Inc., 1960.

"Here's Maggots in Your Ear," (larval stage of flies helps cure inner ear bone infection), Moneysworth, October 25, 1976, p. 2.

"How Insects Sing," Science Digest, December, 1976, p. 16.

Hutchins, Ross E., Insects, Englewood Cliffs, New Jersey, Prentice-Hall, Inc., 1966.

"Immunizing Mosquitoes Against Malaria," Science News, Vol. 110, September 18, 1976, p. 187.

Insect World Digest, (special magazine for professional and amateur entomologists), Data Courier Inc., 620 South Fifth Street, Louisville, Kentucky, 40202.

"Insects Have Their Own Zoo," Current Science, Vol. 62, No. 8, December 15, 1976, pp. 4-5.

"Leather Beetles: Dermestes vulpinus, a Do-It-Yourself Skeletal Preparation Kit," International Biologics, Inc., 1991 Sharondale Avenue, St. Paul, Minnesota 55113 (March 29, 1976).

Lutz, Frank E., Field Book of Insects, Revised, Twenty-third Impression, New York, G. P. Putnam's Sons, 1948.

McElroy, William D. and Carl P. Swanson, Foundations of Biology, Englewood Cliffs, New Jersey, Prentice-Hall, Inc., 1968, pp. 523, 66, 48-49, 102.

"Migrating Monarchs," (butterflies), Current Science, Vol. 62, No. 4, October 20, 1976, p. 14.

Miller, David F. and B. B. Vance, Science of Biology, Philadelphia, J. B. Lippincott, 1965, pp. 288-326.

"Odors Make Crickets Call," Science News, October 23, 1976, p. 266.

Pfadt, Robert E., Fundamentals of Applied Entomology, New York, The MacMillan Company, 1962.

Porter, B. A., The Eastern Tent Caterpillar, Leaflet Number 161, U.S. Department of Agriculture, Washington, D.C.

Schwartz, George I. and Cornelius J. Troost, Labtext for Patterns of Life, Cincinnati, American Book Company, 1972, pp. 47-50, 145-148.

Smallwood, William L., Challenges to Life Science, St. Louis, McGraw-Hill Book Company, 1973, pp. 363-369, 416-417, 437, 441, 47, 53, 258, 26-29, 32-34, 56, 310-311, 365.

Smith, Ella Thea and Thomas Gordon Lawrence, Exploring Biology: The Science of Living Things, Sixth Edition, Chicago, Harcourt, Brace and World, Inc., 1966, pp. 154, 156-157, 184, 236, 602, 603, 217-228, 217, 218, 220, 437-438, 590, 622..

Spencer, Steven M., "Fighting Insects with Insects," National Wildlife, Vol. 9, No. 1, December/January, 1971, pp. 48-51.

Stevens, Weston A., "Bee: Good and Faithful Servant," Reader's Digest, May, 1975, p. 131.

Tipton, V. J., "Insects: A Success Story," The American Biology Teacher, Vol. 38, No. 4, April, 1976, pp. 205-207.

Vance, A. M., Lawn Insects: How to Control Them, Entomology Research Division, Agricultural Research Service, Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. (Price, 20¢)

Vance, B. B. and D. F. Miller, Biology for You, Philadelphia, J. B. Lippincott Company, 1963, pp. 245-286.

Vance, B. B., C. A. Barker and D. F. Miller, Biology Activities, Philadelphia, J. B. Lippincott Company, 1963, pp. 123-142.

Weinberg, Stanley L., Laboratory Manual: Biology, Boston, Allyn and Bacon, 1969, "The Grasshopper: How does its body structure enable the grasshopper to function successfully?", pp. 65-70.

Weinberg, Stanley L. and Abraham Kalish, Biology: An Inquiry into the Nature of Life, Boston, Allyn and Bacon, Inc., 1971, pp. 160-164, 368-369, 260, 336, 163.

Zimmerman, Jerry, "Superbug: Chirimacha," Science Digest, November, 1976, p. 9.

Basic Biology Unit IX--Botany with Forestry: Identification of Local or Naturalized Trees, Shrubs, Creeping Vines, Leaves

Goals

1. Through the use of native creeping vines, shrubs, leaves, and trees, leaves from trees, the student will be able to select the trees, shrubs, leaves and/or creeping vines in their proper category.
2. Given leaf examples or samples, the student will be able to identify (verbally or written) simple, or compound leaves; entire, toothed, or lobed margins; pinnately, palmately, or parallel venation; alternate, opposite, whorl, spiral, or rosette leaf arrangement.
3. Student will label correctly the cross section of a leaf.
4. Given 125 identified leaves, deciduous and evergreen, the student will complete tree leaf information from reference books for own identification guide.
5. At completion of unit, given 50 tree leaf specimens, the student will be able to identify them correctly and be able to identify the genus.

Performance Objectives

1. Given fifteen examples of native creeping vines, shrubs, leaves

and trees, the student will be able to place each example in the proper category, via orally or written, with 84% accuracy.

2. Given twenty examples, the student will be able to identify verbally or written simple, or compound leaves; entire, toothed, or lobed margins; pinnately, palmately or parallel venation; alternate, opposite, whorl, spiral, or rosette leaf arrangement with 80% accuracy.
3. Student will draw and label correctly the cross section of a leaf with 80% accuracy.
4. Given 125 identified leaves (deciduous and evergreen), each student will complete tree leaf information from reference books for own identification guide with 84% accuracy.
5. At completion of unit, given fifty tree leaf specimens, the student will be able to identify them correctly and be able to spell genus correctly for 75% accuracy.

Learning Activities

1. Teach via demonstration the characteristics of trees, shrubs, leaves, or creeping vines; simple or compound leaves; entire, toothed, or lobed margins; pinnately, palmately, or parallel venation; alternate, opposite, whorl, spiral, or rosette leaf arrangement.
2. Take supervised field trips to Farina Park, school grounds, town branch to see examples in native habitat.

3. Identify the parts of a cross section of a leaf, on several different microscope slides; draw and label correctly; diagram and label correctly the cross section of a leaf. Demonstrate making temporary slide showing stomates from under surface.
4. Use textbook, Biology for You, Chapters 2, 3, 4, 5.
5. Demonstrate proper collecting, pressing, and identifying native and naturalized tree leaves; proper placement on tree leaves; proper placement on tree leaf sheet, and how to use reference books to complete information.
6. Field trip to Egyptian Nursery and Landscape Company, Farina.
7. Demonstrate the use of a woodburning kit for wooden cover, use of title page, common name index, scientific name index, and grade sheet.
8. Give student pressed leaves from herbarium and other classmates, as well as using his own.
9. Teach Binomial System of classification and rules of Latin names, if it has not been used earlier by the student.
10. Workbook pages 346-347.

Materials and Resources

Slides: 35411 Acer Maple, C.S. leaf; 34361 Tea Maya C.S. root; F81059U How Trees Live, stem, leaf and seed.

Films: (from E.I.U. Co-op) F81107 Leaves; F81101U How Green Plants Make and Use Food.

Overhead projector: Files 24 and 25.

American Forest Products Industries, Inc., 1835 K Street, N.W., Washington, D.C. 20006. National sponsor of Keep America Green and the American Tree Farm System. Pamphlets, charts, and Teacher's Manual, Grades 4-12. Use current available materials, which change rapidly.

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Scientific Name ______________________________

Common Names ______________________________

Locality ______________________________

Habitat ______________________________

Collector ____________________ Date ____________

Bark Characteristics ______________________________

Leaves are ______________________________

Flowers are ______________________________

Wood is ______________________________

Wood used ______________________________

Unusual or Interesting Fact ______________________________

Reference ______________________________

Owner ____________________ Page ____________

Basic Biology Unit X--Ornithology: Birds of Austral Zone, Illinois

Goals

1. Through the use of a bird notebook (sample birdsheet follows) the student will be able to identify common birds found in eleven choice habitats: towns and farms, evergreen woodlands, lakes and bays, fields and meadows, pine barrens, brushy places, fresh marshes, sand dunes, deciduous woodlands, fresh ponds and creeks, beaches or mud flats in Austral Zone, Illinois. A sample birdlist is attached.
2. Through the use of a chicken, band-tailed pigeon, red-tailed hawk, mallard duck, ring-necked pheasant or other specimens, the student will distinguish the different parts of a bird and identify their specific uses. An examination of the external and internal organs will detect the digestive, respiratory, circulatory, reproductive, muscular, specialized Aves characteristics, and hollow bones flight system.
3. Through the use of different types of feathers, the student will contrast their parts, functions, and uses.
4. The student will be able to quote or write specific characteristics of birds, class-Aves, subphylum - Vertebrata, phylum-Chordata, Kingdom-Animal, nest, song and call notes, flocking with migration knowledge, and valuable contributions to Man.

Performance Objectives

1. The student will write in ink knowledge from reference books concerning birds from different habitats common in our area--Austral Zone, Illinois. (Please see sample attached of rules and regulations on separate sheet along with birdlist.) This is student/teacher contract. 94-100% = A, 88-93% = B, 81-87% = C, 75-80% = D.
2. The student will compare characteristics to distinguish between specific species while on field trips to as many different choice habitats as possible. Features, song and call notes, nests location and materials used will be included for 75% accuracy on field trip lab test at end of unit.
3. The student will be able to identify down, contour and specialized feathers with their unique parts with 81% accuracy.
4. Given an entire and/or dissected specimen, the student will be able to name the specialized parts and functions with 81% accuracy.
5. The student will be able to quote or write interesting facts, specific charactersitics of Class Aves, food habitat, nest, song or call notes, migration with flocking knowledge, and valuable contributions with 75% accuracy.

Learning Activities

1. Demonstrate characteristics from lab specimens or alive and deceased chicken.

2. Go to as many supervised field trips as possible to choice habitats mentioned in Goal 1.

3. Use transparency, bird slides, bird song records (NB), Mrs. Bauer's birdsheets, movies and filmstrips.

4. Use textbook, workbook, reference books.

5. Better students can work at own pace in classroom, teacher available to help slower students.

Materials and Resources

Bird slides #1-60.

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Page.........

NAMES

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Common

....
Other Names

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Family

Genus ....

Species ....

Variety ....
Scientific Name

QUICK CHECK
References

	Page Desc.	Plate
f America	....	....
rs-Field Book	....	....
rs-Guide	....	....
	....	....
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....	....	....
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ld Observation

....

ed in typical habitat Yes No

Seen

Habitat

ng Call Notes

be confused with

Associates

list other birds often seen in at described.

Aids To Identification

Size and Contour Comparison

....

....

....

....
Actual Size in Inches

Wing Spread ....

Color Clues

Male

Female

Juvenal

Migratory Data

Data collected in vicinity of

....
City State

Is Bird Zonal Yes No ....
Zone

Bird usually seen in vicinity as

Migrant ( ) or Permanent Resident ( )

Arrival Time ....

Departure Time ....

Winters ....

Nest

Location

Materials
Frame Work

Lining

Eggs

Number in nest ....

Size ....

Broods Per Year ....

Color:

Sketch Actual Size On Back this Sheet.

Feeding Habits

Food

Distribution

Basic Biology Unit XI--Own Research on Plants or Animals

Goals

1. The student will be able to distinguish some interesting problem of plants or animals to complete interesting original research.
2. The student will identify the scientific method of thinking in the problem which interests him.
3. The student will construct needed equipment, assemble adequate tests, record, questionnaires or the other forms necessary for the research over one specific research problem involving plants or animals.
4. The student will write and type a research paper with abstract, charts, graphs, records or other pertinent information, construct an attractive display following specific rules for participating in many science fairs and scientific opportunities as available.

Performance Objectives

1. Given books, pamphlets, current magazines, current newspapers or other reference sources, the student will select one area involving native plants or animals for research.
2. The student will detect and write a five step scientific method of thinking for own research.

3. Given a specific assignment for ten to fourteen days, the student will analyze research to construct needed equipment, assemble adequate tests, records, or other pertinent charts or graphs for recording the vital statistics, obtain plants or animals and start research which will continue for seven months.
4. The student will write and type a research paper with records, charts, graphs, other pertinent information, with abstract, construct display according to rules for participation in many science fairs. Prepare and practice speech about own research.
5. The student will actively participate in all science fairs, and scientific opportunities for which he is eligible.

Learning Activities

1. Use 2x2" slides of former science projects with high awards.
2. Select and discuss with students best examples of adequate, well completed records on different award winning projects.
3. Assignments on reading scientific articles in current magazines, newspapers, pamphlets, different reference books in library so student will locate a research problem that intensely interests him.
4. Student analyzes problem with scientific method of thinking--teacher conference for him to explain or obtain help.
5. Student construct, or obtain equipment, specific native plants or animals, provide necessary records, charts or graphs for own

research. Negative or unexpected results are often as valuable as positive results.

6. Learn to write and type research paper and abstract as well as constructing an outstanding display, prepare speech about own research are valuable experiences.

Materials and Resources

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Illinois Junior Academy of Science Yearbooks, *Illinois Junior Academy of Science Guidebook*, Past President Oren F. Lackey, Eastern Illinois University, Life Science Building, Charleston, Illinois 61920.

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Investigating Water Problems: A Water Analysis Manual, 1971, (cost - 50¢).

Limnology: An Introduction to the Fresh Water Environment, 1969, (cost - 50¢).

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Basic Biology Unit XII--
Botany: Plant Kingdom; Zoology: Animal Kingdom

Goals

1. The student will be able to identify the characteristics that separate plants and animals into their correct phyla with representative examples from the simplest to the most complex.
2. The student will be able to record the plant phyla: Thallophytes, Bryophytes, Pteridophytes, and Spermatophytes with specific characteristics and examples.
3. The student will be able to identify and record the Invertebrata and Vertebrata phyla of the animal kingdom, with characteristics and examples.

Performance Objectives

1. Given thirty-three characteristics and plants or animals examples, the student will be able to chart orally or written into their correct phyla with representative examples from the simplest to the most complex with 80% accuracy.
2. Given the plant phyla: Thallophytes, Bryophytes, Pteridophytes, and Spermatophytes, the student will be able to repeat specific characteristics and examples with 81% accuracy.

3. Given the animal kingdom, subphyla Invertebrata and Vertebrata the student will be able to identify specific characteristics of the phyla and examples with 77% accuracy.

Learning Activities

1. Teach via demonstration characteristics and examples of plant and animal kingdoms phyla.
2. Take a supervised field trip around school grounds to classify plants and animals found.
3. Teach with living or preserved specimens in the laboratory.
4. Use slides 1-32 for Amphibians.
5. Transparencies available are:

   19: Our Plant Resources

   20: Our Animal Resources

   21: Animal Life

   24: Plant Structures

   25: Plant Structures

   60: Animal Structures

   61: Animal Structures
6. Supplementary textbooks, workbooks, and reference books to be used.

Materials and Resources

Botany: Plant Kingdom; Zoology: Animal Kingdom

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9055 C-Si: Plant Life: Leaves of Plants
9056 C-Si: Plant Life: Flowers and Fruits

Filmstrips: Society for Visual Education, Inc., Div. 1345 Diversey Parkway, Chicago, Illinois 60614.

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"Frog Development: How do frogs develop from eggs?", pp. 163-166;

"Frog Dissection: What are the major internal organs of the frog?", pp. 99-103;

"The Frog: How are a frog's adaptations useful for survival?", pp. 71-73;

"Mammal Reproduction: How do rodent mothers care for their litters of young?", pp. 175-176;

"Nematodes: What are the characteristics of nematode worms?", pp. 63-64;

"Planaria: Are Planarians simple or complex?", pp. 79-81;
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Basic Biology Unit XIII--Anatomy, Eugenics, Euthenics, Genetics, Health, Heredity, Physiology: The Human Body

Goals

1. The student will identify the human body structures, importance, functions, food effects, protection from diseases, preventive training for good health, reproduction, heredity and genetics.
2. Good health is one of the student's most precious possessions and freedom from disease should be recognized by the student.
3. The student will be able to identify the values of the body in correct operation.
4. The student will be able to protect his own bodily and mental fitness.

Performance Objectives

1. Given fifty structures, organs, functions, diseases or preventive treatment from disease, reproduction, heredity or genetics, the student will be able to sort and list under correct headings with 77% accuracy.
2. Student will be able to quote or write good health and freedom from disease rules with 77% accuracy.
3. The student will be able to list structures of the human body and their functions with 77% accuracy.

4. The student will include the importance of: food as a source of energy and building material, vitamins, sale of food, drugs, and cosmetics laws regulate sales; alcohol, tobacco, and Marijuana hazards to good health with 80% accuracy.
5. The student will be able to discuss orally or written reproduction and heredity facts, work genetic problems, with 77% accuracy.

Learning Activities

Textbook, Biology for You, Chapters 2, 9, 10, 11, 12, and 15.

Workbook, Discovery Problems in Biology.

Analyze foods for fats, sugar, starches, proteins, water, vitamins, and minerals.

Keep food charts for each student for all food eaten for 5 days including meals and snacks.

Use records, transparencies, filmstrips, movies, or other sources of materaisl to teach this part.

Drill on structures, organs, systems, diseases, preventive care or treatment, vitamins, body and mental fitness, heredity and genetics.

Learn to spell and define new vocabulary.

Materials and Resources

Transparencies

28: Man's Basic Needs: Food
30: Protein Synthesis
58: Human Structures
59: Human Structures

Filmstrips

American Cancer Society (manufactured by Filmkare Products Company, New York).
300,000,000 Clues

Charles Scribner's Sons, Wonderworld of Science Filmstrip.
Food In the Body, Part A: Investigating Nutrients
Food In the Body, Part B: Using Nutrients

CIBA (manufactured by Filmkare Products Company, New York).
From Test Tubes to Tablets

Encyclopedia Britannica, Films, Inc.
Filmstrip Series: Drug Abuse
11271 C-Si: Drugs and Health
11273 C-Si: Smoking and Health

Guidance Associates, Pleasantville, New York.
The Drug Information Series
The Drug Threat, Your Community's Response:
Part 1: "Facing the Problem"
Part 2: "Dealing With the Problem"
101-087 "Narcotics"
103-109 "Marijuana--What Can You Believe?" - Part I and II
101-061 "Stimulants"
101-160 "Sedatives"
102-804 "L.S.D.: The Acid World"- Parts I and II

McGraw-Hill Book Company, 330 West 42nd Street, New York, New York 10036.
Human Biology Series
148509 "How the Heart Works"
148513 "How Vitamins Help Man"
148525 "Human Respiration"
148526 "Dangers of Narcotics"
148531 "Excretion"
159535 "What Is Digestion?"
159540 "What is Behavior?"

Introductory Physiology Series
400152 "The Teeth"
400153 "The Ears"
400154 "The Respiratory System"
400155 "The Nervous System"

400156 "The Skin, Hair, and Nails"
400157 "The Eyes"
400158 "The Circulatory System"
400159 "The Bones and Muscles"
400160 "The Digestive System"

Society for Visual Education, Inc. Div. 1345 Diversey Parkway, Chicago, Illinois 60614.
A570 Human Physiology Series
A570-1 "Human Digestive System"
A570-2 "Human Respiratory System"
A570-3 "Human Circulatory System"
A570-4 "Human Glandular System"
A570-6 "Human Body Framework"
A570-7 "Human Sense Organs"

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"Biochemical Genetics in Peas: What are some biochemical effects of genes in pea plants?", pp. 197-199;
"Blood Cells: What kinds of cells does the blood contain?", pp. 121-124;
"Blood Clotting: How does the blood clot?", pp. 129-132;
"Blood Typing: What is your blood type? What is the effect of mixing blood of different types?", pp. 125-128;
"Breeding Molds: How can the segregation of genetic traits in molds be traced?", pp. 201-203;
"Chemical Senses: How do human beings taste substances?", pp. 145-147;
"Chick Development: How does a chick embryo develop?", pp. 167-169;
"Chromosomes and Mitosis: How can chromosomes be found and observed during mitosis?", pp. 157-160;
"Circulation: Where does the blood circulate?", pp. 113-116;
"Diffusion through a membrane: Which nutrients diffuse through a selectively permeable membrane?", pp. 95-98;
"Digestion of Protein: How is protein digested?", pp. 109-111;
"Digestion of Starch: What happens to the starch in food?", pp. 105-107;
"DNA: How can DNA be extracted from cells and observed?", pp. 205-206

"Human heredity: What is your genotype?", pp. 217-221;
"Immunology and Evolution: How can we use methods of immunology to identify the blood of various animals related to man?", pp. 211-212;
"Laws of Chance: How does chance determine genetic ratios?", pp. 193-195;
"Nutrients Tests: How can the various nutrients be identified?", pp. 37-40;
"Variation: How do traits vary within a species?", pp. 207-209;
"Vertebrate Evolution: How do higher vertebrates compare with lower vertebrates?", pp. 213-216;
"Visual sensation and perception: How is it possible to distinguish between what the eye sees and what the brain perceives?", pp. 141-144;
"What is the vitamin C content of different fruit juices under different conditions?", pp. 41-42.

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Basic Biology Unit XIV--Evolution: Time/Change, Use and Preservation of Natural Resources, Conservation, Ecology, Earth Science, National and Illinois State Parks and Memorials

Goals

1. The student will identify the importance of evolution through time with change; use and preservation of natural resources, conservation, ecology, earth science and study of National and Illinois state parks and memorials.
2. The student will understand continuous change and be able to evaluate its influence on plants and animals, including man.
3. The energy crisis has sparked a controversy about the conservation, use and preservation of natural resources which the student should be able to debate both pro and con.
4. The student will cite examples of ecological influence of the environment on the distribution of plants and animals.
5. The student will be able to spell and define correctly the new vocabulary.
6. National and Illinois State Parks and Memorials are examples of conservation for future generations; the students will be able to identify the unique features of each and why they are preserved but enjoyed by today's generation.

Performance Objectives

1. Given twenty examples, the student will identify the importance of evolution through time with change; use and preservation of natural resources, conservation, ecology, earth science and National and Illinois State Parks and Memorials with 80% accuracy.
2. The student will be able to list by writing or orally, the continuous change with examples of influence on plants and animals, including man, with 77% accuracy.
3. The student will cite eight pro and con debate facts for the energy crisis sparking controversary about conservation, use and preservation of natural resources, with 80% accuracy.
4. The student will cite ten examples of ecological influences of the environment on the distribution of plants and animals with 80% accuracy.
5. The student will be able to spell and define new vocabulary with 80% accuracy.
6. The student will be able to match or select unique features with National and Illinois State Parks and Memorials with 77% accuracy.

Learning Activities

1. Field trips to Illinois State Parks and Memorials within a 50 mile radius, if feasible. Show movies, slides, filmstrips, pictures, and have oral reports. Conservation at Brownstown Experimental Farm

field trips to show new practices to grow and develop new crops that will adjust to the rainfall, soil, temperature, etc., in this area.

2. Invite conservation speakers to attend class or visit a class member who has soil conservation work completed on their farm.
3. Collect articles on energy crisis and have members debate on teams, based on facts they have learned and quote sources.
4. Textbook, Chapters 3, 14, and 15.
5. Mrs. Bauer's 2 x 2" conservation slides and National and Illinois State Parks and Memorials.
6. Field trips to different environments to show ecological influences of the environment on the distribution of plants and animals.
7. Drill on vocabulary spelling and definitions.

