DOCUMENT RESUME

ED 070 766 SP 007 343

TITLE	Seventh Grade Interdisciplinary Packet (Science-Social Studies).
INSTITUTION	Madison Public Schools, Wis. Dept. of Curriculum Development.
PUB DATE	70
NOTE	79p.
EDRS PRICE	MF-$0.65 HC-$3.29
DESCRIPTORS	*Curriculum Guides; Grade 7; *Interdisciplinary Approach; *Science Curriculum; *Science Education; *Social Studies

ABSTRACT

GRADES OR AGES: Grade 7. SUBJECT MATTER: Science and Social Studies. ORGANIZATION AND PHYSICAL APPEARANCE: This guide presents a series of earth sciences units which would have interdisciplinary potential specifically in the area of social studies. Introductory material includes a rationale, evaluation procedures, 44 "key" environmental concepts, and the interdisciplinary scope and sequence. A trio of organizational themes form the basis for this guide: man's use of communication systems; a descriptive look at the natural environment; and the interaction between man and his environment. Four science units presented include mapping, earth processes, weather, and astronomy. Each unit provides concepts, objectives, activities and evaluation sheets. The guide is lithographed and spiral bound with a hard cover. OBJECTIVES AND ACTIVITIES: Objectives and detailed activities are provided for in each unit. INSTRUCTIONAL MATERIALS: Charts and other materials are listed under Suggested Materials List. STUDENT ASSESSMENT: Provision is made for student evaluation. (MJM)

SEVENTH GRADE INTERDISCIPLINARY PACKET
(Science - Social Studies)

Department of Curriculum Development
Madison Public Schools
Madison, Wisconsin

TABLE OF CONTENTS

RATIONALE - GRADE SEVEN INTERDISCIPLINARY SCOPE AND SEQUENCE

It was the intent of the Middle School Social Studies-Science Committee to accomplish the following tasks during the summer of 1970:

A. Develop the concepts, behavioral objectives, and suggested activities for a series of 7th grade "earth" science unit which would have interdisciplinary potential.

B. Identify and verbalize an "interdisciplinary scope and sequence" for grades six and seven which might result in:

1. A fuller, more complete educational experience for the middle school child, rather than a series of incompletely related episodes.

2. A more systematic application of the skills and content of single disciplines to other disciplines, as well as to the child's total educational experience.

3. An increased emphasis upon the process of valuing, the analysis of value dilemmas, and the roles which values play in decision-making.

4. The development of a sincere concern by the children for their environment and an appreciation of their role in the environment.

5. The sharing of ideas and feedback between professional staff members.

It was within a historical framework and with these guidelines that the committee began the task of developing a series of science units from which an interdisciplinary scope and sequence might spring. A single disciplinary beginning, though apparently contradictory to an interdisciplinary direction, was necessary. Historically, there had been no science program at grade seven.

The piloting of a science program with an earth science flavor in grade seven, but without a well defined curriculum, quickly precipitated the need to chart a more definitive course. Text and laboratory materials, commercially available and ultimately adopted, were oriented to a relatively "classical" approach to earth science. Rocks, water, and air were studied, but man's relationship to them was not. This beginning succeeded in providing seventh graders with a laboratory earth science experience. It also, because of materials, temporarily deflected the direction of the curriculum toward a more

"purely science" stance rather than toward the intended "environmental" stance. But foremost, it provided a base from which to view interdisciplinary change.

In response to the readily apparent need for more definite direction for seventh grade science, a series of science topics with interdisciplinary potential was identified. They included such topics as: Mapping, Earth Materials, Earth Processes, Astronomy, and Weather. It was felt that the development of science units along these lines would:

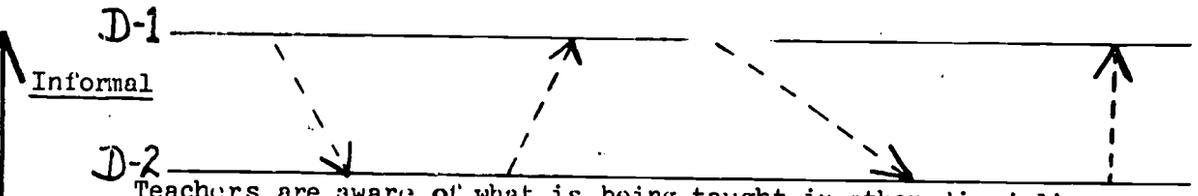
- provide teachers with a greater measure of security and confidence in a "new" program.
- permit the use of existing and available materials.
- result in an activity-based science program.
- provide great opportunity for the use of local resources and the development of local materials.
- unveil the potential for a transition to a more socially relevant "environmental" science program.

Members from the staffs of representative middle schools then developed suggested concepts, behavioral objectives, and activities for four of the five unit titles. These science unit "working papers" are included as a part of this interdisciplinary packet and are intended to be used as a preliminary stepping stone to local development of interdisciplinary units.

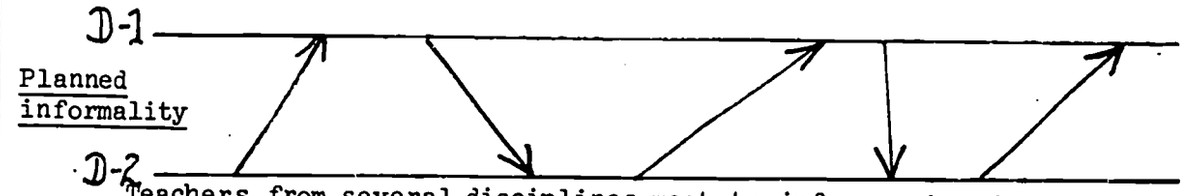
A second preliminary step toward interdisciplinary instruction was taken as the original science membership was balanced with a representation from other disciplines at grade seven and "self-contained" staff at grade six. Using the existing curriculum in social studies and language and the freshly written earth science material as a base, the committee began its interdisciplinary task.

A number of definitions of "interdisciplinary teaching" were considered. A multi-faceted definition was identified as follows:

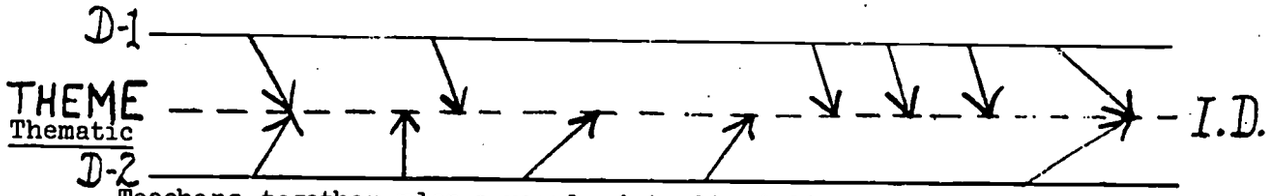
DISCIPLINE = D.



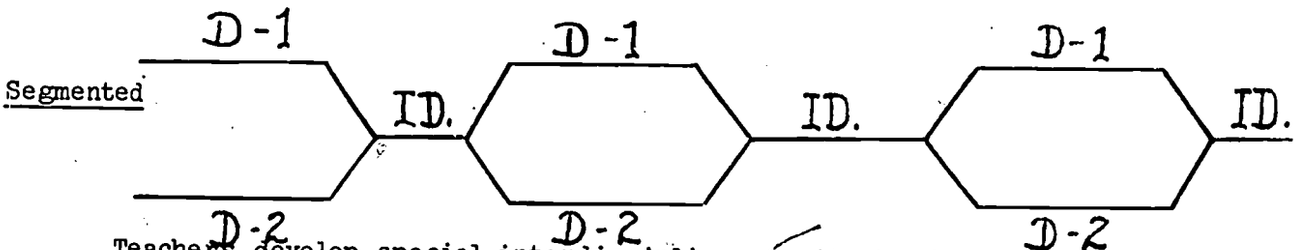
Teachers are aware of what is being taught in other disciplines. They informally point out parallels between their specialty and others to students. They also reinforce and supplement other areas as they teach. Conventional content is not altered.