Resources and Materials

Mrs. Bauer's 2 x 2" slides on conservation and National and Illinois State Parks and Memorials.

<u>Transparencies</u>:

22: Biology Ecological Aspects
23: The Land that Supports Us
26: Rocks and Minerals
45: Soil Resources
46: Stephan A. Forbes State Park
55: Weather
69: Races of Mankind

<u>Filmstrips</u>

American Petroleum Institute
Code: 15Y 11-56 79 - 17-5: Petroleum In Today's Living
Code: 15Y 11-56 79-16-5: Oil: From Earth To You

Eye Gate Media, 146-01 Archer Avenue, Jamaica, New York.

2-6 Heat and Cold
- 2-6A "Basic Theory of Heat"
- 2-6B "Conversion of Heat Into Useful Work"
- 2-6C "Effects of Heat"
- 2-6D "Heat as Radiant Energy"
- 2-6E "Very High Temperature"
- 2-6F "Very Low Temperature"

Society for Visual Education, Inc. Div. 1345 Diversey Parkway, Chicago, Illinois 60614.

A441 Earth Science
- A441-1 "Factors in the Evolution of Landscapes"
- A441-2 "The Gypsum Dunes"
- A441-3 "The Volcanic Cinder Cone"
- A441-4 "The Limestone Canyon"
- A441-5 "The Evolution of a Butte"
- A441-6 "The Glacial Valley"

A468 Modern Biology: Evolution
- A468-6 "Evolution: Supporting Evidence"

A503 Oceanography
- A503-1 "The Study of the Oceans"
- A503-2 "The Ocean Basins"
- A503-3 "Characteristics of Seawater"
- A503-4 "Currents, Waves, and Tides"
- A503-5 "Life of the Open Seas"
- A503-6 "Life of the Sea Floor and Shore"

Teach-O-Filmstrip: Popular Science Publishing Company, 513 West 116th Street, New York, New York 10032
- 3171: Energy For the Future
- 1072: Rescuing Vanishing Species

Books, Magazines, and Journals

Alexander, Taylor R., and George S. Fichter, Ecology, New York, Golden Press, 1973.

American Steel and Wire Division, United States Steel, Rockefeller Building, Cleveland, Ohio, Series of pamphlets on soil and erosion.

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"Bicentennial Landmark: Even in Illinois: Kaskaskia State Park, Fort Kaskaskia (Capitol of Illinois Territory, 1809; First State Capitol, 1818)," The American Legion Magazine, December, 1976, p. 45.

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Carter, William, Middle West Country, San Francisco, Houghton Mifflin Book Company, 1975, pp. 1-270.

Chambers, Robert Warner, and Alma Smith Payne, From Cell to Test Tube: The Science of Biochemistry, New York, Charles Scribner's Sons, 1960.

Chemical Industry Facts Book, Fifth Edition, Washington, D.C., Manufacturing Chemists Association, Inc., 1825 Connecticut Avenue, 1962.

Christensen, Kathryn, "Home Care Brightens a Hemophiliac's Life," Chicago Daily News, December 14, 1976, p. 11.

Comey, David Dinsmore, "The Uneconomics of Nuclear Energy," Skeptic, Issue No. 14, July/August, 1976, pp. 19-21, 49, 50.

Comfort, Alex, "It's a Myth That Aging Stunts the Brain," Chicago Daily News, December 14, 1976, pp. 9-10.

Conservation Education Association, (is in the process of compiling resource materials on evaluation instruments for environmental education at all levels, write: Dr. Craig Cbase, Environmental Education, Slippery Rock State College, Slippery Rock, Pennsylvania 16057.)

"Consumer Corner: Synthetics to Replace Natural Foods," Grit, September 14, 1975, p. 23.

Curl, J. Edward, "Soil Conservation Service Provides Farm Assistance," Vandalia, Illinois, The Vandalia Leader, December 9, 1976, p. 1, Section 2.

"Deer Harvest in Southern Illinois," Farina, Illinois, The Farina News, December 23, 1976, p. 4.

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"Farmers Must Qualify to Use Pesticides," Effingham, Illinois, Effingham Daily News, December 20, 1976, p. 17.

Fayette County Surface Water Resources, Illinois Department of Conservation, Division of Fisheries, Springfield, Illinois 62706, 1968.

First Aid for Flooded Homes and Farms, U.S. Department of Agriculture, U.S. Government Printing Office, Washington, D.C. 20402, 1964.

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Garvin, C. C., Jr., "Facing Energy Realities," The Lamp, Winter, 1976, p. 1.

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Kendall, James R., Illinois Agricultural Statistics, 1974, Annual Summary, Bulletin 74-1, Illinois Cooperative Crop Reporting Service, Illinois Department of Agriculture, United States Department of Agriculture, Statistical Reporting Service, P. O. Box 429, Springfield, Illinois 62706.

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Basic Biology Unit XV--Aerospace

Goals

1. Aerospace education is a fusion of many subject areas which reinforces learning in all. Aerospace is a subject that arouses an interest in reading, how to study with good habits, to search and research beyond minimum requirements. It includes astronomy, biology, earth science, mathematics, geography, social sciences, physics, language skills, speech, aeronautics, business and vocational education classes.
2. Instructional objectives include the student will be able to recite orally or write the history of space achievements, military, and national influences.
3. The student will recognize the value of research in Aerospace as it spinsoff to earth industries, better food and medicinal aspects.
4. Judgmental behaviour objectives the student will be able to evaluate the values of expenditures for space, pro and con; plan and compare scientific project results versus controls; formulate laws of space flight in coorelation of spacecrafts for specific jobs.
5. Laboratory science behavior objectives, the student will be able to reproduce laboratory experiments to learn fundamental principles,

record, note, or chart results; compile current information on space exploration, and search and sort career opportunities in correlation to own abilities and interests.

Performance Objectives

1. The student will list twelve of the fourteen subject areas involved in aerospace education with 85% accuracy.
2. The student will be able to choose nine beneficial spin-offs from a list of fifteen with 81% accuracy.
3. The student will recite or place in the correct order the history of space achievements, military and national influences, with 77% accuracy.
4. The student will be able to evaluate the values of expenditures for space, both pro and con with 77% accuracy.
5. The student will be able to formulate laws of space flight in correlation of spacecrafts for specific jobs, with 75% accuracy
6. The student will be able to reproduce laboratory experiments to learn fundamental principles, record, note and chart results. The student will compile current information on space exploration, search and sort career opportunities in correlation to own abilities and interests.

Learning Activities

1. Demonstrations might include: Archimedes Principles, Bernoulli

principle, wind tunnel to measure drag, gyroscope, parts of an airplane, rocket, or satellite; atmospheric pressure; space hazards of micrometeoroids; rocket vehicles; construction of action-reaction engines; temperature control on rocket vehicles; orbit velocity; biological sensors; laboratory testing of representative freeze-dried foods; good insulating materials, the effect of vibration on human performance and reaction; oxygen insufficiency; problems of isolation and confinement; biological rhythms.

2. Individual student activities include: algae cultures for human consumption; research on plant growth in tissue culture; food packaging for space flight; germicides added to food, wastes or drinks; chromatography of rat and mouse feces, as diets are altered; the effect of heat or cold on the metabolic rates or motor activities of small animals; a study of the chemical analysis of sweat; long-term effects of low residue diets on small mammals could be investigated; what is the effect of a "space diet" on the normal intestinal microflora of an organism; a routine study of hair, beard, and fingernail clippings to show the routes of nutrient loss from the body as well as water-loss from the body.

3. The student will study aerospace careers available as well as education needed in all areas. (In 1973, U.S.A. bad 1,300,000 people involved in aerospace jobs and they need 20,000 to 30,000 replacement

workers yearly due to retirement or leave for various reasons.) Prediction for a high rate for research and development.

4. Field trips could be to Scott Air Force Base, Belleville, Illinois; McDonnell's Planetarium, St. Louis, Missouri (Forest Park); NASA workshops available in the area.

Resources and Materials

American Radio Relay League, Inc., Space Science Involvement, 1975, Second Printing, American Radio Relay League, Inc., Talcott Mountain Science Center, Newington, Connecticut 06111. (This is a curriculum supplement for classroom use with an active communications satellite with activities for: space science, physics, mathematics, astronomy, communications, and electronics.)

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There are additional references and resources listed in the Minicourse: Aerospace Education on pages 33-62 that may be used in this unit.

APPENDIX C

FIELD BIOLOGY

Field Biology

Public Relations of a Summer School Field Biology Program
Effingham Community Unit #40, Effingham, Illinois

I. Introduction

II. Administrator's Supervision for Public Relations

III. The Teachers' Importance in Public Relations

  A. Planning Curriculum

  B. Using Community Resources and Personnel

  C. Building Public Relations Through Contacts with Students

  D. Building Public Relations Through Contacts with Parents

  E. Building Public Relations Through Additional Contacts with Community Citizens

IV. Summary

V. Selected Bibliography

VI. Appendices

  C-1 Effingham High School Summer School, Effingham, Illinois, 1976 (Russell Marvel, Principal)

  C-2 Field Biology Summer Schedule 1973 Calendar

  C-3 Field Biology Summer Schedule 1974 Calendar

  C-4 Field Biology Summer Schedule 1975 Calendar

  C-5 Field Biology Summer Schedule 1976 Calendar

  C-6 Effingham Community Unit #40, Effingham, Illinois, Field Biology Public Relations Handout

  C-7 Selected Bibliography

Public Relations of a Summer School Field Biology Program
Effingham Community Unit #40, Effingham, Illinois

I. Introduction

Effingham Community Unit #40 High School summer school program in the field biology curriculum has been unique since 1971.

Basic innovative ideas include: make a field biology curriculum that is taught out-of-doors with changing environmental habitats; invite qualified guest speakers from industry, state and community parks, junior colleges or universities to add to the expertise of the highly qualified instructors. With the normal four-hours classday it is possible to travel on fieldtrips three or four days per week to different sites that is impossible during one fifty-seven minutes period in the nine-months school year. Two science credits are one of the requirements for high school graduation so the six-week summer program fulfills one credit. Career and vocations education is included.

The only prerequisite is the student must have completed the ninth grade. Students residing in Effingham Community Unit #40 pay a one-dollar summer school book rental fee while high school students residing outside the district pay a thirty-dollar fee for a full unit of credit during registration.

II. Administrator's Supervision for Public Relations

Administrators announce the summer school dates on Effingham radio station WCRA, have public announcements in the Effingham Daily News, and mail flyers to neighboring schools. Students wishing to attend summer school go to the Principal's office to sign their names on a list under whatever subject each student wants to attend. Many students take a subject during summer school that it is impossible to schedule during the normal school year because of scheduling conflicts with other required subjects and interests. Approximately one-third of the students attending summer school are earning credits to replace those lost and two-thirds are earning additional credits. Many of the students are graduating after attending three and one-half nine-months school sessions and three six-week summer school sessions. Each has earned the necessary credits and fulfilled all requirements.

The administrators announce several times that any K-12 faculty member who wishes to teach during summer school is to notify their own building supervisor. Their placement is based on the number of students attending summer school in the different classes and a seniority formula. If sufficient faculty does not want work during the summer, competent teachers are employed from the surrounding areas. Two qualified biological science teachers team-teach fifty or more high school students field biology. When more than fifty students are placed with two teachers team-teaching one teacher's aide is hired to help with clerical work.

The group travels in a sixty-six passenger bus with all students, two teachers and one qualified bus driver. Usually the driver goes on the field trip tour, listens to the speaker, and cooperates fully to help the students and teachers receive the maximum benefits and safety. The administrators fulfill all obligations necessary for an effective program.

III. The Teachers' Importance in Public Relations

A. Planning Curriculum

Successful school public relations must be formed upon an outstanding and dynamic educational program. Teachers plan a class curriculum to teach students more knowledge than he knew before, to influence the capabilities of the student, develop a skill or to be influenced in some different way than he was before the instruction started. Learning experiences are provided to modify the student in attitude, belief, knowledge or distinction. The product is the student progress through the class and receiving another credit is one of its best advertisements. The energetic, talkative, former and current students link between school and community provides data and information about current status of the program. Faculty members and students evaluate the program, give bouquets along with criticism, and recommendations.

B. Using Community Resources and Personnel

The teachers attempt to create positive, favorable impressions when planning and contacting the individuals, who will provide their own expertise in planning a fieldtrips calendar. (Please see sample in appendix.) This contact is usually made via telephone about one week before summer school starts. A follow-up letter is immediately mailed to verify dates, time, topics, and other pertinent information. Some businesses, industries, universities or state parks have special requirements that must be met. For example, any group of twenty-five or more individuals in a state park are to contact the park ranger and obtain a free permit. Often the teachers will go to the business, junior college, university, or park one or two days before the fieldtrip so necessary details, locating of plants or animals that will be discussed, or other arrangements may be completed before taking the students. A majority of the businesses, community leaders, college or university personnel, research workers and other individuals involved spend considerable time, resources and personnel to help the students and faculty year after year. Afterwards a thank you letter is written and signed by both teachers and sometimes students. Copies of any pictures or slides pertaining to the visit are given to the speaker, lecturer, or tour guide. The pictures on the slide presentation are part of a file that the faculty members possess and use in discussing the field biology classes.

C. Building Public Relations Through Contact with Students

Good teaching is the teacher's best means for building effective public relations with his students and providing encouragement of favorable, lasting attitudes. Teaching procedures which help students enjoy the class while learning include the teacher:

(1) giving the student his undivided attention;

(2) providing many different opportunities for experiences involving activities and creativity;

(3) explaining the reasons for the students learning experiences;

(4) relating present biological education to everyday life and its influence on each;

(5) respecting students' opinions and rights;

(6) approaching discipline problems from a viewpoint of student guidance;

(7) providing a pleasant, attractive classroom environment; and

(8) stressing the positive to eliminate the negative.

Teachers are employed to help students and not hinder their development. Student individual success adds to the favorable public relations.

D. Building Public Relations Through Contact with Parents

Building public relations through contact with parents is very important as the parents want their children to succeed. This mutual concern between the parents and teachers can be a major factor in building better school public relations.

One excellent means for developing parent understanding is if they visit the school. Parents are always welcome to visit when the class is in the classroom. Occasionally when the student is ill for a long time period, a teacher may visit in the home or hospital. If a home visit is planned, the teacher should make an appointment in advance as a courtesy to prevent any embarrassment. A brief friendly visit should encourage the student and parents.

Three weeks after summer school starts, the teachers prepare formal report cards which are mailed to all parents. If the student needs assistance to improve grades, specific notes are made with strong points as well as weaknesses mentioned with recommendations for improvement. Conferences may be scheduled if the parents make an appointment. Some conferences are held at night or following working hours for the parents' convenience. The teacher should stress several strong points before mentioning the student's problems or weaknesses. Positive action that will help the student succeed should be stressed. Any solution that the home and school can work on cooperatively rates high. The teacher needs to be a good listener with poise, patience and understanding. Before the conference ends the teacher needs to summarize the major points as well as the agreements that may be reached. Thank the parents for their interest, cooperation and coming to discuss the student. The teacher should write a brief summary of the conference for own future reference after the parents leave.

E. Building Public Relations Through Additional Contacts with Community Citizens

The administrators and teachers are exceedingly proud of the Effingham Community Unit #40 summer school field biology curriculum and welcome any opportunity to speak about it to school classes, community organizations, professional meetings, and/or universities' classes. The community people like to know about the different educational programs including summer school. Community leaders, business owners, industries, junior college and universies personnel are proud of their expertise, willing to give career or vocational qualifications or requirements, job opportunities and show what is available in their own community. There is a wide diversity with each making an unique contribution. Maps, slides, and pictures are used to tell the story of educational opportunities available to the students. A handout is given to each guest (sample is enclosed in the appendix).

IV. Summary

Various public relation methods are effectively used to teach the students, parents, community, and other interested individuals about the Effingham Community Unit #40 summer school field biology. School public relations is a long-range, constant process which promotes friendly working relationships between schools and their communities. They help school serve the educational needs of the students while keeping the people informed about the school purposes, goals, philosophy, programs and/or other pertinent information. Administrators, teachers, non-certified personnel, students, parents, and community resource individuals unite with all the taxpayers to provide the maximum opportunities for each student to develop his interests, capabilities, and knowledge to benefit himself and mankind.

V. Selected Bibliography

Books

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Gronlund, Norman E., Stating Behavioral Objectives for Classroom Instruction, London, The MacMillan Company, Collier-Macmillan Limited, 1970, pp. 1-52.

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Magazines

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Attea, William J., "The Process of Curriculum Change," Illinois School Board Journal, March-April, 1975, pp. 45-46. (Panel: Earl D. Patton, John Beckwith, G. C. Matzner, James Parker).

Bakalis, Michael, "Some Changes for Education," Illinois School Board Journal, May-June, 1971, pp. 4-5.

Blumenfield, Fred, "Science, Yesterday, Today, and Tomorrow," Today's Education, September-October, 1974, pp. 86-89.

"Curriculum is What Accountability is All About," The American School Board Journal, June, 1974, pp. 22-24.

Hoffman, Earl, "Learning Is Great in the Great Outdoors," Illinois School Board Journal, May-June, 1974, pp. 7-9.

Leggett, Stanton, "For Boardmen and Superintendents Only: How to Keep Tabs on Your District's Curriculum," American School Board Journal, February, 1972, pp. 40-43.

MacBeth, Edwin, "Who Masterminds the Curriculum? Educators or Profit-Makers?", The American School Board Journal, August, 1974, pp. 22-27.

"Mini-Workshops in Public Relations: My Head Is Reeling--but I'm Learning," University of Boardmanship, 1974 Annual Convention, National School Boards Association, p. 37.

"Series of Aid Code Revisions: Proposal Would End Support for Summer School Programs," Decatur, Illinois, Decatur Herald, April 14, 1976, p. 37.

"Special Feature on Professional Associations and Improvement of Instruction," Today's Education, NEA Journal, February, 1972, pp. 42-44.

Swan, Malcolm, and Orville E. Jones, "Some Attitudes Towards Summer School Programs--Opinions of Conference," Illinois School Board Journal, November/December, 1969, pp. 33-35.

APPENDIX C-1

Effingham High School

June 4 - July 16, 1976

Cost: Students of Effingham Unit #40 are admitted free
Students NOT residing in Unit #40 - $15.00 per 1/2 unit of credit
Students NOT residing in Unit #40 - $30.00 for a full unit of credit
There is a $1.00 book rental fee for ALL STUDENTS

Place: Effingham High School

Minimum enrollment: 25 students per class

Course Title	Time	Unit of Credit
American History	8:00 a.m. - 12:00	1/2 Carnegie Unit
World History	8:00 a.m. - 12:00	1/2 Carnegie Unit
Art	8:00 a.m. - 10:00	1/2 Carnegie Unit
Personal Typing	8:00 a.m. - 10:00	1/2 Carnegie Unit
Practical Math	8:00 a.m. - 12:00	1 Carnegie Unit
Field Biology	8:00 a.m. - 12:00	1 Carnegie Unit
English, Independent Study	8:00 a.m. - 12:00	1/2 Carnegie Unit
Physical Education	8:00 a.m. - 12:00	1/2 year credit

1976-77 Juniors and Seniors may take any course offered

1976-77 Sophomores may take any course <u>except</u> American History

1976-77 Freshmen may take World History, Art or Personal Typing

For further information, contact:

Russell Marvel, Principal
Effingham High School
Effingham, Illinois 62401

Phone (217) 342-2174

04-14-76

APPENDIX C-2

Field Biology Summer School Schedule 1973 Calendar

Faculty: Mrs. Fern Fisher Wenger   Mrs. Norma G. Hockett Bauer

June

8	Registration - Effingham High School yard
11	Plant seeds for plant growth study. Start forestry unit.
12	Field trip, W. Fayette Ave., Effingham. Soil Analysis.
13	Penn Central Railroad right-of-way to Bliss Park, then northeast and west back to Effingham High School.
14+	Effingham Community Park.
15+	Tour of Brownstown, Ill., U of I Experimental Farm plots.
18	Test. Make insect killing jars.
19+	Lincoln Log Cabin State Park, Charleston, Ill.
20+	Hidden Springs State Forest, big tree, Stewardson, Ill.
21+	Rock Cave Nature Conservancy, Rt. 128 west of Altamont, Ill.
22	Test. Permanent notebook. Insect identification. Bird identification.
25	Conservation film and filmstrips.
26+	Mr. & Mrs. Clinton Cutright's Conservation Farm southeast of Effingham.
27+	Egyptian Nurseries and Landscape Company, Farina, Ill.
28+	Green Creek and Ramsey Cemetery northwest of Effingham.
29	Test. Permanent notebook on plant growth study due.

July

2+	Rend Lake Forest Area, Ina, Ill.* (3 p.m.)
3+	Eastern Illinois University Life Science Building, Charleston.
4	No School.
5+	University of Illinois, Allerton Park, Monticello.* (3 p.m.)
6+	Test. U of I Forestry Test plots, Brownstown, Ill. Leaf collection due.
9	Test. Insect identification.
10+	Red Hills State Park, Sumner, Illinois.
11+	Stephen A. Forbes Park, Sam A. Parr Fish Research, Kinmundy, Ill.
12+	Beall's Woods, Keensburg, Ill.* (6 p.m.)
13+	Test. Mr. & Mrs. Leland Huelskoetter Conservation Farm Winners, Altamont, Ill. Insect collection due.
16	Permanent notebook. Review of plants, birds, insects, trees.
17+	Prairie Grass Remnants, Watson. Interstate 57/70 Landscaping Survey, Altamont Reststop, Altamont.
18+	St. Louis Missouri, Climatron,** and Zoo.* (6 p.m.)
19	Final Exam, Effingham High School classroom.
20+	Final Exam - Practical, Fox Ridge State Park, Charleston, Ill.

+Represents when bus transportation is used.

*Represents long trips, returning to Effingham High School during late afternoon except Allerton Park and Rend Lake should return about 3 p.m. Appropriate clothing, lunches or food money as well as supplies, notebooks, pencils, etc., are essential. All other field trips will return to Effingham High School by twelve noon unless there is bus trouble.

**The Climatron is located at the Missouri Botanical Gardens, St. Louis, Mo.

One or two days per week are scheduled for Effingham High School classroom.

APPENDIX C-3

Field Biology Summer Schedule 1974 Calendar

Faculty: Miss Sharon Reed Mrs. Norma G. Hockett Bauer

June

7 Registration and Orientation, Effingham High School yard.
10 Effingham High School
11 Egyptian Nursery and Landscape Company, Farina. Mr. John Graves.
12 Cutright's Farm, Effingham.
13 Lincoln Log Cabin State Park, Charleston.
14 Brownstown University of Illinois Experimental Farm Crops, soil, herbicides.
17 Effingham High School, WAPORA speaker.
18 Eastern Illinois University Life Science Building tour, Charleston.
19 Rock Cave, Rt. 128, Altamont.
20 Lakeland College, Mattoon, Jim Deters, tour guide.
21 St. Elmo Geological field trip--earth's formation, fossils, gas plant, oil wells, rock quarry.
24 McDevitt's Nursery, Effingham 8-11 a.m. Effingham High School, 11-11:55 a.m.
25 Effingham County Conservation Water Survey, Altamont. Morris Hillard.
26 Red Hills State Park, Olney.
27 Rocky Branch, Marshall.
28 Brownstown Experimental Farm, Forestry Section.

July

1 Effingham High School.
2 Lake Shelbyville, Illinois Natural History Survey Station.
3 Hidden Springs State Park and "Big Tree", Stewardson.
4. No school - legal holiday.
5 Allerton Park, Monticello. Picnic Lunch. Dr. Turok.
8 Effingham High School.
9 Pet, Inc., Greenville. Vandalia Jr. High School Nature Trail.
10 Forbes State Park, Sam Parr Fish Hatchery, Kinmundy. Dr. Buck.
11 Beal's Woods, Keensburg. Picnic Lunch.
12 Huelskoetter's Farm, Moccasin, Illinois, Conservation.
15 Effingham High School.
16 Survey Interstate Landscaping at I57 and I70.
17 St. Louis, Missouri, Climatron, Zoo, Missouri Botanical Gardens, 8 a.m. - 5:30 p.m.
18 Final Exam.
19 Final Practice, Fox Ridge State Park, Charleston.

APPENDIX C-4

Field Biology Summer Schedule 1975 Calendar

Faculty: Mrs. Norma Hockett Bauer Mrs. Sharon Reed Marvel

June

6 Registration and Orientation, Effingham High School. Greenhouse tour.

9 Lab, Effingham High School. Mr. Bernard Burkland, Burkland's Greenhouse, Effingham, Ill.

10 Mr. & Mrs. Clinton Cutright's Farm, Effingham, Ill.

11 Illinois State Museum, Springfield, Ill.

12 Mr. Dave Pierson, Vandalia Jr. High. Vandalia Correctional Center, Vandalia, Ill.

13 McDevitt's Nursery, Effingham, Ill. Lab, Effingham High School.

16 Lab, Effingham High School.

17 Eastern Illinois University, Reptiles, Greenhouse, Charleston, Ill.

18 Prairie Remnants, Watson/Mason, Ill. Interstate 57/70 Landscaping, Altamont, Ill. Mr. Jim Sherrick. Lab, Effingham High School.

19 Lab, Effingham High School.

20 Carlyle Lake Waterfowl Management Station, Hagarstown, Ill. Mr. Merrill Collins.

23 Lab, Effingham High School.

24 Mr. & Mrs. Hillard Morris Conservation Farm, Mason, Ill.

25 Dr. Homer Buck, Sam Parr Fish Hatchery. Forbes State Park, Kinmundy, Ill.

26 Fox Ridge State Park, Insect Collection of Dr. Michael Goodrich, Charleston, Ill.

27 Insect Lab, Effingham High School.

30 Lab, Effingham High School.

July

1 University of Illinois, Allerton Park, Monticello, Ill. Mr. Frank Turok.

2 Lakeland Jr. College, Mattoon, Ill., Mr. Culp and Mr. Deters.

3\. Egyptian Nursery and Landscape Co., Farina, Ill., Mr. John Graves, Mr. Ted Damann.

4 No School - Holiday.

7 Lab, Effingham High School.

8 Lake Sara Bass Hatchery, Effingham, Ill., Mr. J. Jansen.

9 Dr. Ted Storck, Illinois Natural History Survey, Lake Shelbyville, Allenville, Ill.

10 Hidden Springs State Forest and "Big Tree," Stewardson, Mr. Tony Wegner.

11 Dr. Leonard Durham, Eastern Illinois University Life Science Building Tour. Ecology and Pollution Seminar.

14 Lab, Effingham High School.

16 St. Louis, Missouri, Climatron and City Zoo.

17 Final Exam, Effingham High School.

18 Final Exam, Fox Ridge or Lincoln Log Cabin State Park, Charleston.

APPENDIX C-5

Field Biology Summer Schedule 1976 Calendar

Faculty: Mrs. Norma Hockett Bauer Mrs. Sharon Reed Marvel

E. I. U. Student Teachers: Miss Donna Schoen, Mr. Randy Vogel

Every Monday there will be a major test on the past week's work.
Every Monday completed field notes will be due from the previous week.

June

4 Registration & Orientation. Burkland's Greenhouse Tour, B. Burkland.
7 Effingham High School Lab. McDevitt's Nursery, B. McDevitt.
8 Illinois State Museum, Springfield. *
9 Hidden Springs State Forest and Big Tree, Strasburg, Ill., D. Donoho.
10 Effingham High School Lab. Tree leaves, Birds notebooks.
11 Brownstown U. of I. Experimental Farm Crop Day, J. Faggetti.
14 Lab, Effingham High School. Plants.
15 Cutright's Conservation Farm Tour, Clinton Cutright.
16 Plant Lab, Lake Sara.
17 Lab, Effingham High School. Plants.
18 Dr. Goodrich, Mr. Murphy, Randy Vogel, Campus of Eastern Illinois University, Charleston. Reptiles, greenhouse, Life Science Building. Bird notebook due.
21 Lab, Effingham High School. Clifford Stevens, Wildcat Hollow and Ida Kepley's Springs. Plant lab due.
22 Allerton Park, University of Illinois, Monticello. ** Dr. Frank Turok. Completed tree leaf notebook due.
23 Fox Ridge State Park. M. Goodrich Insect Collection.
24 Effingham High School, Insect Lab and EHS Campus.
25 Insect Lab, Effingham High School, Midterm exam.
28 Lab, Effingham High School. Dr. Leonard Durham, Aquatics.
29 Sam Parr Fish Research Station, Stephen A. Forbes State Park, Kinmundy/Omega, Dr. Homer Buck, Richard Bauer.
30 Richard Kocher, Kincaid, Sangchris, **Coal Energy.

July

1 Illinois Natural History Station, Allenville. Lake Shelbyville, Sullivan, Ted Storck.
2 Effingham High School, Aquatic Lab.
5 No school - July 4 holiday.
6 Altamont Lions Park and H. Morris Pond and Conservation Area.
7 Lake Carlyle Wildlife Refuge, Hagarstown, Merrill Collins.
8 Interstate Landscaping and Prairie Remnants, J. Sherrick, 8 a.m. Effingham High School Lab.
9 Wildlife and Prairie Chicken Conservation Program, Paul Moore, Stephen A. Forbes State Park, Kinmundy/Omega.
12 Effingham High School Lab. Wildflowers. Aquatic Lab due.
13 CIPS Energy Conservation and Research, Newton Power Station, D. Grant.
14 St. Louis Climatron and Zoo Trip. *
15 Effingham High School - one-half of Final Exam.
16 Field Final Exam at Lincoln Log Cabin State Park, Charleston

*Bring money for lunch as restaurants will be available.

**Bring <u>food</u> as no restaurants are available at noontime and each student will be responsible for taking his own food and drinks with him.

APPENDIX C-6

Effingham Community Unit #40, Effingham, Illinois, Field Biology Public Relations Handout

Purposes and Philosophy

Purposes include:

to help students obtain an understanding of their environment;

to help students make an acquaintance with plant and animal organisms, their relationships, and the complexities of the local habitats;

to help students conduct on the spot investigations, gather valid useful information by direct observation;

to help students obtain scientific career information about opportunities;

to help students obtain conservation training with better understanding of the balance of nature so each can make wise decisions as informed citizens;

to make a science course available for those students who cannot schedule one in their regular school schedule during the year.

Philosophy includes:

The school board members and administrators believe in the philosophy of providing the best education for each student. (They provide educational expertise, scheduling, and the details necessary for each student to receive maxdmum opportunities.)

The study of biology vastly influences each student. It is the substance of the environment itself.

We feel that each student has the ability to learn, so all are eligible to participate in field biology. The student can pursue and develop his work to the fullest capacity. Teachers, speakers, guides and research personnel are to help him learn.

Special Experiments Required for Each Student

1. Seed growth, germination and soil charts.
2. Bird study notebook.
3. Insect study notebook with collected and identified specimens.
4. Tree study notebook with leaf specimens.
5. Independent study (or possible stream study) dealing with ecology, pollution, or related subject.
6. Field notebook transcribed into permanent record notebook containing notes, diagrams, handouts, supplemental materials, filmstrips or movies.

Results

Students obtain an understanding of their biotic environment. They learn organisms, plants, animals, relationships between and complexities of local habitats.

Students have completed a worthwhile science course, earned one credit, have knowledge of career opportunities, and visited local businesses, parks, nature conservancies, junior college and university campuses.

Facilities Available

A. Effingham, Illinois, High School Facilities

1. One large classroom with lab that contains all students, plus teacher.
2. One large classroom without lab facilities, but can contain all students.
3. Library with reference and resource materials.
4. Laboratory equipment, filmstrips, films, slides, microscopes, etc.
5. Effingham High School yard, football fields, and greenhouse.
6. One sixty-six passenger school bus with driver.

B. Effingham, Illinois, Community Facilities

1. Penn-Central and Illinois Central railroads right-of-way.
2. Parks: Effingham Community and Bliss Park are mostly used, but additional neighborhood parks are available.

3. Hikes along sidewalks to identify birds, trees, insects, flowers, weeds or whatever is available.
4. McDevitt's Nursery, Evergreen Drive.
5. Burkland's Greenhouse and Floral Business.
6. K. & M. Floral Shoppe.
7. Hoover's Christmas Tree Farm.
8. Cutright's Conservation Farm.
9. Gowler's Pond.
10. Lake Sara, including Sportsman's Fish Hatchery.
11. Interstate Landscaping Survey and roadsides of Interstate 70 and 57 including prairie grasses restoration areas.
12. Reststops on I 70 and Green Creek Reststop on I 57.
13. Effingham County conservation farm winners including: Mr. & Mrs. Don Schmidt and Mr. & Mrs. Leland Huelskoetter.
14. Helen Matthes Library.
15. Clyde Martin's Beef Farm with slaughterhouse.
16. Lamkinland.
17. Little Wabash River and tributaries.
18. Miller's Green Tree Farm, Rt. 33.

C. State Parks and Nature Conservancies

1. Lincoln Log Cabin Park, Charleston
2. Fox Ridge State Park, Charleston
3. Red Hills State Park, Olney/Sumner

4. Ramsey State Park, Ramsey.

5. Rock Cave Nature Conservancy, Altamont, Route 128.

6. "Wild Cat Hollow", Ida B. Kepley's Nature Conservacy, Mason, Watson area.

7. Hidden Springs State Forest with "Big Tree", Strasburg.

8. Stephen A. Forbes State Park with Sam A. Parr Fish Research Station, Omega.

9. Beall's Woods, Keensburg.

10. Lake Shelbyville with Illinois Natural History Survey Station, Shelbyville.

11. Rend Lake and Forest Area, Ina.

12. Lake Carlyle with Dam on Kaskaskia River, Carlyle to Vandalia.

13. Lake Carlyle Waterfowl Management Station, Hagarstown.

14. Green Creek, Ramsey Cemetery, Northwest of Effingham.

15. State Forestry Nursery, Anna–Jonesboro.

D. Junior Colleges and Universities Cooperation

1. Lakeland Junior College, Mattoon

2. Eastern Illinois University, Charleston

   a. Rocky Branch, Marshall

   b. Fox Ridge State Park Lake, Charleston Fish Research Station

   c. Life Science Building, Charleston (herbarium, animal research, plants)

   d. Campus tour including a snack at Union

3. University of Illinois, Urbana

   a. Allerton Park, Monticello

   b. Brownstown Experimental Farm, Brownstown (crop and forestry research)

   c. Dixon Springs Research Farm, Dixon Springs

E. Other Areas Included in This Section of Illinois

1. Vandalia Junior High School native grasses and conservation tour, Vandalia.
2. Pet Inc., Greenville (industry, careers).
3. Prairie Grass Remnants, Illinois 37 and Illinois Central right-of-way. (The section between Mason and Alma is in the process of placement in Historical Landmarks.)
4. Vandalia Correctional Center, Vandalia.
5. Egyptian Nursery and Landscape Co., or Shamrock Nursery, Farina.
6. Brown Egg and Produce Company, Farina.
7. Lake Nellie or Beal's Campgrounds, St. Elmo.
8. St. Elmo Geological Fieldtrip (earth formation, fossils, gas plant, oil wells, Winter's Rock Quarry, Diller's Tile Co.).
9. Illinois State Museum, Springfield.
10. Hillard Morris Conservation Farm, Mason.
11. Lake Sangchris, Taylorville/Kincaid.

12. Buzzard's Tree Farm, St. Elmo/Brownstown.
13. Kramer's Conservation Tours, Farina.
14. Altamont Lion's Park, Altamont.
15. Schultz's Grain and Feed Co., Dieterich.

F. Missouri

1. Missouri Botanical Gardens, St. Louis.
2. St. Louis Zoo, St. Louis.
3. General Electric Taum Sauk Dam, Ironton, Missouri.
4. Elephant Rocks, Graniteville, Missouri.
5. Bonne Terre Lead Mines, Bonne Terre, Missouri.
6. Johnson's Shut-Ins, Flat River, Missouri.
7. Cotton Mill with Gin, Sikeston, Missouri.

APPENDIX C-7

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APPENDIX D

EARTH SCIENCE

Earth Science
Units of Study

Unit I: Earth in the Universe
- Chapter 1 - Stars
- Chapter 2 - Galaxies
- Chapter 3 - Place and Time
- Chapter 4 - Solar System
- Chapter 5 - Moon and Earth

Unit II: The Earth's Atmosphere
- Chapter 6 - Atmosphere
- Chapter 7 - Sun, Water and Wind
- Chapter 8 - Weather

Unit III: The Earth's Crust
- Chapter 9 - Rocks
- Chapter 10 - Volcanoes
- Chapter 11 - Earthquakes

Unit IV: The Changing Crust
- Chapter 12 - Weathering
- Chapter 13 - Erosion
- Chapter 14 - Deposition
- Chapter 15 - Mountain Building

Unit V: The Earth's History
- Chapter 16 - Geologic Time
- Chapter 17 - Stories in Stone
- Chapter 18 - Development of Life
- Chapter 19 - Man in His Environment

Unit VI: Importance of Earth Science*
- Influence of Earth Science on Daily Life
- Vocabulary, terminology, definitions
- Career possibilities

*This information may be interspersed in each unit throughout the year as it appears in the reading materials or specific topics.

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Accompanying workbook: Laboratory Supplement

Prepared by: Mrs. Norma Grace Hockett Bauer

Earth Science Unit I--Earth in the Universe

Chapter 1--Stars

Goals

After completing this chapter, the student will be able to:

1. describe stars--their sizes, distances, numbers, colors and radiations.
2. use constellations to locate and identify stars.
3. explain how to determine visual magnitude and distinguish it from luminosity.
4. explain the relationship between surface temperature and luminosity of stars by making a scatter diagram.
5. describe how stars are born, what gives then their energy, and the different stages in a star's life history.
6. The student will spell and define vocabulary and important scientists' contributions associated with astronomy.
7. know about careers, their requirements, advantages and disadvantages associated with space and the stars.

Performance Objectives

1. Given a choice, the student will describe ten of the twenty key stars

with their sizes, distances, numbers, colors, and radiation with 77% accuracy.

2. The student will demonstrate the use of constellations to locate stars with 81% accuracy.
3. The student will be able to explain how to determine visual magnitude and distinguish it from luminosity with 85% accuracy.
4. The student will be able by making a scatter diagram to explain the relationship between surface temperature and luminosity of stars with 90% accuracy.
5. The student will describe how stars are born, their energy sources, and the different stages in a star's life history with 85% accuracy.
6. The student will spell, define either orally or written communication, vocabulary and important scientists with their major contributions associated with astronomy with 75% accuracy.
7. The student will be able to classify careers, vocations and avocations connected with space and stars according to their requirements, necessary education, advantages, disadvantages and other pertinent information with 77% accuracy.

Learning Activities

1. Teach via lecture and demonstration stars and space information.
2. Have students give reports on different key stars to all class members.

3. Do workbook exercises about stars as follows:

   1.3 Use of sky maps in Appendix C.

   1.4 How many stars do you see?

   1.5 Magnitude measurement.

   1.5 Stars look bright and dim.

   1.6 Stars have different real brightness.

   1.8 Scatter stars on paper.

4. If possible, have a fieldtrip to McDonnell's Planetarium, St. Louis, Missouri, during a night and day trip so the students may hear more than one program.

5. Visit an astronomer, who owns a telescope on different nights during each season so the students can see the rotation is different during summer, fall, winter and spring.

6. Use current newspapers, magazines or book articles about space and stars.

7. Film F82061U, Stars and Their Systems, is free from Eastern Illinois Cooperative Film Library, Charleston, Illinois.

8. Drill on vocabulary, terminology, definitions, spelling, noted scientists and their contributions with astronomy.

<u>Resource Materials</u>

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Chapter 2--Galaxies

Goals

After completing this chapter, the student will be able to:

1. describe nebulas, where they occur, and how they may form.
2. describe the basic characteristics and groups of galaxies.
3. describe the earth's place in the universe, including the sun, the Milky Way, the Local Group of galaxies, and more distant galaxies.
4. describe electromagnetic radiation in terms of wavelength, frequency, amplitude, and speed.
5. describe the principal kinds of radiational increases or decreases along the electromagnetic spectrum.
6. describe how the redshift is used to indicate that galaxies are moving away from us.
7. describe three current ideas about how the universe originated and developed.

Performance Objectives

1. The student will describe nebulas, where they occur, and how they may form with 80% accuracy.
2. The student will describe the basic characteristics and groups of galaxies with 82% accuracy.

3. The student will describe the earth's place in the universe, including the sun, the Milky Way, the Local Group of galaxies, and more distant galaxies with 81% accuracy.
4. The student will describe electromagnetic radiation, in terms of wavelength, frequency, amplitude, and speed with 77% accuracy.
5. The student will describe the principal kinds of radiational increases or decreases along the electromagnetic spectrum with 81% accuracy.
6. The student will describe how the redshift is used to indicate that galaxies are moving away from us with 81% accuracy.
7. The student will spell and define vocabulary and terminology associated with galaxies with 81% accuracy.
8. The student will describe three current ideas about how the Universe originated and developed with 77% accuracy.

Learning Activities

1. Teach and demonstrate key concepts.
2. Use films F82033U Magnetic Force and F82035U Radio Waves (27 min. from Eastern Illinois Film Cooperative Library, Charleston, Illinois).
3. Obtain other free films from any available sources that discuss galaxies, nebulas, demonstration of parallax and variable star methods of calculating distances, Milky Way, redshift, quasars.
4. Discuss and drill on vocabulary with spelling, definitions and correct

use of terminology.

5. Complete the following demonstrations and experiments from work book:

   2.1 Nebulas and galaxies

   2.5 Demonstration of density of stars in Milky Way

   2.8 Demonstration of parallax and variable star methods of calculating distances.

   2.2 Model nebulae and galaxies.

   2.3 Galaxies come in different shapes.

   2.4 We live inside the Milky Way.

   2.5 Model energy radiations.

   2.8 What is the Redshift?

   2.9 What kind of universe is this?

6. Obtain current newspapers and magazines article about this area. For example: Scientific American articles: Iben, Icko Jr., Globular Cluster Stars, July, 1970; Maran, Stephen, The Gum Nebula, December, 1971; Rees, Martin and Joseph Silk, The Origin of Galaxies, June, 1970; Schmidt, Maaten and Francis Bello, The Evolution of Quasars, May, 1971.

7. If possible, take a fieldtrip to use a telescope to study our Milky Way.

8. Study careers associated with this area.

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Chapter 3--Place and Time

Goals

After completing this chapter, the student will be able to:

1. devise reference systems of points and/or lines for places or things in various two- and three-dimensional situations.
2. state the direct evidence from photographs that the earth turns.
3. explain how places are located on the earth with the geographic reference points of the poles and reference lines of the equator and Prime Meridian.
4. find latitude and longitude of places from globes or maps and locate current data from space mapping activities.
5. describe the time zone system for setting time around the earth.
6. locate objects on sky maps from celestial sphere data, or give the data from the places of objects on sky maps.
7. spell and define important vocabulary words.
8. study careers associated with time and place. Should astronauts be included in this group of careers?

Performance Objectives

1. Given a globe, pictures of space galaxies, Fayette County Plat Book,

or other information, the student will devise reference system of points and/or lines for places or things in various two- and three-dimensional situations with 80% accuracy.

2. The student will state the direct evidence from photographs that the earth turns with 77% accuracy.
3. The student will demonstrate how places are located on the earth with the geographic reference points of the poles and the reference lines of the equator and Prime Meridian with 80% accuracy.
4. The student will locate latitude and longitude of places from globe or maps and locate places on globes or maps from latitude and longitude data with 77% accuracy.
5. The student will describe the time zone system for setting time around the earth with 85% accuracy.
6. The student will locate objects on sky maps from celestial sphere data, or give the data from the places of objects on sky maps with 82% accuracy.
7. The student will spell and define important vocabulary works with 80% accuracy.
8. The student will be able to describe careers, associated with time and place with 80% accuracy.

Learning Activities

1. Teach concepts with text, workbook, globes, celestial globes, sky

maps, topographic maps, photographs, Fayette County Plat Book, space photographs, clocks, time zone markers, etc.

2. The following free films are available from Eastern Illinois Film Cooperative Library, Charleston, Illinois 61920:

   F82028U The Force of Gravity (27 min.)

   F82046U Latitude, Longitude, and Time Zones (14 min.)

   F82047U Charting the Universe (13 min.)

   F82048U The Van Allen Radiation Belts (17 min.)

   F82059X Rockets, How They Work (18 min.)

3. Drill on vocabulary, definitions, globes, maps terminology.

4. Use current magazines, newspapers, travel guides or other available materials on this Chapter 3.

5. Fieldtrip might be an area that is currently surveying or a surveyor to speak on his job and the knowledge needed to make the survey job correct and complete. Airline pilots might tell the influence of flying across time zones as the crew travels through one time zone and then another on the flights. Why are there rules enforced about pilots resting a time period before flying on or returning to the home base?

6. Complete the workbook activities as follows:

   3.2 Locating points on a sphere

   3.3 Appendix 1, Earth's celestial pole and time of rotation

3.5 Positions of spacecraft in orbit

3.8 Time zones adjust time to the sun

3.8 Appendix K, Local Sun Time

3.10 The Celestial-sphere reference system

3.10 Use of declination and ascension

3.1 How are Places located?

3.2 Locate placed on a ball like the earth

3.4 Latitude and longitude tell where you are

3.5 Make a space flight around the earth

3.6 How well can you judge time?

3.7 Time is measured and set

3.9 Measuring the Altitude of Polaris

7. Optional activities might include letting the students make early time pieces, experiment with early clocks replicas or attempt to find a new method of measuring time as the metric system becomes common in America.

Material Resources

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"The Unveiling of Venus: Hot and Stifling," Science News, Vol. 109, June 19, 1976, pp. 388-389.

"Viking Life Experiments: Pointing Toward Biology," "A Landing Site for Viking 2," Science News, Vol. 110, August 28, 1976, pp. 132-133.

"Viking Life Search: Tantalizing Signs and an Agonizing Wait," Science News, Vol. 110, August 14, 1976, pp. 99-101.