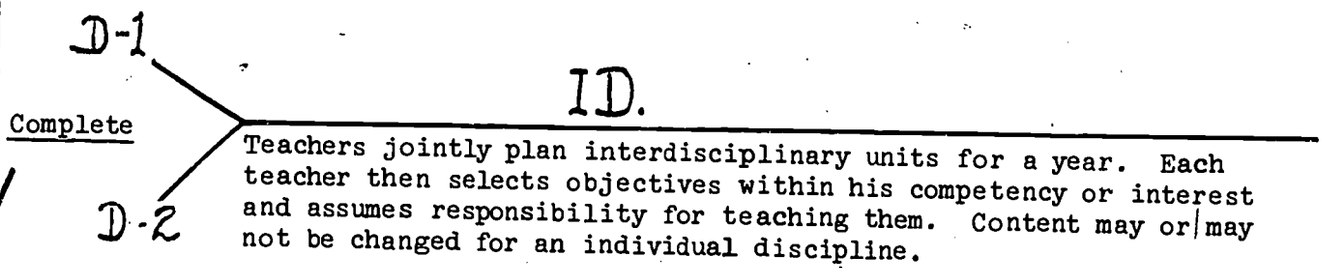
Teachers from several disciplines meet to inform each other of the skills and content they intend to teach. Similarities and possibilities for reinforcement and supplementing are noted. The sequencing of topics is adjusted to allow reinforcement and supplementation to be more effective. Conventional content is not altered.



Teachers together plan a yearly interdisciplinary theme to which each specialty will be able to contribute at various times. Content may not be changed, but special provision may be made to include the theme unit concepts.



Teachers develop special interdisciplinary units to which all disciplines contribute totally for a period of time. At the conclusion of the interdisciplinary unit, teachers return to teaching their speciality.



Teachers jointly plan interdisciplinary units for a year. Each teacher then selects objectives within his competency or interest and assumes responsibility for teaching them. Content may or may not be changed for an individual discipline.

INTERDISCIPLINE = ID.

The many definitions, as you can see, form a hierarchy which begins with a most informal interdisciplinary effort, and ends with a total interdisciplinary curriculum. Each form has its peculiar advantages. However, selection from the latter three definitions would most likely result in the educational dividends described on page one of this document.

The goal defined, the committee began the "interaction process" which resulted in the thematic and conceptual statements of the proposed interdisciplinary scope and sequence for grade seven. A trio of organizing themes: Man Uses a Variety of Communication Systems, A Descriptive Look at the Natural Environment, and Man and His Environment Interact seemed to provide a skeleton on which the present curriculum might be placed. Further, this structure seemed to lend itself to future interdisciplinary modification.

Within this framework, a sampling of behavioral objectives from single disciplines were stated, reacted to, accepted or discarded. It was the feeling of the committee that because of the earlier work done in science that scope and sequence appeared to be heavily weighted with science objectives. Social studies and language members were confident that as teachers worked with it that a balance would be achieved.

The value of this interdisciplinary package is not known. It must be used and tested by teachers and students. It must be modified and added to by teachers and students. As you can see, it is a "working paper" . . . a beginning. It requires your additions, deletions, and comments. Guideposts which might provide you with direction for future development, both locally and centrally, include:

- teacher feedback
- student feedback.
- a focus upon environmental values and value dilemmas.
- forty-four "key" environmental concepts.

EVALUATION - 7th Grade Interdisciplinary Materials

In order to determine the effectiveness and validity of this material, it must be evaluated in terms of specific criteria. It is hoped that evaluation will be an ongoing process as the material is used during the year. For this reason, a checklist is provided beside the objectives within the "working paper."

OPEN-ENDED EVALUATION

An additional, more open-ended evaluation instrument is included at the end of each unit. Specific comments about objectives, concepts, successful activities, sources of material, additions or deletions, or future curricular direction should be made here.