The Viking Mission, Mission to Land On Mars, NF-62/6-75, NASA FACTS, Superintendent of Documents, U.S. Government Printing Office, Washington, D.C.

"Viking 2's View of Utopia: A Rock-Strewn Martian Plain," Science News, Vol. 110, September 11, 1976, pp. 164-165.

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Chapter 4--Solar System

Goals

After completing this chapter, the student will be able to:

1. name the planets in their order from the sun, distinguish the rocky planets and gas giants, and give an approximate idea of their size.
2. describe the ecliptic and zodiac and tell how planets move on the ecliptic and why.
3. state the law of gravitation simply, in terms of how mass and distance affect the attraction between the two bodies.
4. describe some of the physical characteristics of each of the planets.
5. explain the evidence that there may be other planetary systems like our solar system.
6. learn to spell correctly, define, and use vocabulary correctly.

Performance Objectives

1. The student will name the planets in their order from the sun, distinguish the rocky planets and gas giants, and give an approximate idea of their size with 80% accuracy.
2. The student will describe the ecliptic and zodiac and tell how planets move on the ecliptic and why with 80% accuracy.

3. The student will state the law of gravitation simply, in terms of how mass and distance affect the attraction between two bodies with 77% accuracy.
4. The student will describe some of the physical characteristics of each of the planets with 80% accuracy.
5. The student will explain the evidence that there may be other planetary systems like our solar system with 77% accuracy.
6. The student will spell, define, and use vocabulary correctly, with 84% accuracy.

Learning Activities

1. Teach key information with discussion, lecture, and demonstration.
2. The following free movies are available from the Eastern Illinois Film Cooperative, Charleston, Illinois 61920:

   F82003U Eclipses of the Sun and Moon (11 min.)

   F82012U Space Probes: Exploring Our Solar System (11 min.)

   F82024U Cosmic Rays (27 min.)

   F82034U The Nearest Sun (Sun and Solar Activity) (27 min.)

   F82039U The Shape of the Earth (27 min.)

   F82040U Universe (28 min.)

   F82062X The Solar System--Its Motions (11 min.)

   F82070X Rockets--Junior Missile Men in Action (15 min.)

   F83031U History and Development of Rockets (16 min.)

   F83036U Race For Space (55 min.)

3. Additional free films, filmstrips, slides, transparencies, tapes, scripts, transcriptions, charts, exhibits, magazines, posters, and other printed materials may be obtained from:

   NASA Educational Center, Cleveland, Ohio and/or

   Educators Guide to Free Science Materials, Educators Progress Service, Inc., Randolph, Wisconsin 53956 (use current issue).

4. If possible, go on a fieldtrip to McDonnell's Planetarium, St. Louis, Missouri.

5. Southern Illinois University (Carbondale and Edwardsville campuses), Eastern Illinois University (Charleston), and University of Illinois (Champaign/Urbana) often have free programs to which area high school students are invited. If possible, the instructor and class members should attend the programs when they are available.

6. Complete the experiments from text as listed:

   4.1 Model the solar system yourself.

   4.2 Where do the Planets appear in the sky?

   4.3 Planets wander in the sky.

   4.4 How and why do the planets move?

   4.5 Measure the size of the sun.

   4.7 What are the planets like?

   4.9 What is happening to the sun?

7. Drill on vocabulary, terminology, definitions and spelling.

8. Current magazines and newspapers articles should be used for additional pertinent information.

Material Resources

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Chapter 5--Moon and Earth

Goals

After completing the activities in this chapter, the student will be able to:

1. use models of natural events and processes, effectively and understand how models can be used to answer many questions.
2. describe the positions of the earth, moon, sun, during the lunar month as the moon passes through its phases and as solar and lunar eclipses occur.
3. describe the actual and relative sizes of earth and moon, and the paths they follow around the sun.
4. describe various gravitational reactions between the earth and moon that make tides on earth, bands on seashells, and quakes on the moon.
5. describe some of the differences between terrestrial and lunar landscapes and explain the meteoritic and volcanic processes that shaped lunar features.

Performance Objectives

1. The student will use models of natural events and processes effec-

tively and understand how models can be used to answer many questions with 85% accuracy.

2. The student will describe the positions of the earth, moon and sun during the lunar month as the moon passes through its phases and as solar and lunar eclipses occur with 81% accuracy.
3. The student will describe the actual and relative sizes of earth and moon and the paths they follow around the sun with 80% accuracy.
4. The student will describe various gravitational reactions between the earth and moon that makes tides on earth, bands on seashells, and quakes on the moon with 77% accuracy.
5. The student will describe some of the differences between terrestrial and lunar landscapes and explain the meteoritic and volcanic processes that shape lunar features with 80% accuracy.

Learning Activities

1. Teach with discussions, lecture, and demonstrations the key concepts.
2. Complete the workbook experiments as follows:
   - 5.1 Make the moon's shapes.
   - 5.2 What paths do earth and moon follow?
   - 5.3 Earth and moon are called a double planet. Why?
   - 5.5 What do lines on seashells tell?
   - 5.7 Make some lunar landscapes.
3. Free films available from Eastern Illinois Film Cooperative are

F82071X Mission to the Moon--Gemini 6 & 7 (13 1/2 min.)

F82072X Moon--In and Out of the World; Gemini 8, Luna 9 (13 1/2 min.)

F82073X Moon--Spaceport, Destination Moon (15 min.)

F82074X Moon--Apollo Project--Saturn 5 (13 min.)

F82075X Moon--The Flight of Apollo 7 (13 1/2 min.)

F82076X Moon--Walk on the Moon (14 min.)

F82077X Moon--A Visit to Fra Mauro (14 min.)

F82078X Moon--Flight of Apollo 15 (14 min.)

F82083X Stepping Stones in Space (15 min.)

4. Additional free films and other materials may be obtained from:

   NASA Educational Center, Cleveland, Ohio and/or

   The Educator's Guide to Free Science Materials, Educators' Progress Service, Inc., Randolph, Wisconsin 53956

5. Use current newspaper and magazine articles about recent space exploration.

6. LHS transparency #56 -- The Moon.

7. Drill on terminology, vocabulary, definitions, and spelling.

8. When available in our area, attend any NASA displays and hear speakers.

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Earth Science Unit II--The Earth's Atmosphere

Chapter 6--Atmosphere

Goals

After completing the activities of this chapter, the student will be able to:

1. describe and give his own examples of fields, and describe the magnetic and gravitational fields of the earth.
2. describe and illustrate the magnetosphere formed as the earth moves through the solar wind.
3. explain how temperature, pressure, and composition of the atmosphere vary with increasing height above the earth's surface.
4. describe the principal heavy gases mixed in the air and the layers of gases at greater heights.
5. describe air pressure and water vapor in the air at and near the earth s surface.

Performance Objectives

1. The student will describe and give his own examples of fields, and describe the magnetic and gravitational fields of the earth with 77% accuracy.

2. The student will describe and illustrate the magnetosphere formed as the earth moves through the solar wind with 80% accuracy.
3. The student will explain how temperature, pressure, and composition of the atmosphere vary with increasing height above the earth's surface with 80% accuracy.
4. The student will describe the principal heavy gases mixed in the air and the layers of gases at greater heights with 80% accuracy.
5. The student will describe air pressure and water vapor in the air and near the earth's surface with 80% accuracy.

Learning Activities

1. Teach via discussion, lecture, and demonstrations the main concepts.
2. Obtain the free films from Eastern Illinois Film Cooperative as follows:

   F82027U The Flaming Sky (17 min.)

   F82036U Research by Rockets (27 min.)

   F83064X Exploring Electromagnetic Energy (15 min.)

   F83089X Air Pollution--Autos in America (13 min.)
3. Complete experiments in the workbook with the text:

   6.1 A Magnet makes its own field.

   6.2 Model the earth's magnetic field.

   6.3 The solar wind shapes the magnetic field.

6.5 What goes on in the Atmosphere?

6.6 How much Oxygen is in the air?

4. Use current magazines, newspapers and reference books to obtain current pertinent information.

5. Drill on terminology, vocabulary, definitions with spelling.

6. If possible, visit Scott Air Force Base for a fieldtrip so their weather alert (worldwide) and experimental plane research may be developed in the student's knowledge.

7. Study careers associated with this area of earth science.

Material Resources

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Chapter 7--Sun, Water, Wind

Goals

After completing the chapter, the student will be able to:

1. describe and give examples of the ways in which heat energy is transferred.
2. explain why the heat energy coming to the earth varies with the seasons.
3. describe the relationship between solar radiation and broad climate zones.
4. explain the paths followed by water in its various forms through atmosphere.

Performance Objectives

1. The student will describe and give examples of the ways in which heat energy is transferred with 80% accuracy.
2. The student will explain why the heat energy coming to the earth varies with the seasons with 75% accuracy.
3. The student will describe the relationship between solar radiation and broad climate zones with 77% accuracy.
4. The student will explain the paths followed by water in its various forms through the water cycle with 77% accuracy.

5. The student will explain the formation of high and low pressure eddies in the atmosphere with 75% accuracy.

Learning Activities

1. Teach via discussion, lecture, and demonstration this knowledge.
2. Use the following free films from the Eastern Illinois Film Cooperative, Charleston, Illinois:

    F82023U Challenge of the Oceans (27 min.)

    F82025U Energy from the Sun (17 min.)

    F91063U Pacific Northwest--Putting Water to Work (19 min.)

    F91137X Wild River--A Family Adventure (25 min.)

3. Use LHS record 92 -- Life of Sea-Open Sea

    LHS Filmstrips #96 -- Life of the Open Seas

    #97 -- Life of the Sea Floor and Shore

4. Drill on terminology, vocabulary, definitions and spelling.
5. Use LHS Transparencies # 32 & 33 -- Water Resources

    # 48 -- Water, Air and Heat

6. Illinois Geological Survey Circulars available include:

    207 Ground Water in Northwestern Illinois

    212 Ground Water Geology in Southern Illinois

    222 Ground Water in Western Illinois North Part

    232 Ground Water in Western Illinois South Part

    225 Ground Water in South-Central Illinois

    248 Ground Water in East-Central Illinois

7. Fieldtrips may be to creeks, rivers, lakes, ponds or other water resources.

8. Use current magazines and newspapers and file clippings on pertinent data pertaining to this unit.

9. Complete the following experiments in workbook:

   7.1 Make an earthbox to sample data for the sun and atmosphere model.

   7.5 Air moves by convection.

   7.8 and 7.9 Prevailing Winds and the Coriolis Effect.

   7.10 Climate activity.

   7.3 Heating of the earth varies.

   7.6 You can move water through air.

   7.7 What changes happen in the water cycle?

10. If possible, visit an oil well or water well digging site or in the oilfield where waterflooding is occurring to produce more oil. Have speakers knowledgeable in these areas.

11. Study careers associated with sun, water and wind studies.

Materials Resources

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Chapter 8--Weather

Goals

After completing the work in this chapter, the student will be able to:

1. describe the main components of the weather and explain a number of the varying conditions that determine it.
2. explain how the varying conditions related to weather are measured.
3. describe the conditions that are most reliable for a weatherman in predicting the weather in his local area.
4. read and explain weather maps as they appear in the local newspapers and on TV weather reports.
5. explain how air masses, fronts, and cyclones are related to weather.
6. describe the character of some of the more extreme forms of the weather: such as thunderstorms, hurricanes, and tornadoes.

Performance Objectives

1. The student will describe the main components of the weather and explain a number of the varying conditions that determine it with 84% accuracy.
2. The student will explain how the varying conditions related to weather are measured with 81% accuracy.

3. The student will describe the conditions that are most reliable for a weatherman in predicting the weather in his local area with 81% accuracy.
4. The student will read and explain weather maps as they appear in local newspapers and on TV weather reports with 92% accuracy.
5. The student will explain how air masses, fronts, cyclones, are related to the weather with 88% accuracy.
6. The student will describe the character of some of the more extreme forms of the weather such as thunderstorms, hurricanes, and tornadoes with 80% accuracy.

Learning Activities

1. Teach via discussions, lectures, and demonstration the chapter information.
2. Use LHS Filmstrip #20 - Changes in the weather.
3. Complete workbook activities as follows:

    8.1 Weather maps and forecasting.

    8.4 Conclusions to be drawn from the weather chart.

    8.5 The air mass concept.

    8.6 Weather fronts.

4. Use LHS Transparencies #29, Mapping a Temperature Field

    #55, Weather

5. Free films offered at Eastern Illinois Film Cooperative, Charleston,

Illinois, include:

F82017U Weather Satellite (15 min.)

F82020X What Makes the Wind Blow?

F82031U The Inconsistent Air (Weather and Climate) (27 min.)

F82090U Urban Impact on Weather and Climate (16 min.)

6. Drill on terminology, vocabulary, definitions, and spelling.
7. Use current magazines, newspapers, or pamphlets in files for up-to-date pertinent information.
8. If possible, obtain a meteorologist to speak to Hi-Sci-Ki Members and earth science class members.
9. Subscribe to "Daily Weather Maps" Weekly series, cost--$7.50 from Weather Service, Superintendent of Documents, U.S. Printing Office, Washington, D.C. 20402.

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Earth Science Unit III--The Earth's Crust

Chapter 9--Rocks

Goals

After completing this chapter, the student will be able to:

1. explain how igneous, sedimentary, and metamorphic rocks are formed.
2. classify common rock samples as sedimentary, igneous or metamorphic.
3. explain and demonstrate how crystal size relates to cooling rate in igneous rocks.
4. explain and demonstrate how sediment can be cemented together to form sedimentary rocks.
5. describe how fossil molds and casts are formed.
6. explain or demonstrate how banding and crystal orientation becomes a distinguishing characteristic of some metamorphic rocks.
7. spell and define vocabulary and terms used to identify rocks and minerals.

Performance Objectives

1. The student will explain orally or in writing how igneous, sedimentary and metamorphic rocks are formed with 85% accuracy.

2. The student will classify common rock samples as sedimentary, igneous or metamorphic with 77% accuracy.
3. The student will explain and demonstrate how crystal size relates to cooling rate in igneous rocks with 90% accuracy.
4. The student will explain and demonstrate how sediment can be cemented together to form sedimentary rocks with 90% accuracy.
5. The student will describe how fossil molds and casts are formed with 90% accuracy.
6. The student will explain or demonstrate how banding and crystal orientation become a distinguishing characteristic of some metamorphic rocks with 77% accuracy.
7. The student will spell and define vocabulary and terms used to identify rocks and minerals with 90% accuracy.

Learning Activities

1. Teach via lecture and demonstration rock and mineral information. Use labelled specimens of rocks and minerals.
2. Have students give reports on specific rocks and minerals to classmates in entire class.
3. Have students collect and identify rocks and minerals from local areas. If possible, use fieldtrips to different environments: rolling hillsides, creeks, rivers, coalmines, rock quarries, prairies, swamps.

4. Use fossils that are found or available to teacher and students.

5. Do workbook exercises about rocks:

    9.1 Examining rocks and minerals.

    9.1 Rocks are made of minerals.

    9.4 Make rocks from melted minerals.

    9.5 Cooling rate affects the size of crystals in a rock.

    9.6 Rocks are broken down and carried away.

    9.7 Cemented sediment make sedimentary rocks.

    9.8 Dissolved animal shells can cement sediment.

    9.9 Some sedimentary rocks need no cement.

    9.10 Sedimentary rocks contain records of the past.

    9.12 Sedimentary rock may become another kind of rock.

    9.13 Igneous rock can also be changed.

6. Use current movies on rocks. The following are available from Eastern Illinois Film Cooperative Library:

    F82010X Rocks that Form on the Earth's Surface (17 min.)

    F82069X Rocks that Originate Underground (16 min.)

7. Use LHS Filmstrips: #80 Hunting Fossils

    #81 Up Through the Coal Age

    #84 Stories that Fossils Tell

8. Use Transparencies #26 Rocks and Minerals.

9. The following pamphlet aids are from: Illinois Geological Service:

#4 Guide for Beginning Fossil Hunters

#7 Guide for Geologic Map of Illinois

#8 Industrial Mineral and Metals of Illinois

#9 Inside Illinois--Mineral Resources

#10 History of Illinois Mineral Industries. Origin of Geodes

Bulletin #91 Handbook on Limestone and Dolomite

Bulletin #21 Illinois Mineral Production by Counties--1966

Bulletin #321 Uses of Limestone and Dolomite

Bulletin #418 Mineral Production in Illinois in 1966

Bulletin #233 Pottery Clay Resources of Illinois

10. Fayette County Surface Water Resources, Illinois Department of Conservation, Division of Fisheries, Springfield, Illinois 62706

11. If possible, attend an Illinois Geological Fieldtrip during the spring or fall.

12. If possible, have a fieldtrip to Lutz Molding Sand and Gravel Business in western Fayette County. It has been owned for four generations of the same family and is one of two molding sand businesses in Illinois, at Mulberry Grove, Illinois.

Materials and Resources

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Zim, Herbert S. and Paul R. Shaffer, Rocks and Minerals, pp. 1-160.

Chapter 10--Volcanoes

Coals

After completing this chapter, the student will be able to:

1. explain and demonstrate that minerals expand when they melt.
2. explain and demonstrate that minerals expanding can force the melted rock to the surface of the earth.
3. show with aid of a map and data that volcanic activity takes place in certain areas forming a pattern around the earth.
4. demonstrate that volcanic eruptions cannot be accurately predicted through the use of past records of activity.
5. explain modern methods of attempting to predict future volcanic eruptions.
6. identify volcanic rock samples by sorting a few of the more common types from a mixture of volcanic and nonvolcanic samples.

Performance Objectives

1. The student will explain and demonstrate that minerals expand when they melt with 85% accuracy.
2. The student will explain and demonstrate how expanding minerals can force melted rock to the surface of the earth with 77% accuracy.

3. The student will show with aid of a map and data that volcanic activity takes place in certain areas forming patterns around the earth with 80% accuracy.
4. The student will demonstrate that volcanic eruptions cannot be accurately predicted through the use of past records of activity with 85% accuracy.
5. The student will explain modern methods of attempting to predict future eruptions with 85% accuracy.
6. The student will identify volcanic rock samples by sorting a few of the more common types from a mixture of volcanic and nonvolcanic samples with 80% accuracy.

Learning Activities

1. Teach via lecture and demonstration volcanic information, including the formation of islands by volcanoes' actions.
2. Use Film F82002X, The Earth in Change: The Earth's Crust (16 min.), from Eastern Illinois Film Cooperative, Charleston, Illinois.
3. Do workbook exercises and demonstrations about volcanoes.

   10.1 Melted minerals take up space.

   10.2 Melted minerals build up pressure.

   10.5 Gases in magma leave holes.

   10.6 The dissolved materials can kill.

   10.7 The "Where" for an eruption is no secret.

   10.8 The "When" for an eruption is difficult to predict. Skullduggery.

4. Identify volcanic rock samples by sorting a few of the more common types from a mixture of volcanic and nonvolcanic samples.

5. Current newspapers, magazines, or pamphlets on volcanoes or articles found in the files.

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Rapp, George Jr., Color of Minerals, Boston, Houghton Mifflin Company, 1971.

Chapter 11--Earthquakes

Goals

After completing this chapter, the student will be able to:

1. relate earthquakes to movements beneath the surface of the earth.
2. demonstrate, using data and a map, that earthquakes epicenter patterns match patterns of volcanic activity.
3. explain and demonstrate how energy results and travels from the breaking of a rock layer.
4. explain the difference between two types of earthquake waves.
5. explain and demonstrate how to locate epicenters of earthquakes by using seismograph tracings and information of wave-travel speed.
6. spell and define vocabulary and terminology used to identify and correctly discuss earthquakes and their activities.

Performance Objectives

1. The student will explain orally or in writing how earthquakes relate to movements beneath the surface of the earth, with 80% accuracy.
2. The student will demonstrate, using data and a map, that earthquakes epicenter patterns match patterns of volcanic activity with 90% accuracy.

3. The student will explain and demonstrate how energy results and travels from the breaking of a rock layer with 85% accuracy.
4. The student will explain the difference between two types of earthquake waves with 90% accuracy.
5. The student will explain and demonstrate how to locate epicenters of earthquakes by using seismograph tracings and information of wave-travel speed with 75% accuracy.
6. The student will spell and define vocabulary and terminology used to discuss earthquakes with their activities with 85% accuracy.

Learning Activities

1. Teach via lecture and demonstrations the information on earthquakes.
2. Arrange a fieldtrip to the New Madrid earthquake fault in Southeast Missouri and Southern Illinois. If that is impossible, attempt to arrange for a guest speaker from Southern Illinois University, Carbondale, Illinois. Dr. Jones, or Dr. Roger Robinson are excellent or somebody else associated with the statistics and research may be available.
3. Do workbook exercises about earthquakes:

   11.2 A fault box for land in earthquake areas moves up and down.

   11.1 Earthquakes change the earth's surface.

   11.5 Sensitive instruments detect earthquakes.

11.7 Energy is released when a rock breaks.

11.8 The released energy shows up elsewhere.

11.9 Suggested diagrams for illustrating how energy is transferred in P and S waves.

11.10 Energy can be passed along by rows of particles.

11.13 Three Seismographs can determine the epicenter of an earthquake.

4. Use film: F82068X, Waves on Water (16 min.) from Eastern Film Service Cooperative, Charleston, Illinois.

5. Attempt to locate more and newer films depicting earthquake disasters from all over the world from other free film sources.

Materials and Resources

"A Bad Year for Earthquakes," Current Science, Vol. 62, No. 4, October 20, 1976, p. 13.

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The San Andreas Fault, U.S. Department of Interior Geological Survey, GPO-1969-0-357-269.

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Everhardt, Gary, "Pinnacles National Monument on the Move," (moved two hundred miles northward from original position because of location on San Andreas Earthquake Fault), St. Louis Globe-Democrat, September 20-21, 1975, p. 9A.

"Focal Depth of Earthquake," (includes map), Effingham, Illinois, Effingham Daily News, December 28, 1976, p. 21.

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Earth Science Unit IV--The Changing Crust

Chapter 12--Weathering

Goals

After completing this chapter the student will be able to:

1. illustrate the natural tendency for things to become disordered.
2. explain the difference between chemical and mechanical weathering, listing agents, and examples for each type.
3. associate mechanical and chemical weathering with the deterioration of materials around him and his home.
4. explain why water can be called the most versatile of the weathering agents.
5. explain how a soil is formed from hard rock.
6. explain differences in soils and reasons for the differences.
7. identify, spell and write definitions of terms associated with weathering.

Performance Objectives

1. The student will be able to illustrate the natural tendency for things to become disordered with 85% accuracy.
2. The student will explain orally or in writing the difference between

mechanical and chemical weathering, listing agents and examples of each type with 80% accuracy.

3. The student will associate mechanical and chemical weathering with the deterioration of materials around him and his home with 90% accuracy.
4. The student will explain why water can be called the most versatile of the weathering agents with examples with 85% accuracy.
5. The student will explain how a soil is formed from hard rock with 80% accuracy.
6. The student will explain differences in soils and reasons for the differences with 80% accuracy.
7. The student will identify, spell and write definitions of terms associated with weathering with 85% accuracy.

Learning Activities

1. Teach via lecture and demonstration the data and information on weathering.
2. Take field trips about the schoolyard, interstate 57 interchange, the Cliffs, and Rock Cave to show actual examples of mechanical and chemical weathering. If this is not feasible, have student bring as many examples as each can place in a large grocery bag and discuss the assortment of materials that each student brings to the lab.
3. Drill on vocabulary, terms and definitions.

4. Complete workbook exercises about weathering as listed:

   12.4 Mechanical weathering activity.

   12.7 The solubility of calcium carbonate.

   12.6 Chemicals act as weathering agents.

   12.8 What does the soil contain?

   12.10 There are many types of soil.

5. If possible to schedule, show the following free films from Eastern Illinois Film Cooperative, Charleston, Illinois:

   F82029U Glaciation

   F82038U Secrets of the Ice

6. If possible, take the students on a Saturday with Illinois Geological Survey Guide Leaflet #70 of St. Elmo Area and other parts of Fayette and Effingham Counties and ends at Rock Quarry at Iola. (This fieldtrip is also mentioned in another unit as the data is vast and overlaps several of the earth science units.)

   There is also an excellent fieldtrip in the Vandalia, Illinois, area that the Illinois Geological Survey prepared a guide that shows many earth changes because of the Kaskaskia River flowing through the area. There have been magnificent changes since the Shelbyville and Carlyle Dams were placed in the River for flood control. The Corp of Illinois Engineers has excellent pamphlets available with one copy per teacher for student use.

Materials and Resources

Bertin, Leon, Larousse Encyclopedia of the Earth, pp. 117-136.

Dukert, Joseph M., "World of Ice," (Antarctica), The Lamp, Vol. 53, No. 2, Summer, 1971, pp. 1-4.

Fayette County, Surface Water Resources, Illinois Department of Conservation, Division of Fisheries, Springfield, Illinois 62706.

Hammond, Inc., Earth and Space, pp. 83-95.

Leet, L. Don and Sheldon Johnson, Physical Geology, Englewood Cliffs, New Jersey, Prentice-Hall, Inc., 1971.

Longwell, Chester R. with Richard Foster Flint and John E. Sander, Physical Geology, pp. 135-182.

Navarra, John Gabriel and Arthur N. Strahler, Our Environment in Space, pp. 330-340.

Pearl, Richard M., 1001 Questions Answered About Earth Science, pp. 263-299.

Soil--

"New Soil Cycle," Science News, 107:37-8, January 18, 1975.

"Baring High-Albedo Soils by Overgrazing: A Hypothesized Desertification Mechanism," J. Otterman, Science, 186:531-3, November 8, 1974

"Soils of the Tropics and the World Food Crisis," P. A. Sanchez and S. W. Buel, Science, 188:598-603, May 9, 1975.

Strahler, Arthur N., The Earth Sciences, New York, Harper and Row, 1971.

Winchester, James H., "Men of the Mississippi," (pilots work and know the Mississippi River), Lamp, Vol. 53, No. 2, Summer, 1971, pp. 12-17.

Xerox Education Publications, Education Center, Columbus, Ohio 43216, has excellent supplemental materials in the following:

Number 576	Designing For the Future	50¢
Number 347	The Earth and Its Story	50¢
Number 343	Weather and You	50¢
Number 364	Physical Geography	50¢

Number 370 The Conservation Story 50¢
Number 342 Secrets of the Sea 50¢
(This material includes information for many earth science units as well as on this particular unit.)

If possible, have each student purchase an annual subscription to Current Science, ($1.50 for 28 issues during the school year), Xerox Corporation, 245 Long Hill Road, Middletown, Connecticut 06457, because each issue contains current pertinent science data in all areas of science.

Information on careers and vocations may be obtained from:

Career Opportunities, Career Information Service, New York Life Insurance Company, Box 51, Madison Square Station, New York, New York, 10010.

Allied Health Education Programs, Health Delivery Systems, Inc., 6-7 North Grand Boulevard, St. Louis, Missouri 63103 (cost: $1.00)

Occupational Outlook Handbook, Current Edition, U.S. Department of Labor, Bureau of Labor Statistics, (Cost: $6.85), Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

Chapter 13--Erosion

Goals

After completing this chapter, the student will be able to:

1. explain and demonstrate those factors that limit the water available for eroding.
2. explain and describe conditions that increase or decrease a stream's ability to erode.
3. list the features that distinguish old streams from young streams.

Performance Objectives

1. The student will explain and demonstrate those factors that limit the water available for eroding, with 80% accuracy.
2. The student will explain and describe conditions that increase or decrease a stream's ability to erode with 82% accuracy.
3. The student will list the features that distinguish old streams from young streams with 80% accuracy.
4. The student will spell, define and use correctly the terminology for erosion with 85% accuracy.

Learning Activities

1. Teach via lecture and demonstration the data and information concerning erosion.

2. If possible, take a fieldtrip throughout LaGrove Community Unit #206 showing examples of erosion and places where erosion is being controlled. If this is impossible, use Mrs. Bauer's 2 x 2" conservation slides on erosion and conservation.
3. Drill on vocabulary, terms and definitions.
4. Complete a fieldtrip about "Investigating a Stream" via the Town Branch if sufficient water is flowing from the Altamont Road to the bridge across Highway 185 if possible. Stream velocity is greatest or the least on the bends. Does a stream velocity influence erosion? What is a meander study? (Crooked Creek located on Iola/Farina Road has excellent meanders.) Why is it questioned for this lab via the fieldtrip?
5. Complete workbook exercises about erosion as listed:

    13.2 Glaciers push, pull or drag to carry rocks and soil.

    13.5 More water falls on the land than runs off.

    13.7 You can measure pore space and particle size.

    13.8 Flow rate and water held back can be measured.

    13.10 Small streams are usually parts of larger streams.

    13.12 Distributaries develop at the ends of some streams.

    13.13 The faster the stream, the more it erodes.

    13.14 Stream speed depends on the angle of the stream bed.

    13.16 Changing the stream volume changes the stream velocity.

    13.17 Stream erosion decreases with age.

6. Show movies from Eastern Illinois Film Cooperative, Charleston, Illinois, if each may be scheduled:

   F82022X The Beach--A River of Sand (20 min.)

   F82054X Erosion--Leveling the Land (14 min.)

   F82080U The Earth: Action of Rivers (11 min.)

   F82081U The Earth: Coastlines (11 min.)

7. Use records: 89 Seawater Currents and 90 Study of Oceans--Ocean Basins.

8. Use reference file folders, free materials from The Educator's Guide to Free Science Materials (current issue) or any other available materials from Illinois Soil and Water Conservation on this chapter.

Materials and Resources

Bertin, Leon, LaRousse Encyclopedia of the Earth, pp. 93-115.

Bishop, Margaret S., Phyllis G. Lewis and Richmond L. Bronaugh, Focus on Earth Science, Second Edition, pp. 204-285.

Boyer, Robert E., The Story of Oceanography, New York, Harvey House Publishers, 1975.

"Deep Sea Leg 48," (Deep Sea Drilling Project, continental drift), Science News, Vol. 110, July 31, 1976, p. 71.

Erosion--
"That Sinking Feeling," Newsweek, 85:61, February 3, 1975.
"Deep Sea Erosion and Manganese Nodule Development in the Southeast Indian Ocean," J. P. Kennett and N. D. Watkins, Science, 188:1011-13, June 6, 1975.
"Denudation studies: can we assume stream steady state?", S. W. Trimble, Science, 188:1207-8, June 20, 1975.

Falorp, Nelson P., "Long Island's Living Beach," (wind and sea constantly reshape the map of Long Island's south shore, where beaches and inlets refuse to stay in one place), Lamp, Vol. 55, No. 2, Summer, 1973, pp. 20-23.

Glaciers--

"Ice-Age Hunters of the Ukraine," R. G. Klein, Scientific American, 230:96-105, June, 1974.

"Modeling Periodically Surging Glaciers," W. F. Budd and B. J. McInnes, Science, 186:925-7, December 6, 1974.

"Floating Glacial Ice Caps in the Arctic Ocean," W. S. Broecker, Science, 188:1116-18, June 13, 1975.

"Ice Age Blamed on Volcanoes," Science Digest, 77:]3, June, 1975.

"Ice Age and the Galaxy's Spiral Arms," Science News, 108:23, July 12, 1975.

"Weyl's Theory of Glaciation Supported by Isotopic Study of Norwegian Core, K 11," J. C. Duplessy, Science, 188:1208-9, June 20, 1975.

Hammond, Inc., Earth and Space, pp. 128-146.

Hibbs, Albert R. and Albert F. Eiss, Earth-Space Science: Investigating Man's Environment, pp. 301-321.

Hines, Daisy Marie, "Stop the Railroad Trail! Valuable Farmland May Be Turned Over for Public Access, What Are Consequences?", Prairie Farmer, August 21, 1976, p. 63.

Leet, L. Don and Sheldon Judson, Physical Geology, Englewood Cliffs, New Jersey, Prentice-Hall, Inc., 1971.

Longwell, Chester R. with Richard Foster Flint, John E. Sanders, Physical Geology, pp. 253-284.

Navarra, John Gabriel and Arthur N. Strahler, Our Environment in Space, pp. 419-423, 386, 355-357, 360-362, 409-412, 396-403, 377, 380, 227, 32-237, 419-432, 104-106.

Pearl, Richard M., 1001 Questions Answered About Earth Science, pp. 109-142.

"Securing the Dunes: A Study In Coastal Erosion," Friends, February, 1975, pp. 28-29.

Strahler, Arthur H., The Earth Sciences, New York, Harper and Row, 1971.

Taylor, Nancy, T. Daniel Kimbrough and Gerald C. Llewellyn, "An Apparatus to Test Environmental Gases," The American Biology Teacher, Vol. 38, No. 7, October, 1976, pp. 434-435.

Treichel, Jean Arehart, "Life in the Ocean Depths," Science News, Vol. 109, June 19, 1976, pp. 394-395.

Wharton, Don, "Nevada: Strange, Lonesome Land," Reader's Digest, July, 1975, pp. 152-159. (land topography, sand dunes.)

Chapter 14--Deposition

Goals

After completing this chapter, the student will be able to:

1. explain and demonstrate how sediment can be sorted into different particle sizes and mineral types.
2. explain how turbidity currents carry sediment beyond river deltas.
3. demonstrate that an irregular sea floor does not prevent sediment from being deposited in horizontal layers.
4. explain the theory of geosynclines and give the evidence for their existence as coral reefs, sediment depth, and deep-sea treanches.
5. spell, define, and use correctly the terms associated with deposition.

Performance Objectives

1. The student will be able to explain and demonstrate how sediment can be sorted into different particle sizes and mineral types with 90% accuracy.
2. The student will explain how turbidity currents carry sediment beyond river deltas with 85% accuracy.
3. The student will demonstrate that an irregular sea floor does not

prevent sediment from being deposited in horizontal layers with 85% accuracy.

4. The student will explain geosynclines and give the evidence for their existence as coral reefs, sediment depth and deep-sea trenches with 82% accuracy.
5. The student will spell, define and use correctly the terms associated with deposition with 88% accuracy.

Learning Activities

1. Teach via lecture, and demonstration the information and data concerning deposition.
2. During the fieldtrip "Investigating a Stream" from Chapter 13--Erosion, notice the places where the eroded substances are now deposited.
4. Complete the workbook exercises about deposition as listed:
    - 14.2 Different particles sizes settle at different rates.
    - 14.3 Some particles are heavier for their size than others.
    - 14.5 Currents carry sediments far out to sea.
    - 14.6 Turbidity currents can be influenced by conditions in the sea.
    - 14.7 Strong current may spread sediment over the ocean floor.
    - 14.9 Sediment deposition can change the shape of the sea floor.
5. Use film F82004X--Evidence for the Ice Age (19 min.)-- and Record

92--Glacial Valley--Evolution of a Butte.

6. Use LHS filmstrips: #86 - The Glacial Valley

88 - The Limestone Canyon

92 - The Ocena Basins

94 - Currents, Waves, and Tides

95 - The Study of Oceans

Materials and Resources

Bertin, Leon, Larousse Encyclopedia of the Earth, pp. 34-45.

Bishop, Margaret S., Phyllis G. Lewis, and Richmond L. Bronaugh, Focus on Earth Science, Second Edition, pp. 13-62.

Illinois Geological Survey, Glacial Geology, Northeastern Illinois.

Illinois State Water Survey, Box 232, Urbana, Illinois 61801, has many free reports of investigations that may be requested by teachers and other qualified personnel.

The International Decade of Ocean Exploration, A Midterm Review, Superintendent of Documents, U. S. Printing Office, Washington, D. C., 1975, pp. 1-52.

Leet, L. Don and Sheldon Judson, Physical Geology, Englewood Cliffs, New Jersey, Prentice-Hall, Inc., 1971.

Longwell, Chester R., Richard Foster Flint, John E. Sanders, Physical Geology, pp. 1-134, 183-252, 315-424.

Navarra, John Gabriel and Arthur N. Strahler, Our Environment in Space, pp. 438-440, 424-425, 496-499, 362-366, 411-412, 482-484.

Oceans--

"Carbonate Composition Depth: Relation to Carbonate Solubility in Ocean Waters," S. Ben-Yaakov and others, Science, 184: 982-4, May 31, 1974.

"Top Millimeter of the Ocean," F. MacIntyre, Scientific American, 230:62-9+, May, 1974.

"Antarctic Voyage of Discovery," Science News, 105:317, May 18, 1974.

"Famous Project: French-American Mid-Ocean Undersea Study," Time, 103:77, June 17, 1974.

"Quest to the Birthplace of Earth's Crust, Mid-Atlantic Ridge," Science News, 105:349-50, June 1, 1974.

"Who Gets the Ocean's Economic Wealth?", Business Week, June 22, 1974, p. 60.

"Antarctic Waters' Broad and Icy Reach," Science News, 105:399, June 22, 1974.

"Equatorial Jet in the Indian Ocean Theory," J. J. O'Brien and H. E. Burlburt, Science, 184:1075-7, June 7, 1974.

"Long Range Weather Forecasting: Sea Temperatures Anomalies," A. L. Hammond, Science, 184:1064-5, June 7, 1974.

"Undersea Storms: Experiment in the Atlantic: Mid-Ocean Dynamic Experiment," A. L. Hammond, Science, 185:244-7, July 19, 1974.

"Foam Solar Sea Power Plant," C. Zener and J. Fetkovich, Science, 189:294-5, July 25, 1975.

"Ocean Thermal Gradient Hydraulic Power Plant," E. J. Beck, Science, 189:293, July 25, 1975.

"Navy Oceanographic Move: Renewal or Disaster for Basic Research?", D. Shapley, Science, 188:1189-91, June 20, 1975.

"Ever Downward Beneath the Ocean Deep: Ocean Drilling by Glomar Challenger," J. Eberhart, Science News, 107-9, January 4, 1975.

"Mid-Atlantic Ride: Window on the Earth's Core," A. Anerson, Saturday Review World, 2:54+, November 30, 1974.

"Restless Continents: Sea Floor Spreading," W. Sullivan, New York Times Magazine, pp. 12-13+, January 12, 1975.

"Counterclockwise Circulation in the Pacific Subantarctic Sector of the Southern Ocean," R. F. McGinnis, Science, 186:736-8, November 22, 1974.

Schiller, Ronald, "The Growing Menace of Our Sinking Lands," Reader's Digest, September, 1975, pp. 124-127.

Steinkamp, Erwin, "Teen Archeologists Do Their Things," (Kampsville, Koster Dig), Current Science, Vol. 61, No. 4, October 1, 1975.

Steinkamp, Erwin, "Thirsty Pumps Sink U.S. Cities," Current Science, Vol. 61, No. 6, October 22, 1975, pp. 4-5.

Strahler, Arthur N., The Earth Sciences, New York, Harper & Row, 1971.

Tides--

"Tidal Power May Now Make Sense: Proposed Conadaian Tidal Dam at Bay of Fundy," Business Week, November 9, 1974, p. 115.

"Why Is Tide Prediction, In Most Cases, Usually Inaccurate?", Science Digest, 77:77, January, 1975.

Chapter 15--Mountain Building

Goals

After completing this unit, the student will be able to:

1. explain how convection currents may account for the existence of geosynclines.
2. cite evidence in support of the continental drift theory and how it supports the convection theory.
3. explain recent changes in the convection and continental drift theories.
4. explain, with the aid of diagrams, how earthquakes data provides information about the earth's interior in support of the convection theory.
5. spell, define, and use correctly the terms associated with mountain building.

Performance Objectives

1. The student will be able to explain how convection currents may account for the existence of geosynclines with 77% accuracy.
2. The student will cite, orally or written, evidence in support of the continental drift theory and how it supports the convection theory with 80% accuracy.

3. The student will explain recent changes in the convection and continental drift theories with 82% accuracy.
4. The student will explain with the aid of diagrams, how earthquake data provides information about the earth's interior in support of the convection theory with 85% accuracy.
5. The student will spell, define, and use correctly the terms associated with mountain building with 88% accuracy.

Learning Activities

1. Teach via lecture, demonstration the information and data concerning mountain building including convection currents, geosynclines, continental drift theory, earthquakes and volcanoes.
2. Drill on vocabulary, terms, and definitions along with theory explanations.
3. Use LHS Record #91 - Limestone Canyon--Cinder Cone and filmstrips #89 - The Volcanic Cinder Cone

   #91 - The Gypsum Dunes
4. Use the following films from the Eastern Illinois Film Cooperative, Charleston, Illinois, 61920:

   F82032U The Interior of the Earth (14 min.)

   F82066X Why Do We Still Have Mountains? (20 min.)

   F91067U Rocky Mountains Area: Backbone of the Nation (16 min.)

   F91127U Map Skills--Using Different Maps Together (11 min.)

5. Have different students report on the following series of articles from the Scientific American for an excellent background on continental drift theory:

   Hurley, Patrick, "The Confirmation of Continental Drift," April, 1968.
   Dietz, Robert and John Holden, "The Breakup of Panguaea," October, 1970.
   Anderson, Don, 'The San Andreas Fault," November, 1971.
   Dietz, Robert, "Geosynclines, Mountains, and Continent-Building," March, 1972.
   Dewey, John, "Plate Tectonics," May, 1972.
   Newell, Norman, "The Evolution of Reefs," June, 1972.

   (Add any additional current reports on these topics.)

6. Complete the following experiments in workbook as listed:

   15.1 The continents are in balance with the ocean floor.

   15.2 Mountain roots rise as the sea floor sinks.

   15.4 A theory of drifting continents was proposed many years ago.

   15.7 New evidence from the sea floor supports the theory.

   15.12 The earth has an inner core and an outer core.

Materials and Resources

If possible, have Dr. Davy Jones or another qualified expert as a guest speaker from S.I.U., Carbondale, or elsewhere, to discuss the continental drift theory versus convection currents.

Bertin, Leon, Larousse Encyclopedia of the Earth, pp. 187-195.

Bishop, Margaret S., Phyllis G. Lewis, and Richmond L. Bronaugh, Focus on Earth Science, Second Edition, pp. 318-352.

Guiness Book of Records, "Mountains," pp. 116-119.

Hammond, Inc., Earth and Space, pp. 67-71.

Hibbs, Albert R. and Albert F. Eiss, Earth-Space Sciences: Investigating Man's Environment, pp. 309-321, 380-395.

"How Not To Save New Orleans," (New Orleans is sinking/peat deposits), Science News, Vol. 109, June 19, 1976, p. 393.

Longwell, Chester R., Richard Foster Flint, and John E. Sanders, Physical Geology, pp. 51[illegible]-5[illegible].

Navarra, John Gabriel, Arthur N. Strahler, Our Environment in Space, pp. 478-479, 503, 509, 482-484, 454-457.

Earth Science Unit V--The Earth's History

Chapter 16--Geologic Time

Goals

After completing this chapter, the student will be able to:

1. describe four methods of dating objects older than 2500 years.
2. solve simple problems related to tree-ring dating, carbon-14 dating, varve dating, and uranium dating.
3. locate events in the earth's past on a time line representing the 4.5 billion years of the earth's existence.
4. demonstrate to an acquaintance the geologic time chart and its use.
5. explain the truth of analogies like "one million years ago in the life of the earth is like yesterday in the life of man".
6. spell, define, and use accurately terms associated with geologic time.

Performance Objectives

1. The student will describe four methods of dating objects older than 2500 years with 90% accuracy.
2. The student will solve simple problems related to tree-ring dating, carbon-14 dating, varve dating and uranium dating with [illegible] accuracy.

3. The student will locate events in the earth's past on a time line representing the 4.5 billion years of the earth's existence with 82% accuracy.

4. The student will demonstrate to an acquaintance, who is not enrolled in earth science, the geologic time chart and its use with 80% accuracy.

5. The student will explain the truth of analogies like "one million years ago in the life of the earth is like yesterday in the life of man" with 77% accuracy.

6. The student will spell, define, and use accurately terms associated with geologic time with 85% accuracy.

Learning Activities

1. Teach information, help with experiments, and attempt to make the concept about the age of the earth meaningful to the student.

2. Drill on terms, vocabulary, and definitions.

3. Complete the workbook with the following experiments:

   16.5 Carbon atoms place events in time.

   16.7 Important events help organize the earth's history.

4. Use film F82030U - The Hidden Earth (27 min.) from Eastern Illinois Film Cooperative Library, Charleston, Illinois.

5. Use Illinois Geological Survey Bulletin #442 - Glacial Geology of the Vandalia, Illinois Region.

Materials and Resources

Algae, Fossil--
"Fossil Chemicals, Life Among the Ruins, Cyclic Ethers Formed by Stromatolite Materials in the Precambrian," Science News, 107:7, July 5, 1975.

Apes, Fossil--
"Ape Limb Bone from the Oligocene of Egypt: Ulna Attributed to Aegyptopithecus," J. G. Fleagle, Science, 189:135-7, July 11, 1975.

Bishop, Margaret S., Phyllis G. Lewis, and Richmond L. Bronaugh, Focus on Earth Science, Second Edition, pp. 392-433.

Dinosauers--
"Life and Death of the Dinosaur: excerpt from Centennial," J. A. Michener, Reader's Digest, 105:219-23+, November, 1974.
"Dinosaurs Live," Science Digest, 78:15-16, July, 1975.

Dott, Robert H., Jr., and Roger L. Batten, Evolution of the Earth, New York, McGraw-Hill, 1971.

Fannin, Paul, and Hamilton Fish, Jr., "Should We Have A Moraterium On Nuclear Power Plants?", The American Legion Magazine, December, 1976, pp. 22-23.

"Fossils," Earth Science-Environmental Geology Workshop, Summaries and Field Guide, pp. 27-38, October 11 and 12, 1974, Southern Illinois University, Carbondale, Illinois.

Hammond, Inc., Earth and Space, pp. 66-69.

Hancock, Sam, "Importation of Coal Costs (Marion) Illinois 5,000 Mining Jobs," Effingham, Illinois, Effingham Daily News, December 9, 1976, p. 26.

Hibbs, Albert R. and Albert F. Eiss, Earth-Space Science, Investigating the Man's Environment, pp. 364-379, 396-410.