OBJECTIVE EVALUATION

It is essential that the teacher evaluate the objectives of the unit. It would be most valuable if the student would also evaluate the objectives. The following criteria, numbered 1-5, corresponds with the aforementioned checklist:

CRITERIA

1. It was written at the student's level of maturity, comprehension, or interest.
2. It suggests a usable activity or available materials.
3. It communicated an instructional direction.
4. It was readily evaluated.
5. It was successfully accomplished by the majority of students.

PROCEDURES

It is not expected that all objectives will be evaluated in all categories. Some objectives may not be applicable to the unit. If so, place a check (✓) in column "0" along side those objectives which are not applicable.

Similarily, the student may find that certain criteria have greater meaning for him than others. If only selected criteria are applicable, place check mark opposite the objective and within the boxes of the appropriate criteria. In this case, leave inappropriate criteria blank.

Should a given objective fulfill all five criteria, a check mark should be placed in each box (1-5).

Within this packet, two objective evaluation sheets are provided. One copy is intended for the teacher. The second copy may be used as a ditto master, should the teacher choose to have students evaluate.

44 "KEY" ENVIRONMENTAL CONCEPTS

A. MANAGEMENT

1. Water is a reusable and transient resource, but the availability of quality water may be reduced or impaired.

2. Processes, such as erosion and deposition, will modify the landscape.

3. Atmospheric contamination causes physical and chemical changes on earth and affects living things.

4. Man has responsibility to develop an appreciation of and respect for the rights of others.

5. In most countries, wildlife is a public resource.

6. Wildlife refuges, undisturbed natural areas and preserves may be of value in protecting endangered species, and thus perpetuating the gene pool.

B. SAFE WASTE DISPOSAL IS IMPORTANT IF THE WELL-BEING OF MAN AND THE ENVIRONMENT IS TO BE PRESERVED.

1. Environmental contamination can be attributed to increasing human populations, rising standards of living, and the resultant demands for greater industrial and agricultural productivity.

2. Pollutants are produced by natural and man-made processes.

3. The quantity and quality of renewable resources can be extended by reproduction, growth, and management.

4. Soil is classified as a renewable resource, but its natural rate of renewal is extremely slow.

5. Maintaining, improving, and restoring soil productivity is important to human welfare.

6. Soil capability can be maintained by utilizing known agricultural processes.

7. Land zoning, a practice based on value judgments, may result in land uses which will meet the need of society.

8. To reproduce the structure of the natural environment is exceedingly difficult.

9. Plants and animals are renewable resources.

10. The management of nonrenewable resources involves using of all known methods to maximize benefits to the most people over time: Minerals are nonrenewable resources.

11. The rate of use of a nonrenewable natural resource is dependent upon supply and demand.

12. The rate of resource use can be slowed by the development and adoption of alternatives.

13. The amount of precipitation available for use by man varies with topography, land use, and applied management practices.

14. As populations increase, competition for the use of water increases, resulting in a need for establishing water use priorities.

C. NATURAL RESOURCES ARE INTERDEPENDENT, AND THE USE OR MISUSE OF ONE WILL AFFECT OTHERS.

1. All resources are vulnerable to depletion in quantity, quality, or both.

2. Natural resources are important economically, aesthetically, and biologically.

3. Man's ability to reason enables him to change his environment.

4. Options available to future generations must not be foreclosed.

5. Environmental management involves the application of knowledge from many different disciplines.

6. Optimum environmental management is dependent upon a well-informed public.

7. Natural resources are unequally distributed over the earth's surface.

8. Biological systems are described as dynamic, because the materials and energy involved are parts of continuous cycles: All life is dependent upon the energy transfers of green plants.

9. Green plants are the basic source of food, clothing, shelter, and energy.

10. At each successively higher level on an energy pyramid, the organic mass is reduced due to metabolic and energy transfer losses occurring at each exchange.