Jackson, Jari, "Mine Safety Practices Improved Since Disaster," St. Louis Globe-Democrat, December 25-26, 1976, p. 2B.

Navarra, John Gabriel and Arthur N. Strahler, Our Environment in Space, pp. 515-520.

"Oldest North American Metazoan Fossils," Science News, Vol. 110, August 21, 1976, p. 123.

Shelton, John S., Geology Illustrated, pp. 246-247.

Simpson, B. R., "Glacial Migrations of Plants: Island BiogeoEvidence," Science, 185:951-3, September 13, 1974.

"Southern Illinois Geological Fieldtrip," Earth Science-Environmental Geology Workshop Summaries and Field Guide, pp. 39-60, October 11 and 12, 1974, Southern Illinois University, Carbondale, Illinois.

Chapter 17--Stories in Stone

Goals

After completing this chapter, the student will be able to:

1. explain how to determine whether or not a rock layer has been overturned.
2. explain and demonstrate how fossils can be used to spot where rock layers are missing from a series of layers.
3. explain and demonstrate with the aid of sketches how several outcrops can be used to construct a geologic history of an area.
4. explain and demonstrate how to interpret geologic maps.
5. interpret the geologic history of the North American continent, given a time line illustrated with maps of North America during the various time periods.

Performance Objectives

1. The student will explain how to determine whether or not a rock layer has been overturned with 85% accuracy.
2. The student will explain and demonstrate how fossils can be used to spot where rock layers are missing from a series of layers with 77% accuracy.

3. The student will explain and demonstrate with the aid of sketches how several outcrops can be used to construct a geologic history of an area with 77% accuracy.
4. The student will explain and demonstrate how to interpret geologic maps with 80% accuracy.
5. The student will interpret the geologic history of the North American continent, given a time line illustrated with maps of North America during the various time periods with 77% accuracy.

Learning Activities

1. Teach information and aid all students with interpretations of illustrations, in textbook, Spaceship Earth-Earth Science.
2. Teach key fossils for different time eras.
3. Complete workbook with the following:
   - 17.1 Interpretation of figure 17/3.
   - 17.7 Interpretation of figures 17/8 and 17/9.
   - 17.8 Interpretation of figures 17/10 and 17/11.
   - 17.9 Making a modeling clay map of New York State with figure 17/14. Rock patterns can be used as clues.
4. Use film F93002X - Cave Dwellers of the Old Stone Age (18 min.) from Eastern Illinois Film Cooperative, Charleston, Illinois 61920.
5. Drill on vocabulary, definitions and key concepts.
6. If possible, take a fieldtrip to road cuts on Interstates 57 and 70 as

they show excellent examples in our own area. The road cuts are beginning to weather but the newer each is, the easier it is to read.

Materials and Resources

Obtain and show film "Stop Destroying America's Past," from State of Illinois, Department of Conservation, Springfield, Illinois.

The following teaching aids are available from Illinois Geological Survey, Urbana, Illinois 61801 (one copy per school):
 Rocks, minerals and fossil set
 Film, "Geology is . . . "
 Ed. Serv. 4: Guide for Beginning Fossil Hunters
 Booklist Fossils (1972) Prehistoric Animals (1972)

Excellent free films are also to be obtained from: Shell Oil Company, Educational Division, P. O. Box 290, Tulsa, Oklahoma 74102

Bertin, Leon, Larousse Encyclopedia of the Earth, pp. 305-412.

Dean, Tom, "Energy Answers," The Workbench, November/December, 1976, pp. 106-107.

Fenton, Carroll Lane, Tales Told by Fossils, Garden City, New York, Doubleday & Company, 1966.

Fenton, Carroll Lane and Mildred Adams, The Fossil Book, pp. 1-465.

Hammond, Inc., Earth and Space, pp. 116-122.

"History's Worst Spill" (oil tanker Argo Merchant spilled 6.5 million gallons of thick industrial oil when grounded on the Nantucket Shoals, Massachusetts), Effingham, Illinois, Effingham Daily News, December 23, 1976, p. 1.

Lindsey, Roland, "Natural Gas Production," Effingham, Illinois, Effingham Daily News, December 15, 1976, p. 4.

Navarro, John Gabriel and Arthur N. Stahler, Our Environment in Space, p. 515.

Rhodes, Frank H. T., Herbert S. Zin, and Paul R. Shaffer, Fossils--A Guide to Prehistoric Life, Golden Science Guide, Racine, Wisconsin, Western Publishing Company, 1962.

Shelton, S. John, Geology Illustrated, pp. 264-293, 48, 83, 33, 49, 32, 42.

If possible, have a guest speaker of a geologist, who works in the oil-fields, who can bring a core and explain what the layers show and the knowledge that the geologist obtains from it.

Chapter 18--Development of Life

Goals

After completing this chapter, the student will be able to:

1. describe how records in the rocks are clues to the development of life.
2. describe the richness of the biosphere, and the influence of the environment on the geographical distribution of organisms.
3. explain how environment and mutations may have determined which creatures have survived.
4. explain how mutations may have helped produce the wide variety of life forms now on the earth.
5. show familiarity with the concept of extinction.
6. demonstrate the vocabulary with definitions and correct usage of terms.

Performance Objectives

1. The student will describe how records in the rocks are clues to the development of life with 85% accuracy.
2. The student will describe vocally or in writing the richness of the biosphere and the influence of the environment on the geographical distribution of organisms with 85% accuracy.

3. The student will explain how mutations may have helped produce the wide variety of life forms now on the earth with 82% accuracy.
4. The student will explain how environment and mutations may have determined which creatures have survived with 82% accuracy.
5. The student will show familiarity with the concept of extinction with 85% accuracy.
6. The student will demonstrate the vocabulary with definitions and correct usage with 77% accuracy.

Learning Activities

1. Teach information and aid all students with interpretations of life development, biosphere in different parts of the world, influence of the environment on the geographical distribution of the plant and animal organisms, mutations and extinction as environment changes.
2. Use free film F81183H - "Early Man in North America" - from Eastern Illinois Film Cooperative, Charleston, Illinois, if it is possible to schedule.
3. If possible, schedule "Born Free" film from some source.
4. Department of Conservation, State of Illinois, State Office Building, 400 South Spring Street, Springfield, Illinois 62706, has many excellent films for this area. Some examples include:

   Alone in the Midst of the Land
   Atonement
   Beaver Valley

Conservation and Balance of Nature
Land of the Prairie Ducks
A Nation of Spoilers
Our Crowded Environment--The House of Man
Our Endangered Species
Soil, Part I, Part II
Our Natural Resources
Problems in Conservation--Water
The Reclaimers
Troubled Waters
What Are We Doing to Our World, Part I and II
Wild River

5. Complete experiments in the workbook as follows:

   18.3 Animal geography

   18.5 The Birdland Puzzle

   18.6 Only Fittest Organisms Survive

6. Drill on vocabulary, definitions, and correct usage.

7. Individual students might give special reports on the animals on animal geography to entire class so they would understand the concept better that the basic reasons for the geographic distribution of a species are: climate, food supply, and evolutionary history. How does natural and artificial barriers influence the plants and animals distribution? How does the building of roads, pipelines, connecting locks and dams, let animal and plant migration and distribution change? If time permits, the birds in the birdland puzzle might be included.

Materials and Resources

Dobshansky, Theodosius, Genetics and the Origin of the Species, (3rd Edition), New York, Columbia University Press, 1951.

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"Measuring Evolution: New Approach Proposed," Science News, 107: 268, April 26, 1975.

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Siehl, G. H., "Environment Update: A Review of Environmental Literature and Developments in 1975," Library Journal, 100:817-22, May 1, 1975.

Simpson, George G., Tempo and Mode in Evolution, New York, Hefner Publishing Company, Inc., 1966.

Skylab Experiments, Volumes 1, 2, 3, 4 National Space and Aeronautics Administration, Washington, D.C. 20546.

Chapter 19--Man In His Environment

Goals

After completing this unit, the student will be able to:

1. explain what is meant by and give examples of dynamic equilibrium.
2. explain how dynamic equilibrium operates in the environment to give the living conditions on which man depends.
3. explain how a system in dynamic equilibrium can be upset to create new equilibrium.
4. characterize the world's population growth.
5. give examples of water pollution, air pollution, noise pollution, visual pollution, thermal pollution, and people pollution.
6. demonstrate how the amount of pollution in the immediate environment can be measured.
7. demonstrate knowledge of vocabulary, definitions, and correct usage of terms and spelling.
8. have knowledge of current status of career possibilities in all fields of environmental education.

Performance Objectives

1. The student will explain orally or in writing what is meant by and give examples of dynamic equilibrium with 77% accuracy.

2. The student will explain how dynamic equilibrium operates in the environment to give the living conditions on which man depends with 77% accuracy.
3. The student will explain how a system in dynamic equilibrium can be upset to create new equilibrium as illustrated with permanent demonstrator as illustrated in textbook, Spaceship Earth-Earth Science, on page 562, with 77% accuracy.
4. The student will give examples and characteristics of world's population growth with 82% accuracy.
5. The student will give examples of water pollution, air pollution, noise pollution, visual pollution, thermal pollution, and people pollution with 86% accuracy.
6. The student will demonstrate how the amount of pollution in the immediate environment can be determined and measured by completing an individual project, writing a brief paper, and presenting it to his classmates with 88% accuracy. Ideas from current magazines, newspapers, or references may be used to decide on the individual test or the student may devise his own.
7. The student will demonstrate orally or in writing his knowledge of vocabulary, definitions, and correct usage terms along with spelling with 77% accuracy.
8. The student will possess knowledge about current status of career and

educational specifications for career possibilities in all fields of environmental education with 84% accuracy.

Learning Activities

1. Teach information along with demonstrations to explain the concept of man's beneficial and harmful effects on the environment and how the environment affects man's life.
2. Drill on vocabulary, definitions, correct term usage along with spelling and career possibilities with educational requirements.
3. Concoct the equilibrium demonstrator, as illustrated in the text on page 562.
4. Use current magazines, newspapers or supplemental materials to obtain current information on man in the environment.
5. Use Transparency #18--"Man Learns to Control His Environment".
6. The following free movies are available from Eastern Illinois Film Cooperative, Charleston, Illinois:

   F82056X House of Man, Part I, Our Changing Environment (17 min.)

   F82082X House of Man, Part II, Our Crowded Environment (11 min.)

   F82089U Man's Effect on the Environment (13 1/2 min.)

   F82096U The Desert (28 min.)

   F83088X Water--A Town That Washes Its Water (12 1/2 min.)

F91034U The American Spectacle (34 min.)

F91061U The Middle Atlantic Seaboard Region--Great Cities--Megalopolis (16 min.)

7. Other free films, filmstrips, books, pamphlets, booklets, or slides may be obtained from other sources.

8. Have fieldtrips to locate water pollution, air pollution, noise pollution, visual pollution, thermal pollution, and people pollution in our own community.

9. Obtain speakers who work with different kinds of pollution to speak to the students on their careers, advantages, disadvantages, educational requirements or other pertinent data and information.

10. Obtain and successfully complete original research on a pollution problem in our community including written report presented to classmates or other interested individuals.

11. Complete experiments in the workbook as follows:

    19.2 Equilibrium demonstrations

    19.5 Temperature Inversion Activity

    19.8 Comparison of heat radiated through smokey air and clean air

    Skullduggery

    We Pollute the Air

    Air pollution activities

Materials and Resources

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Air Pollution Control Association, 4400 5th Avenue, Pittsburgh, Pennsylvania 15213.

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Anderson, Jack, "Taxpayers' Metals Sold at Bargain Prices," St. Louis Globe-Democrat, December 14, 1976, p. 8A.

Answers to Questions You Are Asking about Plastics and the Environment, Plastics Education Foundation, 1913 Central Avenue, Albany, New York 12205.

Aylesworth, Thomas G., Our Polluted World, Xerox Corporation, American Education Publications, 245 Long Hill Road, Middletown, Connecticut 06457, 1972, pp. 1-48.

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"Bats Suffer Delayed Pesticide Effect," Science News, October 23, 1976, Vol. 110, p. 266.

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Boffey, Philip M., "Radioactive Waste Site Search Gets into Deep Water," Science, October 24, 1975, p. 361.

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Carr, Donald E., "The Lost Art of Energy Conservation," The Atlantic, Volume 236, No. 6, December, 1975, pp. 59-70.

Clapper, Louis S., "Congress Compiles Good Conservation Record," National Wildlife, Vol. 9, No. 1, December/January, 1971, p. 46.

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Cox, George W., Ed., Readings in Conservation Ecology, New York, Appleton-Century-Crofts, 1969.

Creative Learning Experiences in Conservation, Soil Conservation Service, U.S. Department of Agriculture, Washington, D.C.

Daly, Dr. Herman E., (Louisiana State University), "Cut Energy Consumption in Half, Economist Says," St. Louis Globe-Democrat, October 14, 1976, p. 12A.

Dental Projects for High School Science Students, American Dental Association, Chicago, Illinois, 1963. Obtain from Science Service, 1719 N Street, N.W., Washington, D.C. 20036.

"Energy Usage--Consumer Recommendations on the Safe Use of Appliances," (free), Association of Home Appliance Manufacturers, 20 North Wacker Drive, Chicago, Illinois 60606.

"Environment: Losing Ground; Pollution and the Poor," Science News, Vol. 109, May 1, 1976, p. 280.

"Environmental Impact Assessment for Effingham County Memorial Airport, Now Available," Effingham, Illinois, Effingham Daily News, December 20, 1976, p. 13.

"Farina Scouts Aid Recycling," Farina, Illinois, Farina News, September 19, 1975, p. 1.

Fee, Rodney J., "Status Report: World Food Situation: Six Billion People Coming to Dinner in Year 2000," Successful Farming, September, 1976, pp. 21, 42.

"Giant Ocean Structures Seen as Power Generators," (concept: Ocean Thermal Energy Conversion), Lloyds Listing Post, Summer, 1975, p. 14.

Guidelines for Conservation Study in Illinois Schools, The Office of Public Instruction, Springfield, Illinois.

Hall, Leonard, "Planning a Future for Spaceship Earth," St. Louis Globe-Democrat, October 23-24, 1976, p. 7E.

Hall, Leonard, "Wide Misunderstanding on Wild Land Needs," St. Louis Globe-Democrat, August 30-31, 1975, p. 5F.

Harte, John, and Robert H. Socolow, Editors, Pattern Earth, New York, Holt, Rinehart, and Winston, Inc., 1971.

Hayes, Denis, "The Fruitful Wasteland," (Rich fertilizers, electric power, and fuels to cook tomorrow's dinner are buried in the garbage), Natural History, November, 1976, pp. 96-99.

Hines, Daisy Marie, "Stop the Railroad Trail! Valuable Farmland May Be Turned Over for Public Access, What Are Consequences?", Prairie Farmer, August 21, 1976, p. 63.

Houston, Walter, You and Your Environment, Part I and Part II, Xerox Corporation, American Education Publications, 245 Long Hill Road, Middletown, Connecticut 06457, 1971.

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The Many Faces of Health Education, American Medical Association, Health Education Materials, 535 North Dearborn Street, Chicago, Illinois 60610.

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National Coal Association, Education Division, 1130 Seventeenth Street, N.W., Washington, D.C. 20036, has Map of Coal Areas of U.S., Coal Wall Charts, Coal and the Environment, Coals in Today's World are examples.

Navarra, John Gabriel and Arthur H. Strahler, Our Environment In Space, pp. 63-84.

Navarra, John Gabriel, Joseph Zafforoni, John Edward Greene, Life in the Environment, Evanston, Illinois, Harper & Row, Publishers, 1973.

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Schwach, Howard, "A Smaller Car in Your Future?", Current Science, Vol. 62, No. 8, December 15, 1976, p. 13.

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Wagner, Richard H., Environment and Man, New York, W. W. Norton, 1971.

Earth Science Unit VI--The Importance of Earth Science*

Influence of Earth Science on Daily Life

Goals

After completing this unit, the student will be able to:

1. through the use of identification or writing or quoting, the student will be able to identify and illustrate reasons that earth science influences his life and environment.
2. to select relationships that exist between man, plants and animals, soil, water, minerals, rocks or fossils, crop production for food, air and other essential needs; space, stars, galaxies, solar systems, moon and earth, atmosphere, sun, water and wind; weather, climate, volcanoes, earthquakes, mountain building, weathering, erosion, deposition, and the influence of the environment.
3. better comprehend the relationships between humans and all organic and inorganic substances found on our planet, Earth.
4. identify the specialized branches of earth science.
5. know career possibilities, requirements, advantages and disadvantages associated with earth science.

*This information may be interspersed in each unit throughout the year as it appears in the reading materials and specific topics. Therefore, the learning activities, materials and resources vary with each unit.

Vocabulary, Terminology, Definitions*

Goals

After completing this unit, the student will be able to:

1. discern that all areas of science including earth science has a stock of words with specific meanings, relevant to that subject.
2. to identify scientific terms with correct meanings, pertaining to each specific topic.
3. use and spell the word correctly in his discussions via writing or verbally quoting the correct meaning for the topic discussed.

Performance Objectives

1. The student will discern scientific terms with definitions with 80% accuracy on each unit on earth science.
2. The student will identify scientific terms with correct meanings, pertaining to each specific topic, with 75% accuracy.
3. The student will use vocabulary correctly in quoting or writing information about the topic. Correct spelling is imperative so the meaning and knowledge are accurate.

*Correct vocabulary, terminology and definitions along with spelling will be taught in each unit. Therefore, the learning activities and materials or resources change as the different topics are studied.

Career Possibilities*

Goals

After completing this unit, the student will be able to:

1. use the different areas of earth science, to explore career possibilities, scientific vocations or avocations.
2. differentiate the value of education including technical, vocational, or requiring academic college credits for the professions.
3. select different scientific workshops, seminars, or summer institutes to participate in pre-career training.

Performance Objectives

1. Given thirty examples of career possibilities, student will be able to differentiate each example in the correct career for science, vocations or avocations with 80% accuracy.
2. Given twenty examples, the student will be able to identify orally or by written communications the value of education including technical, vocational, or professional training with 80% accuracy.
3. The qualified student will be given opportunities to attend and participate in science fairs, JETS summer training programs, Westinghouse Science Talent Search, American Heart Association, or American

*Career possibilities will be stressed throughout the year in all areas and units. Learning activities and resources will vary.

Cancer Society workshops, earth science and conservation workshops or any other available seminars for high school students.

Learning Activities

1. Teach throughout the year during each unit the career possibilities, including educational needs and opportunities.
2. Have speakers from scientific fields to talk to class members or Hi-Sci-Ki Science Club members.
3. Attend Illinois Geological Survey fieldtrips whenever any are close enough for the school students and faculty to attend.
4. Attend seminars at different colleges, universities, industries, or wherever available when possible. (School board, administrator, parents, and student participation must be approved with ample insurance, funding, and necessary items available to the student and faculty member.)
5. Participate in as many fieldtrips in the school community, and elsewhere throughout Illinois, Indiana, Kentucky, Missouri, and Iowa as time and finances allow.
6. Have individual students obtain opportunities to attend and participate in summer training programs in any areas of earth science and/or conservation when finances will allow it. Attempt to obtain monies from additional groups as Fayette County Soil and Water Conservation, service clubs, etc.

7. Obtain as many free or inexpensive materials as possible from any available sources as: Educators' Guide to Free Science Materials (current edition), Educator's Progress Service, Inc., Randolph, Wisconsin 53956.

APPENDIX E

ENVIRONMENTAL SCIENCE

Environmental Science

The Environmental Education Act of 1970 gives the following definition:

> Environmental education means the educational process dealing with man's relationship with his natural and man-made surroundings, and includes the relation of population; pollution, resource allocation and depletion, conservation, transportation, technology, and urban and rural planning to the total human environment. (Public Law 91-516)

Each school district in the state of Illinois is to follow the guidelines as established in the Environmental Education Handbook; published by the Illinois Office of Education during 1976. The basis is the 1970 Constitution of State of Illinois, Article XI, Section 1, which offers every person a "right to a healthful environment"; while Article X, Section 1, says Illinois citizens mandated "the educational development of all persons to the limits of their capacities".

Scientific technology recently developed should help the human race to survive and solve today's environmental problems. If each individual is educated with a broad understanding of his environment, he will be able to make the wiser decisions for survival.

Environmental education is multidisciplinary so it should be integrated into the regular school subjects through the use of broad themes. The Environmental Education Handbook discusses curriculum development under major themes of interdependence, impact, maintenance, quality of life, and improvement.

Administrators, school board members, educated teachers and community leaders are all integral parts of a well-coordinated team if efforts to meet the environmental crisis through education are fulfilled. Teacher preparation programs will mandate that elementary and secondary teachers in all areas will be able to wisely use resources in the classroom, school site, and community for each individual student's maximum development. In service training programs are necessary for current teachers to receive the essential training.

The plan for implementing environmental education in a school program has six steps:

Step 1: Appoint a well-qualified interested individual as a local environmental education coordinator.

Step 2: Invite educators and resource people to help develop local quality school programs. The committee should be charged with the responsibility for planning, implementing and assessing the program. The Environmental Education Handbook lists potential members as:

1. Local Environmental Education Coordinator
2. Education Service Region Superintendent
3. School district superintendent
4. Principal

5. Curriculum directors or supervisors
6. Elementary and secondary teachers
7. County extension agents
8. Resource Agency personnel
9. Private organization personnel
10. Community organization representatives
11. Park and recreation district representatives
12. College representatives
13. News media representatives

Suggested activities for the committee are:

A. Environmental Learning Areas
B. Teacher Training
C. Curriculum Integration
D. Educational Tours

Step 3: Specific program goals and objectives need to be written so the activities would be directed towards them.

Step 4: All teachers need to be involved in establishing the curriculum, including philosophy, concepts, processes, learning activities and guidelines.

Step 5: Develop, plan and coordinate in-service teacher education program for our district and neighboring schools. Schedule resource personnel and University personnel to teach the classes.

Step 6: Develop evaluation guides with proper procedures to see if the goals and objectives are met and the direction of the program is consistent.

Environmental education guidelines are necessary because natural and physical sciences, the humanities, psychology, sociology, political sciences, and economics are involved and interwoven. Environmental science deals with broad areas. Examples include: atomic power, air pollution, heavy metals, energy supply and demand, transportation, recycling and solid waste disposal, noise pollution, the effects of excessive use of pesticides, herbicides, or insecticides; preservation of wilderness areas, forest management, wildlife conservation, water pollution, and human settlements, value, and behavior. The activities scheduled in each grade need to meet the age level, interests and capabilities of the students involved as well as the resources available. The teacher's interests, education and implementing the curriculum will greatly influence the student's attitudes and knowledge.

Free and/or Inexpensive Materials

Each school district is struggling with finances due to the increasing costs for educating the masses.

There is a wealth of free and/or inexpensive materials which may be ordered from different county, state and federal agencies as well as book companies, and other suppliers. One of the tasks is to get the Environmental Education Coordinator or some other responsible individual, as a librarian, to write letters on school letterheads requesting the specific pamphlet, chart, map, or other offered materials. Sometimes filmstrips, slides, or movies may be borrowed for only the cost of returning the materials to the owners.

The United States is the leader as the first nation to have a National Environmental Policy Act of 1969. It is a firm and positive commitment to preserve and protect all the environment for the present and future people. It was the first to have an organization at the highest levels of government and an action-forcing mechanism requiring each government agency to issue public statements. This helped the greatest advances in environmental education, manpower development, and jobs since 1970. Therefore, the first listing consists of federal environmental agencies.

Action, Washington, D.C. 20525

Department of Agriculture, Washington, D.C. 20250

Agricultural Research Service

Agricultural Stabilization and Conservation Service

Extension Service

Forest Service

Office of Education

Soil Conservation Service

Department of Commerce, Washington, D.C. 20230

National Bureau of Standards

National Oceanic and Atmospheric Administration

Citizen's Advisory Committee on Environmental Quality, Washington, D.C. 20006

(Request announcements about publications on voluntarism.)

Council on Environmental Quality, Washington, D.C. 20006

Department of Defense, Washington, D.C. 20301

Assistant Secretary of Defense (Health and Environment)

Energy Research and Development Administration, Washington, D.C. 20545

Environment Canada, Information Branch, Ottawa, K1A OH3, Canada

Atmospheric Environment

Environmental Management

Environmental Protection

Fisheries and Marine

Forestry Service

Inland Water Directorate

Lands Directorate

Wildlife Service

Environmental Protection Agency, Washington, D.C. 20460

Air Quality Programs

Marine Programs

Noise Abatement Programs

Radiation Programs

Solid Waste Management Programs

Toxic Substances Programs

Water Quality Programs

Federal Energy Administration, Washington, D.C. 20461

Federal Water Pollution Control Administration, Crystall Mall, Building 2, 1921 Jefferson Davis Highway, Arlington, Virginia 22203

Department of Health, Education and Welfare, Washington, D.C. 20201

Center for Disease Control, Atlanta, Georgia 30333

Office of Environmental Education, Washington, D.C. 20201

Food and Drug Administration, Rockville, Maryland 20852

National Institute of Environmental Health Service, Research Triangle Park, North Carolina 22709

Department of Housing and Urban Development, Washington, D. C. 20410

Department of the Interior, Washington, D. C. 20240

Geological Survey

Bureau of Land Management

National Park Service

Bureau of Mines

Johnny Horizon Program

Bureau of Outdoor Recreation

Bureau of Sport Fisheries and Wildlife

U.S. Youth Conservation Corps, (P. O. Box 2975, Washington, D. C. 20013)

Department of Labor, Washington, D. C. 20210

Bureau of Labor Statistics

Occupational Safety and Health Administration

National Aeronautics and Space Administration, Washington, D. C. 20546

National Science Foundation, Washington, D. C. 20550

Division of Environmental Sciences

Division of Environmental Systems and Resources

Office of Experimental Projects and Programs (Student Science Training Summer Projects for High School Students)

Division of Higher Education in Science

Office for the International Decade of Ocean Exploration

Office for Oceanographic Facilities and Support

Office of Polar Programs

Division of Pre-College Education in Science

Office for Student-Originated Studies (Summer Programs for College Students)

Public Understanding of Science Programs

Smithsonian Institution, Washington, D. C. 20560

International and Environmental Program

Smithsonian Institution-Peace Corps, Environmental Program, Office of Ecology

Department of Transportation, Washington, D. C. 20590

Environmental Organizations

Action on Smoking and Health, 2000 H St., N.W., Washington, D.C. 20006

American Conservation Association, 30 Rockefeller Plaza, New York, New York, 10020

Bureau of Solid Waste Management, Environmental Control Administration, Consumer Protection and Environmental Health Service, Arlington, Virginia 22203

Bureau of Sport Fisheries, Fish and Wildlife Service, Washington, D.C. 20240

Citizens League Against the Sonic Boom, 19 Appleton St., Cowbridge, Massachusetts 02138

Committee for Environmental Information, 438 Skinker Boulevard, St. Louis, Missouri 63130

Common Cause, 2100 M St. N.W., Washington, D.C. 20037

Douglas, John H., "Russell Peterson: A Call For New Directions," (October 1, he resigned as Chairman of the President's Council on Environmental Quality" to become the first president of a new recently formed citizen's group called New Directions), Science News, Volume 110, pp. 267, 270.

Ecological Society of America, Radiation Ecology Section, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831

Ecosources is a bibliography of books, articles, games, films, and teaching aids on ecological issues, compiled monthly. Free copies will be sent to anyone sending self-addressed, stamped envelopes to Janet Woerner, Sunset Hill School, 400 West 51st St., Kansas City, Missouri 64112.

Environmental Action, 1346 Connecticut Ave., N.W., Washington, D.C. 20036

Environmental Action Coalition Educational Services, 235 East 49th St., New York, New York 10017

Environmental Alert Group, 1543 N. Martel Ave., Los Angeles, California 90046

Environmental Association of Illinois, Lorado Taft Field Campus, Box 299, Oregon, Illinois 61061

Environmental Conservation--A Progress Report (free booklet), Editor of the Lamp, Exxon Corporation, 1251 Avenue of the Americas, New York, New York 10020

Environmental Defense Fund, 162 Old Town Road, East Setauket, New York 11733

Federal Water Pollution Control Administration Crystal Mall, Building 2, 1921 Jefferson Davis Highway, Arlington, Virginia 22203

Forest Service, U.S. Department of Agriculture, Information and Education, Room 3223 South Agriculture Building, Washington, D.C. 20250

Friends of the Earth, 30 East 42nd St., New York, New York 10017

Friends of the Earth, 529 Commercial St., San Francisco, California 94111

The Garden Club of America, 598 Madison Avenue, New York, New York 10022

Illinois Department of Conservation, State Office Building, Springfield, Illinois 62706

Ecological Society of America, Radiation Ecology Section, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37831

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Environmental Association of Illinois, Lorado Taft Field Campus, Box 299, Oregon, Illinois 61061

Environmental Conservation--A Progress Report (free booklet), Editor of the Lamp, Exxon Corporation, 1251 Avenue of the Americas, New York, New York 10020

Environmental Defense Fund, 162 Old Town Road, East Setauket, New York 11733

Federal Water Pollution Control Administration Crystal Mall, Building 2, 1921 Jefferson Davis Highway, Arlington, Virginia 22203

Forest Service, U.S. Department of Agriculture, Information and Education, Room 3223 South Agriculture Building, Washington, D.C. 20250

Friends of the Earth, 30 East 42nd St., New York, New York 10017

Friends of the Earth, 529 Commercial St., San Francisco, California 94111

The Garden Club of America, 598 Madison Avenue, New York, New York 10022

Illinois Department of Conservation, State Office Building, Springfield, Illinois 62706

Illinois Environmental Education Update (pamphlet newsletter), Environmental Association of Illinois, LTFC, Box 299, Oregon, Illinois 61061

Illinois Environmental Protection Agency, 2200 Churchill Road, Springfield, Illinois 62706

Illinois Federation of Women's Clubs, 30 West Washington St., Chicago, Illinois 60602

Illinois Geological Survey, Natural History Building, Urbana, Illinois 61801

Illinois Institute of Environmental Quality, 309 West Washington, Chicago, Illinois 60606 (Directory of Environmental Groups in Illinois available free.)

Illinois Natural History Survey, University of Illinois, Urbana, Illinois 61801

Illinois Pollution Control Board, 309 West Washington St., Suite 300, Chicago, Illinois 60606

Illinois Wildlife Federation, 13005 South Western Ave., Blue Island, Illinois 60406

International Union For Conservation of Nature and Natural Resources, 2000 P St. N.W., Washington, D.C. 20006

The Izaac Walton League of America, 1800 North Kent St., Arlington, Virginia 22209

John Muir Institute for Environmental Studies, 451 Pacific Ave., San Francisco, California 94133 or
P. O. Box 11, Cedar Crest, New Mexico 87008

Keep America Beautiful, Inc., 99 Park Avenue, New York, New York 10016

League of Women Voters of Illinois 67 East Madison Avenue, Chicago, Illinois 60603

National Association of Biology Teachers, 11250 Roger Bacon Drive, Reston, Virginia 22090

National Audubon Society, 1130 Fifth Avenue, New York, New York 10028

National Audubon Society, 950 Third Avenue, New York, New York 10022

The National Intervenors, 153 E St., S.E., Washington, D.C. 20003

National Parks and Conservation Association, 1701 18th St., N.W., Washington, D.C. 20036

National Science Teachers Association, 1201 16th St., N.W. Washington, D.C. 20036

National Wildlife Federation, 1412 16th St., N.W., Washington, D.C. 20036

Natural Resources Defense Council, 15 West 44th St., New York, New York 10036

The Nature Conservancy, 1800 North Kent St., Arlington, Virginia 22209

Open Lands Project, 53 West Jackson, Room 1009, Chicago, Illinois 60604

PEMAP Bulletin (President's Environmental Merit Awards Program), Office of Public Affairs, U.S. Environmental Protection Agency, Washington, D.C. 20460.

Planned Parenthood/World Population, 515 Madison Ave., New York, New York 10022

Planning Executives Institute, Box 70, Oxford, Ohio 45056

Public Citizen, P. O. Box 19404, Washington, D.C. 20036

Public Interest Research Group, 2000 P St., N.W., Washington, D.C. 20036

Redwood Empire Association, 476 Post St., San Francisco, California 94102

Russell, Helen Ross, "Tips for Environmental Education: Audio-Visual Aids and Audio-Visual Perception," American Nature Study Society, 4405 Paulsen St., Savannah, Georgia 31405 (Jean Milmine, Secretary)

Save-the-Redwoods League, 914 Sansome St., San Francisco, California 94104

Scientists'Institute for Public Information, 30 E. 68th St., New York, New York 10021

Sierra Club, 1050 Mills Tower, San Francisco, California 94104

Touch of Nature Environmental Center, Southern Illinois University, Carbondale, Illinois 62901

United States of America Environmental Protection Agency, Region V, Central Regional Laboratory, 1819 W. Pershing Road, Chicago, Illinois 60609

United States Department of Agriculture, Soil Conservation Service, State of Illinois, 200 West Church St., Champaign, Illinois 61820

U.S. Environmental Protection Agency (Region V), 1 North Wacker Drive, Chicago, Illinois 60606

World Future Society, 4916 St. Elmo Ave., Bethesda, Maryland 20014

Additional Organizations or Businesses Where Free or Inexpensive Materials May Be Obtained for Environmental Science

"A National Aerospace Program," The American Legion, 1608 "V" St., N.W., Washington, D.C. 20006.

Aerosol Education Bureau, 300 E. 44th St., New York, New York 10017

AGBIZ TILLER. Free sample copy (new newsletter that monitors agribusiness) for a letter-sized self-addressed stamped envelope to: Agbiz Tiller, P. O. Box 5646, San Francisco, California 94101.

Age of Flight, United Technologies, The United Technology Building, Hartford, Connecticut 06101

Air Pollution Primer may be obtained from American Lung Association

Aluminum Association, Attention: Recycling Education, 750 Third Ave., New York, New York 10017

Aluminum Company of America, 800 Alcoa Building, Pittsburgh, Pennsylvania 15219

American Association of Colleges of Pharmacy, Office of Student Affairs, 4630 Montgomery Ave., Suite 201, Bethesda, Maryland 20014

American Forest Institute, 1619 Massachusetts Ave., N.W., Washington, D.C. 20036

American Gas Association, Educational Services, 1515 Wilson Boulevard, Arlington, Virginia 22209

American Paper Institute, 260 Madison Ave., New York, New York 10016

American Radio Relay League, 222 Main St., Newington, Connecticut 06111

American Society of Agricultural Engineers, 2950 Niles Road, Box 410, St. Joseph, Michigan 49085

American Trucking Association, Education Section, Public Relations Department, 1616 P St., N.W., Washington, D.C. 20036

The American Waterways Operators, Inc., Suite 101, 1600 Wilson Boulevard, Arlington, Virginia 22209

Amoco Oil Company, The Energy Crisis, P. O. Box 5910-A, MC 3705, Chicago, Illinois 60680

Anaconda Company, Inc., Public Relations Department, 1271 Avenue of the Americas, New York, New York 10020

"Anti-pollution Guide," free, FX-Lab, 77 Okner Parkway, Livingston, New Jersey 07039.

Appalachian Trail, plus "Four Lines of Defense Against Hypothermia," Appalachian Trail Conference, Box 236, Harpers Ferry, West Virginia 25425

Atomic and Nuclear Energy booklets, United States Energy Research & Development Administration, Technical Information Center, Oak Ridge, Tennessee 37830

"Aviation/Aerospace Education High School Planning Guide," and "High School Aviation Education Status Report," (free copies of each), Jeppesen Sanderson, Education Marketing Division, 8025 East 40th Ave., Denver, Colorado 80207

Avocado Information, Box 2162, Costa Mesa, California 92626

"Beginning With Bees," (one free copy) Dadant & Sons, Inc., American Bee Journal, Hamilton, Illinois 62341

Brookhaven National Laboratory, Public Relations, Building 460, Upton, Long Island, New York 11973

Bureau of Labor Statistics, U.S. Department of Labor, Washington, D.C. 20212

Bureau of Mines, Publications Branch, 4800 Forbes Avenue, Pittsburgh, Pennsylvania 15213

Bureau of Reclamation, U.S. Department of the Interior, Engineering and Research Center, ATT: Code 922, Building 67, Denver Federal Center, Denver, Colorado 80225

"Camping in Death Valley," "Hot Weather Hints," Death Valley National Monument, Superintendent, Death Valley, California 92328

Can Manufacturers Institute, 1625 Massachusetts Ave., N.W., Washington, D.C. 20036

Careers For a Changing World, New York Life Insurance Company, Box 51, Madison Square Station, New York, 10010

Consolidated Papers, Inc., P. O. Box 50, Wisconsin Rapids, Wisconsin 54494

Consumer Information Catalog, Consumer Information Center, Pueblo, Colorado 81009

"Coping With the Energy Crisis," Consumer Federation of America, Suite 901, 1012 14th St., N.W., Washington, D.C. 20005

Defense Civil Preparedness Agency, The Pentagon, Washington, D.C. 20301

Delta Dart Teacher's Guide, The Academy of Model Aeronautics, 806 15th St., N.W., Washington, D.C. 20005

Director of Consumer Information, Soap and Detergent Association, 475 Park Ave., South at 32nd St., New York, New York 10016

Eco-Agriculture Supplies, Gardening with Seaweeds, Rutherford Road, Oakham, Massachusetts 01068

Eco-Tips, Concern, Inc., 2233 Wisconsin Ave., N.W., Washington, D.C. 20007

Edison Electric Institute, Information Service, 90 Park Ave., New York, New York 10016

Edison Electric Institute, Public Relations, "The Atom, Electricity and You." 90 Park Ave., New York, New York 10016

Encyclopaedia Britannica Educational Corp., Dept. 10-A, 425 N. Michigan Ave., Chicago, Illinois 60611

"Energy Context," free single copy, DuPont Context, Public Affairs, Dept. D-8111, 1007 Market St., Wilmington, Delaware 19898

"Energy and the Environment" (up to 30 free copies), Union Oil Company of California, Corporate Communications, P. O. Box 7600, Los Angeles, California 90051.

"Environmental Impact on Fossil-Fueled Power Plant Studied in Colstrip, Montana," News and Notes for the Analyst from Hack Chemical Company, P. O. Box 907, Ames, Iowa 50010

ESB Inc., 5 Penn Central Plaza, Philadelphia, Pennsylvania 19103

Fermentation Chemistry, Public Affairs Division, Pfizer, Inc., 235 E. 42nd St., New York, New York 10017

Field Procedures in Water Microbiology, AB314 (free pamphlet), Millipore Corporation, Ashby Road, Bedford, Massachusetts 01730

Food and Drug Administration, HFL-12, 5600 Fishers Lane, Rockville, Maryland 20852

General Aviation Manufacturers Association, 1025 Connecticut Ave., N.W., Suite 1215, Washington, D.C. 20036

General Motors Corporation, Public Relations Staff, General Motors Building, Detroit, Michigan 48202

Guide to 52 Creative Cleaning Ideas, free, The Home Care Institute, Bloomington, Illinois 61701

High School Aviation Teacher Packet (one free copy per teacher), Cessna Aircraft Co., Air Age Education Dept., Box 1521, Wichita, Kansas 67201

Hopkins Syndicate, Inc., Hopkins Building, Mellott, Indiana 47958 (Ocean's 44 trace chemicals)

Hopper, Jay, 599 Free Things For Teachers, Xerox Education Publications, New York, New York, June, 1976.

"How Noise Affects Your Health," Consumer Information, Public Documents Distribution Center, Pueblo, Colorado 81009

"How Temperatures Are Measured," Tempil Division, Big Tree Industries, Inc., 2901 Hamilton Boulevard, South Plainfield, New Jersey 07080

"How Weather and Climate Affect You," 35¢, Pamphlet No. 533, Public Affairs Pamphlets, 381 Park Ave. South, New York, New York 10016

Hurricane! (free use of 27 min. film), Aetna Life & Casualty, 151 Farmington Ave., Hartford, Connecticut 06156

Insects, 341East Ohio Street, Chicago, Illinois 60611

Insect simple projects--"Finding Hidden Insects," #PA786, and "Trapping Insects With Light," #PA787, send postcard to Publications, Office of Communications, U.S. Department of Agriculture, Washington, D.C. 20250

"Insects That Sting," "Plants That Poison," CIBA-GEIGY Corporation, FX Marketing Communications, One Stanton St., Marinette, Wisconsin 54143

Institute for Human Relations, 165 E. 56th St., New York. New York 10022 (Booklet "The Energy Crisis--Questions and Answers").

Invest in America National Council, Inc., Architects Bldg., Suite 906-7, 17th and Sansom Streets, Philadelphia, Pennsylvania 19103

"Joys of Electronic Living," National Alliance of TV & Electronics, 5908 S. Troy St., Chicago, Illinois 60629

Lead Industry Association, 292 Madison Ave., New York, New York 10017

Libbey Owens Food Company, 811 Madison Ave., Toledo, Ohio 43695

Life and Society of the Honey Bee, A.I. Reet Company, P. O. Box 706, Medina, Ohio 44256. (35 free copies available.)

Lockheed Aircraft Corporation, Dept. 07-60, P. O. Box 551, Burbank, California 91520

Los Angeles Department of Airports, Public Relations Division, No. 1 Worldway, Los Angeles, California 90009

Magic American, Free Household Cleaning Tips for Every Room in Your Home, 23700 Mercantile Road, Cleveland, Ohio 44122

Manufacturing Chemists Association, 1825 Connecticut Ave., N.W., Washington, D.C. 20009

"The Marine Aquarium," Nektonics Research and Development, Ltd., 1015 East 35th St., Brooklyn, New York 10021

Miller Redwood Company, Public Relations Department, P. O. Box 247, Crescent City, California 95531

Mirro Aluminum Company, 1512 Washington St., Manitowoc, Wisconsin 54220

Miscellaneous Microbes: The Non-Conformists (free), National Institute of Allergy and Infectious Diseases, Office of Research Reporting and Public Response, National Institutes of Health, Room 7A32, Building 31, Bethesda, Maryland 20014

Mississippi River Navigation, Department of the Army, U.S. Army Engineers Division, Lower Mississippi Valley and Mississippi River Commission, Corps of Engineers, Vicksburg, Mississippi 39108

National Association of Recycling Industries, 330 Madison Ave., New York, New York 10017; attention Filmstrip Distribution.

National Coal Association, Coal Building, 1130 17th Street, N.W., Washington, D.C. 20036

National Fire Protection Association, Public Affairs Division, 470 Atlantic Avenue, Boston, Massachusetts 02210

National Institutes of Health, Science and Health Reports, Division of Research Resources, National Institute of Health, Bethesda, Maryland 20014

National Planning Association, 1606 New Hampshire Avenue, N.W., Washington, D.C. 20009

Natural Gas Story (free), Publications Distribution Officer, Federal Energy Administration, Room 6500, Federal Building, Washington, D.C. 20461

New Jersey Institute of Technology, Director of Publications Office, 323 High Street, Newark, New Jersey 07102

Organic Gardening Book (free), Madison Chapter of N.F.A., c/o Mrs. Esther Horstad, R. R. #2, Waunakee, Wisconsin 53597

Owens-Corning Fiberglas Corporation, Attention: H. S. Meeks, Inquiry Dept., Fiberglas Tower, Toledo, Ohio 43659

Phillips Petroleum Company, Bartlesville, Oklahoma 74004

"Project: School Flight," (students can build an airplane), EAA Air Museum Foundation, Project School Flight, Box 229, Hales Corner, Wisconsin 53130

Public Affairs Department GTE Sylvania Inc., 100 Endicott St., Danvers, Massachusetts 01923

Publications on soil and water conservation, outdoor education, Publications, Office of Communication, U.S. Department of Agriculture, Washington, D.C. 20250

Reclamation, Conservation, and Beautification, Institute of Scrap Iron and Steel, 1729 H St., N.W., Washington, D.C. 20006

Recycler in America, free, National Association of Recycling Industries, Inc., 330 Madison Ave., New York, New York 10017

"Reference and Audio-visual Materials on Iron and Steel," American Iron and Steel Institute, 1000 16th St., N.W., Washington, D.C. 20036

Rust-Oleum, "101 Rust Stopping Tips," 2301 Oakton St., Evanston, Illinois 60204

Simplified Science Activities . . . With a Little Help from Your Friends, Edmund Scientific Co., 555 Edscorp Building, Barrington, New Jersey 08007

Southern Forest Institute, One Corporate Square, NE., Atlanta, Georgia 30329

Space Primer, Aerospace Corporation, The Office of Information, Box 92957, Los Angeles, California 67201 (25 free copies)

Space Sciences and Satellite Tracking, (free single copies), Smithsonian Astrophysical Observatory, Public Information Office, 60 Garden Street, Cambridge, Massachusetts 02138

"Sportsman's Wildlife and Game Map," and "Sportsman's Fish Map," (cost: $6.00 for both) Outdoor Life Maps, 380 Madison Avenue, New York, New York, 10017. 1976

Story of North Central Airlines (free single copies), North Central Airlines, 7500 Northliner Drive, Minneapolis, Minnesota 55450

Underwriters' Laboratories, Inc., 207 E. Ohio St., Chicago, Illinois 60611

UNESCO Publications, (United Nations Educational, Scientific and Cultural Organization publications on education, mass communications, life sciences, earth and marine sciences, ecology, engineering, art, social sciences, music, library science and more.) 1976, free. Unipub, Box 433, Murray Hill Station, New York, New York 10016.