D. ORGANISMS AND ENVIRONMENTS ARE IN CONSTANT CHANGE.

1. An organism is the product of its heredity and environment.

2. All living things, including man, are continually evolving.

3. Even over a long period of time, environments may change at a faster rate than organisms can adapt to them.

4. In any environment, one component, like space, water, air, or food, may become a limiting factor.

5. Succession is the gradual and continuous replacement of one kind of plant or animal community by another, characterized by gradual changes in species composition.

6. The interaction of environmental and biological factors determines the size and range of species and populations.

E. KNOWLEDGE OF SOCIAL STRUCTURES, INSTITUTIONS, AND CULTURE OF A SOCIETY, MUST BE BROUGHT TO BEAR ON ENVIRONMENTAL CONSIDERATIONS.

1. Man's culture is influenced by the relationships between man and his natural environment.

2. Aesthetic resources and recreational facilities are becoming increasingly important in leisure time activities.

F. THE ECONOMY OF A REGION DEPENDS ON THE UTILIZATION OF ITS NATURAL, HUMAN, AND CULTURAL RESOURCES AND TECHNOLOGIES OVER TIME.

1. The location of resources affects the economy of a region.

2. The political and economic strength of a country is in part dependent upon its access to domestic and foreign resources.

3. Man's need for food, fiber, and minerals increases as populations expand.

4. Social and technological changes alter the interrelationship, importance, and uses for natural resources.

5. Increased population mobility is changing the nature of the demands upon some resources.

6. Supply and demand, in relation to values held by society, determines economic values of resources.

Unit I Man Uses a Variety of Communications Systems

Concept I: Communication is a process by which meaning is transmitted through a common set of symbols.

a. The symbol is not the thing; it has no inherent meaning.
b. Man uses sensory organs to encode and decode communications.
c. A map is a graphic communication of a location.

Concept II: Communication exchanges meaning in many different ways.

a. The meaning received is not always the meaning sent.
b. The character of the message changes with the nature of the audience.
c. The character of the message may change due to the medium which transmits the message.

Concept III: Communication is vital to the production, exchange, and preservation of culture.

a. Communication occurs across time.
b. Communication occurs across space.
c. Communication influences human affairs.

Concept IV: Communication has many purposes and its effectiveness can be improved through planning and design.

a. The major elements in message design are purpose, audience, focus, and media.
b. Effective decoding of a message demands attention to all elements of the message and to the sender.

- Sender
- Message
- Tone
- Time
- Context
- Motive

UNIT I Man Uses a Variety of Communication Systems

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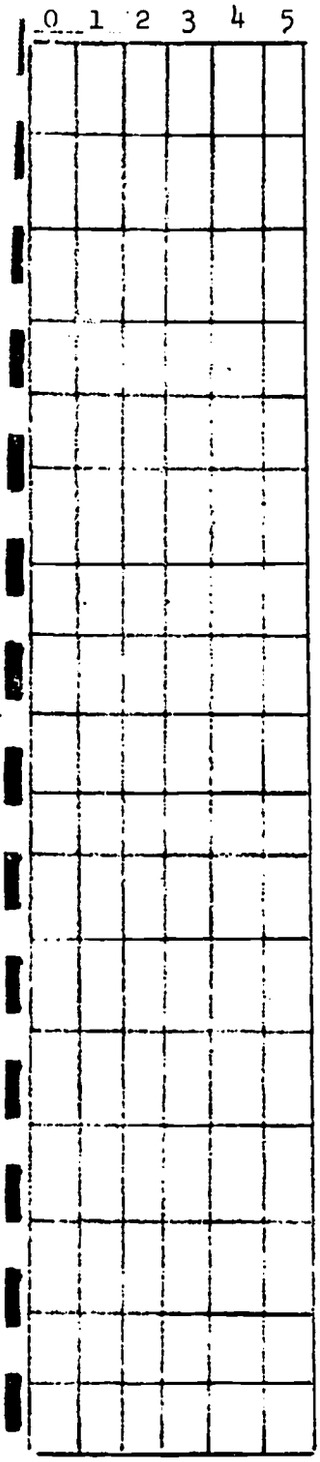
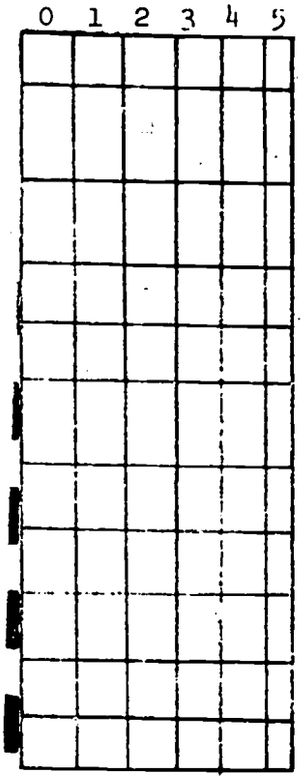
Concept I Behavioral Objectives:



The student should be able to:

1. Locate on a topographical map and define: strait, bay, gulf, isthmus, island, hill, plateau, tributary, mountain, plain, basin.
2. List devices other than words which various disciplines use to communicate ideas.
3. Estimate the actual distance between two points given their difference in latitude or longitude.
4. Convert map distances to actual distances using the map's scale.
5. Identify the parts of the communicative process: sender, encoding, message, decoding, receiver.
6. Orient a map in terms of direction or landmarks as is appropriate for a given map.
7. Describe the boundary of a country using latitude and longtitude.
8. Sketch on a circle: Tropics of Cancer and Capricorn, the equator, the Arctic and Antarctic Circles.
9. Find and describe locations using azimuth and distance.
10. Find and describe locations using latitude and longtitude.
11. Use maps to discover the topography, climate, resources, and basic economy of a country.
12. Describe the physical conditions necessary for the production and transmission of sound.
13. Describe, in terms of points on the compass, the relative direction of one point from another.
14. List words which are unique to the study of English, geography, math, and science.
15. Construct a map having an appropriate title, a definite purpose, appropriate symbols and scale.
16. Illustrate the communication model.
17. Find, on a map using contours, the steepest place, the most level area, and the top of an elevation such as a hill.



18. Construct a scale drawing of an object and compare the dimensions of the actual object with those of the scaled object.

19. Give locational directions using reference point, direction, and significant landmarks.

20. Identify directions on a map.

21. Locate and name the continents.

22. Distinguish between symbols and their referents.

23. Devise a new system of communication with another student and demonstrate it to the class.

24. Represent variations in altitude on a map.

25. Identify factors which affect the pitch and volume of sound.

26. Identify parallels and meridians.

27. Find and describe locations using a simple grid system.

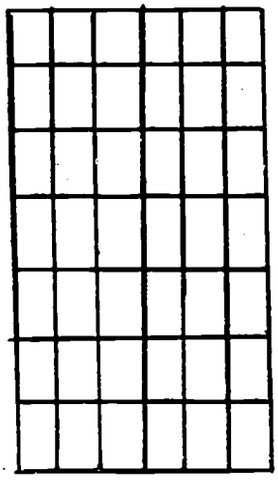
28. Explain how language is learned.

Unit I Man Uses a Variety of Communication Systems

Concept II Communication exchanges meaning in many different ways.

a. The meaning received is not always the meaning sent.
b. The character of the message changes with the nature of the audience.
c. The character of the message may change due to the medium which transmits the message.

Concept II Behavioral Objectives



The student should be able to:

1. Distinguish between the stated and implied meaning of a message.
2. Be sensitive to audience reaction while communicating.
3. Perceive when the medium is affecting the message.
4. Evaluate the relative effectiveness of verbal and non-verbal communication.
5. Prepare a communication for a specific, non-peer, audience.
6. Use common electronic or mechanical communications media effectively.
7. Evaluate the effectiveness of electronic devices as message transmitting media.

Unit I Man Uses a Variety of Communication Systems

Concept III Communication is vital to the production, exchange, and preservation of culture.

a. Communication occurs across time.
b. Communication occurs across space.
c. Communication influences human affairs.