United Air Lines, P. O. Box 66100, Chicago, Illinois 60666

United States Borax & Chemical Corporation, Public Relations Department, 3075 Wilshire Blvd., Los Angeles, California 90010

United States Department of Commerce, National Ocean Survery (NOAA), Code: 0513, Rockville, Maryland 20852

United States Department of the Interior, U.S. G.S., 1200 South Eads Street, Arlington, Virginia 22202

United States Energy Research and Development Administration, Technical Information Center, P. O. Box 62, Oak Ridge, Tennessee 37830

United States Environmental Protection Agency, 401 M St., S.W., Washington, D.C. 20460

Value of Charcoal, John Randall, Requa Manufacturing Co., Box 4008, Greenwich, Connecticut 06830

Vitamins Specialties, 18813 Felbar Avenue, Torrance, California 90504

Walter, Katherine B. (mail 24¢ plus long self-addressed stamped envelope for the booklet), Philodendrons, St. Louis Globe-Democrat, St. Louis, Missouri

Weiss, Mark, Encyclopedia of 501 Valuable Free Things for Housewives and Homemakers to Fight Inflation and Save Money, P. O. Box 402091, Miami Beach, Florida 33140

Western Union Corporation, Donn Dutcher, Public Affairs Department, 85 McKee Drive, Mahwah, New Jersey 07430

Environmental Science Files Organization

When the free and/or inexpensive materials arrive it is necessary to have a detailed method of grouping and separating the materials so each will be available for future use. The following file system was adapted from Daniel A. Dreyfus' classification system to portray environmental management activities. Mr. Dreyfus developed it for the Senate Committee on Interior and Insular Affairs. Please see Odom Fanning, Opportunities in Environmental Careers, pages 28 and 29.

I. Renewable Resources Conservation

 A. Pollution control

  1. Air pollution control

  2. Water pollution control

B. Agriculture

1. Agricultural production research and assistance
2. Agricultural soil conservation

C. Water resources conservation

1. Water supply
2. Water quality control
3. Saline water conversion

D. Land management

1. Public land use management
2. Watershed management
3. Forestry research and management
4. Wetland and estuary conservation

E. Marine resources conservation

1. Oceanography
2. Commercial fishery conservation

F. Atmospheric sciences

1. Basic meteorology
2. Weather modification

G. Space exploration and research

1. Space research
2. Space vehicle construction and operation

II. Nonrenewable Resources Conservation

H. Urban land utilization

1. Urban planning

2. Urban redevelopment

3. Urban public recreation

4. Utility engineering and construction

5. Zoning

I. Nonurban land utilization

1. Surveying and mapping

2. Rural community stabilization, planning and development

3. New city planning and development

J. Transportation

1. Urban transit planning and development

2. Highway planning, safety and beautification

3. Air transport planning and development

4. Marine and inland waterway transport planning and development

5. Traffic control and safety

6. Railroad regulation and safety

K. Energy

1. Thermal-electric plant siting, design and operation

2. Electric power transmission line siting, design, construction and operation

3. Fossil fuel exploration, inventory, and research

4. Heat utilization and dispersion

5. Nuclear power research, development, and operation

6. Hydroelectric power research, development, and operation

7. Solar energy, possibilities, plans, construction

L. Mineral resources conservation

1. Mineral exploration and inventory

2. Materials research and development

3. Solid waste storage, recycling, and disposal

4. Mining technology research and development

5. Mineral extraction research and development

III. Environmental Health and Well-being

M. Physiological health and well-being

1. Sanitation

2. Radiation control

3. Industrial and domestic health and safety

4. Environmental health protection

5. Contagious disease control

6. Pest control

7. Food and drug regulation

8. Flood control

9. Natural disaster warning and relief

10. Population control

N. Psychological health and well-being

1. Noise suppression

2. Relief of acoustic, mechanical, and interpersonal tension stresses

3. Promotion of community identity

4. Population dispersion

5. Environmental education

IV. Promotion of Amenities

O. Outdoor recreation

1. Public recreation, planning and development

2. Wild lands preservation

3. Sport fish and wildlife conservation

4. Conservation and promotion of natural beauty

P. Cultural stimulation

1. Urban beautification

2. Historic preservation

3. Enhancement of architectural and engineering design

4. Maintenance of continuity of environmental associations

5. Provision for diversity of experience and life style

V. Ecological Research

Q. Human ecology

1. Basic research in human ecology

VI. Miscellaneous

R. Bibliography and sources

S. Environmental vocations

T. Government environmental strategy

U. Environmental Protection Agency (Illinois)

V. Interim Guide for Environmental Assessment (1975 Field Office Edition)

Environmental Tour I

0.0 This tour starts in the faculty parking lot on the northeast corner of the LaGrove High School at Farina, Illinois. Drive south on the driveway. STOP at Highway 185, turn right.

0.4 As you approach the Interstate 57 overhead bridge, stop on the shoulder of the road on the east side. Notice the development of the landscaping on the northeast section of the interchange. Fescue and timothy are the principal grasses with many field mice in resident during the winter and early spring. Note the sycamore and flowering crabapple trees. The stakes support the trees while they develop roots, the depressions hold water but there appears to be a low survival rate especially in the area next to the highway. Culverts with concrete wings aid in controlling erosion. Netting was used on the slopes and drainage way bottoms to control erosion until the grasses, trees and other plants could become stabilized. If time permits, contrast plant growth in the southeast, southwest or northwest cloverleafs. You will notice that each is unique. Continue west on highway 185 over Interstate 57 and turn right on the frontage road.

0.7 STOP. The steel culvert you just crossed to enter the frontage road does not need wings for stabilization because of shortness of the slope. Note the effects of building restaurant, gas pumps, and truck stop business on environment surroudings. Continue on frontage road.

0.8 Note two concrete right-away markers on the left used to establish property lines when Interstate 57 was plotted. They are not to be moved or destroyed.

0.9 Continue on the frontage road, which was built when Interstate 57 was made. The rural road was gravelled and then blacktopped.

1.3 Look on the left for the oil line marker.

1.5 A natural gas line marker tells the location of the gas line which runs from Texas to Chicago, Illinois.

1.6 See a telephone marker, that identifies location of buried telephone lines.

1.75 The pipeline marker shows location of crude oil pipeline. This area is a busy thoroughfare below the ground as well as above the ground.

1.9 The Frontier Village sign on the right was installed for tourists to read from the interstate. Note the location.

2.1 It was necessary to buy dirt to build Interstate 57. Thead Sigrist's bar pit on right. It has been stocked with bluegill, catfish, bass and other species.

2.5 These fields have slow drainage and water stands in the fields during the rainy season. The watershed is to the east and then south.

2.65 Notice the telephone marker on the left.

2.7 Watershed drains to the north and then west.

3.0 STOP at crossroads. Continue north. Note the large drainage ditch on west. Watershed drains to the west to the big ditch then south. Also notice the windmill on left with concrete watering trough once used for livestock.

3.6 Stan Roberts owns the new type of steel building on right. The watershed flows to the north here.

3.8 Notice to the left that the pine trees have been planted for erosion control.

4.05 Turn left on T road between the concrete bridges with high bannisters. Continue west. Please note the large drainage ditch on the right. The different types of trees include: hedge, locust, oaks, and cockspur thorns. It is an excellent habitat for raccoons, squirrels, and rabbits. There are several trappers in this area who catch raccoons, muskrats, foxes, skunks, opossums, minks and a few coyotes for their pelts. Water drainage to the east.

4.3 Note drainage ditch on left coming into the creek. Also notice the erosion on the right caused by the rushing water.

4.4 Patch of pines on left were planted for erosion control and stabilization. Note fence used for protection until sufficient growth of trees made their survival certain.

4.45 Drainage ditch from south with water flowing north. This land is low lying, good fertile land, but surface drainage must be maintained for good crop production. Notice large areas without fences for better farming on the fields. If no fences are present, farmers till the edges so no weeds or brush can grow. The additional crops produced help feed the world's population.

4.6 Note the bank of soil on the left side to hold road ditch water from moving south onto the field. Water from road ditches runs east.

4.7 Crude pipeline marker.

5.05 Note on the left: another example of soil bank to hold road water in the ditch.

5.2 Note telephone station ML8W. Also notice old well with pump on the left on the Richard Rothe farm. The field water runs south while the road water runs east.

5.4 Wayne Kramer farm on right has a remodeled gable barn, windmill, and concrete block storage building along with the home.

5.5 Drainage ditch takes water to the south.

5.6 STOP. Turn right.

5.8 Underground cable pole number 30.43.

6.2 Note water drains to the east from this area.

6.3 Turn right on T-road. On left note beehives, beneficial to farmers for cross-fertilization of crops and honey. The dugout farm pond has muskrats, rabbits and field mice living around it. The hay area east of the pond is mowed and hay baled for cattle in winter. The trees on the left were all planted and include: Osage Orange, Mulberry and Peach.

6.6 Concrete bridge with high bannister. A main drainage ditch with water flowing to the southeast. This is the head of the Dismal Creek watershed.

6.7 Surface drainage flows to the south.

7.0 Eugene Kramer's beef and grain farm on the left. Please notice blue and Black Hills spruce planted for ornamental and windbreak purposes. Watershed predominately to the south but diverted to the east and west by road ditches. There is not any culvert needed here because of natural drainage. The wise pioneers chose higher level ground to build their homes on for this reason.

7.45 Roedl Brothers beef and grain farm.

7.5 Waterway from north with water flowing east in road ditch.

7.6 Water is forced to flow south because of earthen fill in road ditches.

7.7 Another earthen fill forces water south from road ditch. Natural watershed to the east.

8.1 STOP. Turn left at cross roads. Proceed north past Shatz Brothers farm. Watershed to the south.

8.6 Watershed to the east.

8.7 Turn right at the crossroads. Watershed is to the east.

9.0 Watershed to southeast in an well-established fifty foot wide grass waterway.

9.2 Main drainage ditch going to the southeast. Old steel frame bridge with creosoted yellow pine planks. Note soil erosion in the ditch on the south side caused by rushing water. The main trees are willow, sycamore, elms and locusts with blackberry and multiflora rose bushes.

9.4 Wind power was once commonly used in this area. Note Quandt's windmill on the left.

9.45 Waterway to the south.

9.55 Hedge planted by pioneers to mark property lines and to make fence posts. They are not native trees but were widely planted through the midwest during the nineteenth Century. Other names include: Hedge Apple, Mock Orange and Osage Orange.

9.6 Harold Richardson farm has a newly established waterway. Note growth in waterway and along the sides.

9.7 STOP. Turn right on the Altamont-Farina blacktop road. Watershed is to the south.

9.85 Main drainage ditch to the east.

10.1 An excellent sodded waterway on the left. Watershed to the east.

10.2 Surface drainage ditch from west. Water flows to the south because of earthen fill in the road ditch.

10.5 Turn left at crossroads. Park auto and walk south on blacktop to south of Stock's entry lane. On right side, notice large planting of lilies for erosion control on bank and in road ditch. Due to root system and bulb formation, these lilies have been widely used for erosion control and are often planted by road crew members. Return to auto. Note the deep road ditch on left with bricks serving as a structure to slow down water flow to prevent more erosion.

10.6 Drainage area to the southeast.

10.65 Excellent waterway on left from the north. This waterway contains about three acres from which hay is harvested each year.

10.7 Pre-fab concrete bridge constructed by township and county. Note the concrete blocks and riff-raff on north bank of creek to control erosion. Watershed to northeast.

10.8 Schatz Brothers beef and grain farm.

11.0 Waterway to the north with brush and trees providing good habitat for wildlife.

11.45 Main waterway from south to north. Concrete culvert also serves as a cattle crossing under the road.

11.5 Old Cash School House on right, where the early pioneers received their education.

11.6 Alan Morris farm on left. About 150 yards north of building site is an underground tile waterway with sump hold and stand pipe. Brush piles are left to slow down water flow to prevent erosion and provides shelter for wildlife.

12.0 Main drainage area from south. This area provides a good habitat for wildlife, including deer. In this immediate area surface drainage ditches are not as critical as surrounding areas.

12.4 On right is an elevation and old surveyor's marker.

12.6 STOP. Turn right to travel south over Interstate 57. Slopes of overhead bridge contain Crown Vetch to prevent erosion. Trees and shrubs help purify the air, cut down on noise pollution, as well as beautify the area.

12.8 Eugene Kramer's four-acre, fourteen feet deep bar pit; stocked with bluegill, channel catfish, and bass. The dirt from this pit was used to build the overhead over Interstate 57.

13.1 Main drainage ditch from west to east toward Dismal Creek.

13.9 Drainage-way from south to north.

14.1 STOP. Village of LaClede. The *1878 History of Fayette County,* Illinois, tells the following about LaClede Township and village: The township was formed in the early 1800's; comprised the Congressional township of 5, range 4, and is bounded on the north by Effingham County, on the east by Clay County, on the south by Marion County and on the west by Lone Grove township. The second cabin in the area was built during 1832 by a Mr. Hawkins. The book, LaClede of Yesterday; LaClede of Today, 1853-1975 discusses the building of the Illinois Central Railroad and its importance to the formation of towns situated along the railroad. During 1857 the Illinois Central commissioned surveyors to plot and lay out towns along its route. April 8, 1859, LaClede was plotted, surveyed and recorded at Fayette County courthouse. The town grew and it was a center for farm products as hay, grain, beef cattle, poultry and fruits. Businesses, churches and homes were built. It was named for the pioneer explorer. Turn right at Route 37. Road ditches play an important part in drainage in this area. Illinois Central railroad on left has native prairie grasses growing along its right-of-way. The railroad right-of-way between Mason and Alma, Illinois is unique and is to be designated a national landmark and preserved.

15.5 Glen Ernst fruit farm, noted for strawberry production is on right.

16.0 Egyptian Nursery and Landscape Company on right is nationally known for excellent nursery stock grown and sold from Buffalo, New York to Denver, Colorado and south to Tennessee, north to Minnesota.

16.5 Notice depth of road ditches. Drainage ditch from the north.

17.4 Main drainage ditch to the west through Farina. This ditch was built by landowners who formed the largest drainage district in Fayette County. Water control, erosion prevention and other conservation problems can best be solved with many individuals working together.

18.1 Main drainage ditch to the west from Route 37.

18.3 Turn right on Route 185 at the northeast edge of Farina. Farina is also situated on the Chicago Branch of the Illinois Central Railroad, was first organized as a town in 1867 and reorganized as a village in 1875. It received its name because of the huge areas of grain along the railroad. Today it is still known for the large shipments of grain raised by the prosperous farmers.

18.7 Cross the big drainage ditch. Water flows to west.

18.9 Turn right into the east drive leading to the faculty parking lot at the LaGrove High School, grades 9-12, approximately 185 students. This completes Tour I. Do you understand that the landowners and tenants are doing an excellent job of preserving the land, conserving the natural resources and working together for the good of all? If so, perhaps you will like to take other tours of other parts of our community on another day. Each tour shows a great variety of practices used in conserving our natural resources and each tour is different and unique in its own area.

Thank you and have a pleasant journey.

Kathleen Diane Kramer

and

Mrs. Bauer

The Association of Illinois Soil and Water Conservation Districts or Area Possibilities

County, District or Regional Soil and Water Conservation Associations are interested in assisting Illinois Junior Academy of Science interested students in the development of projects concerned with soil, water, energy conservation in the environment in their locality. Two possible beneficial ways might be:

1. professional assistance and guidance concerning project ideas, providing realistic expertise on projects and papers explaining the experiment.
2. a monetary grant to the student.

Requirements to receive any professional assistance, must include the student must contact the Illinois Soil and Water Conservation District representative in their County, Council or area. The Illinois Junior Academy of Science member/student will submit a written as well as oral proposal to the Association of Illinois Soil and Water Conservation District which will include:

a. a tentative outline of the proposed project,

b. an itemized list of expenditures,

c. the purpose or goal of which he or she is to accomplish by doing the project; (this needs to include original research, with a specific problem tested, and other variables controlled),

d. the experiment, writing of the research paper, exhibit and other factors will follow the guidelines as specified in the Illinois Junior Academy of Science Guidebook, currently valid.

If a student obtains a grant to pursue a project, a report will be sent to the Association of Illinois Soil and Water Conservation District and State Association upon completion of the work.

Outline for Federal Grant for Conservation/
Environmental Education

I. Give assistance to aid elementary, junior high and senior high school teachers to obtain more competent education in soil, water, conservation, energy and environmental education.

A. Prepare a conservation/environmental curriculum at nine major state universities throughout the state for twenty to thirty elementary, junior high and/or high school teachers to complete majors with necessary credits towards a Master's degree or Specialist degree in soil, water, energy, conservation and environmental education. The Association of Illinois Soil and Water Conservation District officers should work closely with the University personnel, the Illinois Office of Education, State Superintendent, Joseph M. Cronin, and Donald Roderick, Science, Energy and Environmental Curriculum Development coordinator, as well as local school superintendents and teachers to help prepare and organize these programs. The Association of Illinois Soil and Water Conservation Grant could be partially used to pay enrollment and book fees for the teachers to these seminars. The Universities need to be located so each teacher would be in seventy-five miles radius to travel to the University class. If funds are sufficient, the Grant should make provisions to pay participants' mileage, supplies, and pay the Coordinator from the University mileage to visit the teachers in their teaching positions. Classes could be scheduled to start from 4:30 to 5:00 p. m. and have three-hour meetings per week, so currently employed teachers could participate and have the class materials include experiments, knowledge, free or inexpensive materials that the teachers may use in their own classrooms teaching immediately.

B. The Association of Illinois Soil and Water Conservation Districts should work closely with the Illinois Office of Education and other groups on accreditation and requirements of certification programs at all levels. The state and federal agencies should also work for federal monies, expertise, and low-cost publications to be used at all levels of education from Kindergarten through the Doctor of Philosophy degrees. Provisions should be included for all areas including special education for the handicapped, EMH, TMH, blind, deaf or other necessary programs so all children and adults will learn about the importance of conservation of their environment as part of their basic education.

C. Additional spot announcements, similar to commercials, could be prepared for Illinois Radio and Television Stations discussing career possibilities, education available K-18 in their area, excellent teaching that is giving students necessary knowledge and unique conservation or environmental practices in the area. Students and their current research should be included. More favorable publicity will benefit all concerned.

II. Students attending Universities majoring in conservation, energy and environmental education for future careers.

A. If monies are available either through the Association of Illinois Soil and Water Conservation Districts or Federal Grants to the Universities, scholarships of $500.00 to the best qualified student and a $250.00 scholarship for the second qualified student at each Illinois University. The student should be majoring in soil and water conservation, energy, or environmental education.

B. The students should be college sophomores, juniors, or seniors and one student could be given monies for one, two or three years.

C. Also one qualified individual could be given $500.00 per nine-month school year for completing a Master's Degree of Specialist Degree in Soil and Water Conservation, energy and/or environmental education, providing each attend school full time and the degree requirements will be completed in a one school year time period.

D. County, District, or Regional Soil and Water Conservation Associations personnel should encourage local interested students, teachers and college students to participate and apply for these scholarships/grants.

Outline for Federal Grant Under Conservation/Environmental
Education in Cooperation with the Association of Illinois
Soil and Water Association and Illinois
Junior Academy of Science

I. Students at Illinois Junior Academy of Science State Exposition

A. Give all conservation/environmental education entries by students at Illinois Junior Academy of Science State Exposition including both paper sessions and project fair framed certificates of appreciation.

B. Give each outstanding winner at the Paper Sessions and Project Fair a three to five days conservation/environmental workshop sponsored at and by an Illinois University with all their fees paid directly to the University. The student will be responsible for transportation and other expenses to and from the workshop.

C. Give each first award winner from the paper sessions and project fair at IJAS State Exposition a choice of a $25.00 (cost $18.75) E Bond or one-half payment of fees for the student to attend an Illinois University Conservation/Environmental three to five days workshop.

II. Students Exhibits at the Illinois State Fair, Springfield, Illinois

A. Have a state exhibit at the Illinois State Fair, Springfield, in

August of each year to help educate the public about conservation/environmental education.

B. Choose five or six of the outstanding displays at the Illinois Junior Academy of Science State Exposition during May of each year and five or six alternate displays (if any of the first group cannot attend) for exhibition at the Soil and Water Conservation/environmental education exhibit.

C. Give each exhibitor a total of $200.00 ($100.00 upon arrival at the Illinois State Fair, Springfield, $50.00 more five or six days later, and the last $50.00 on the last day of the exhibition) to help pay food and lodging. (Arrangements might be made for them to stay in the 4-H dormitories or some other supervised low-cost housing.) Expenses exceeding the $200.00 should be paid by the student. The student's own school district should be encouraged to contribute another $100.00.

D. Make arrangements for each student to work four-hour shifts with two four-hour shifts per day for a total of eight hours to explain their research, knowledge, and aspirations to the public. These shifts should be arranged so two or three students are always with the project exhibits and each can explain all projects there. Below is a hypothetical example of the work schedule based on the hours the exhibit will be open:

Shift I:	8 a.m. to 12 noon	Student A
Shift II:	noon to 4 p.m.	Student B
Shift III:	4 p.m. to 8 p.m.	Student A
Shift IV:	8 p.m. until closing	Student B

Alternate the beginning shifts so each student works about the same total hours during the entire twelve days.

E. When the Illinois State Fair ends the students who stay the entire time and participate according to all rules and regulations should be given small eight or ten inch statues or framed certificates in addition to the expense monies. (The Illinois High School Association has a rule regarding the amount an award may be and an amateur status kept.)

F. The alternates who attend receive the same award. If the Alternate does not attend and participate each will receive an unframed certificate.

III. Junior High School and High School Teachers and School Districts' Participants in Illinois Junior Academy of Science State Exposition

A. Give all junior high and high school teacher/sponsors as well as the school districts framed certificates of appreciation for each Paper Sessions and Project Fair senior high school entry in earth science and conservation or environmental education or junior high category of earth science, conservation, environmental education entry at the Illinois Junior Academy of Science State Exposition each year.

B. Teachers/sponsors of Outstanding Winners of the Illinois Junior Academy of Science State Exposition Paper Sessions or Project Fair may receive a $50.00 E Bond (cost: $37.50) while First Award Winners Sponsors should receive a $25.00 E Bond (cost: $18.75). No teacher/sponsor should have more than one bond, if he or she should have more than one student winner in each category.

C. Each school district should receive framed certificates for their science department trophy case.

IV. Teacher participation in the Illinois State Fair, Springfield, Illinois, if funding is available.

A. If a student exhibition at the Illinois State Fair, Springfield, in August of each year is prepared, it might be possible to give each sponsor/teacher $100.00 to pay transportation costs to help the student exhibitors. The sponsor will need to be there on the day the student comes, moves home, and one additional eight-hour day for supervision at the exhibit. Two or four sponsors could volunteer to chaperone the exhibitors with $500.00 to be paid for each for twelve days work plus the $100.00 transportation expenses. Each sponsor receiving the total $600.00 must stay the entire time--if any time is missed the total amount paid will be reduced $50.00 for each twenty-four hours time period missed.

B. Awards--engraved plaques, trophies, certificates, or other suitable awards.

Engraved plaques should be given to each of the sponsors of the participating students.

The school district of each participating student should receive a framed certificate for their science department trophy case.

This report is submitted by Mrs. Norma Grace Hockett Bauer in preparation for Application for Grants Under Environmental Education Program (CFDA No. 13,522).

Closing date: February 23, 1977.

Copies to: Mr. Donald Roderick, Curriculum Development Science/ enviornmental and Energy Coordinator, Illinois Office of Education

Mr. Hillard Morris, Soil and Water Conservation State of Illinois Executive Board Member

Mr. Oren F. Lackey, Past President and Rev. Bernard Horzen, 1976-77 President, Illinois Junior Academy of Science.