Concept III Behavioral Objectives:

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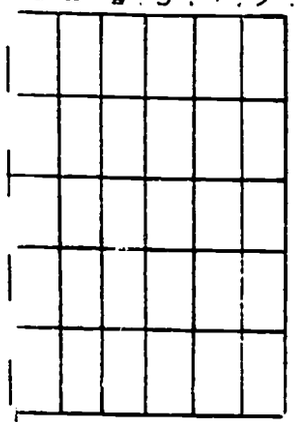


The student should be able to:

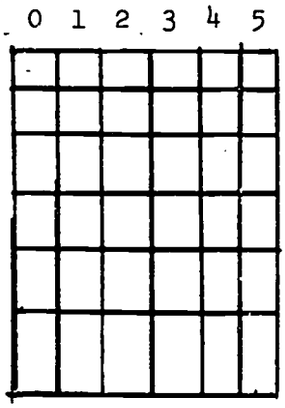
1. Illustrate by example that communication can bridge the gap between the past and the present.
2. Explain how man's use of media can reduce the proglem of space.
3. List examples of the unique effect of communication on his generation.
4. Cite specific examples from history where improved communications systems may have changed events.
5. Explain how early man communicated his cultural heritage to succeeding generations.

Unit I Man Uses a Variety of Communication Systems

Concept IV Communication has many purposes and its effectiveness can be improved through planning and design.

a. The major elements in message design are purpose, audience, focus, and media.
b. Effective decoding of a message demands attention to all elements of the message and to the sender.
   1) Who is the sender? (authority)
   2) What is said? (message)
   3) How is it said? (tone)
   4) When is it said? (time)
   5) What is its context? (relationship)
   6) Why is it said? (motive)

Concept IV Behavioral Objectives:



The student should be able to:

1. Use the elements of communication design to devise effective messages.
2. Evaluate the effectiveness of a communication.
3. Listen critically.
4. Identify and apply propaganda techniques.
5. Determine the purpose of a message, whether obvious or implied.
6. Evaluate a message for validity of its content using the elements of the message and knowledge of the sender.

Unit II A Descriptive Look at the Natural Environment

Concept I: The natural environment consists of physical and biotic phenomena.

a. Landscapes are constantly changing.
b. The earth is a member of the solar system.
c. Earth-sun relationships determine climate and vegetation.
d. Observable ecosystems and man are part of the natural environment.
e. Weather is the prevailing atmospheric condition.

Concept II: Man has attempted to describe and explain his environment in many ways.

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Concept I Behavioral Objectives:

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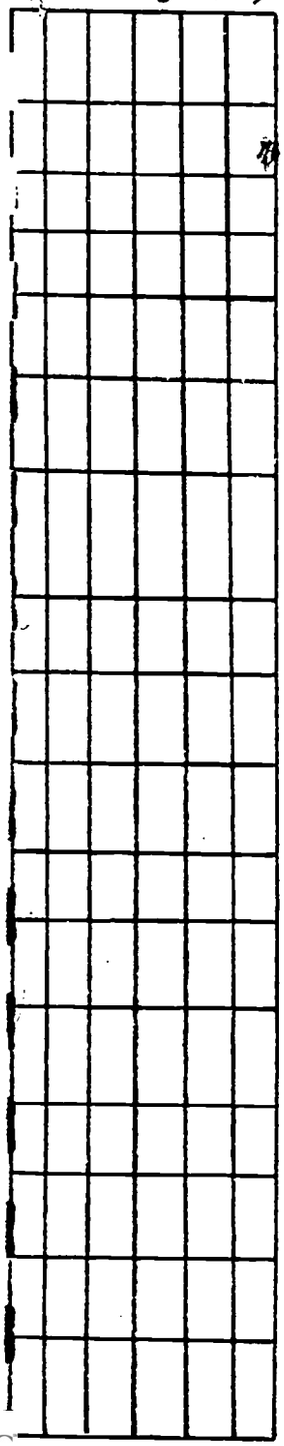
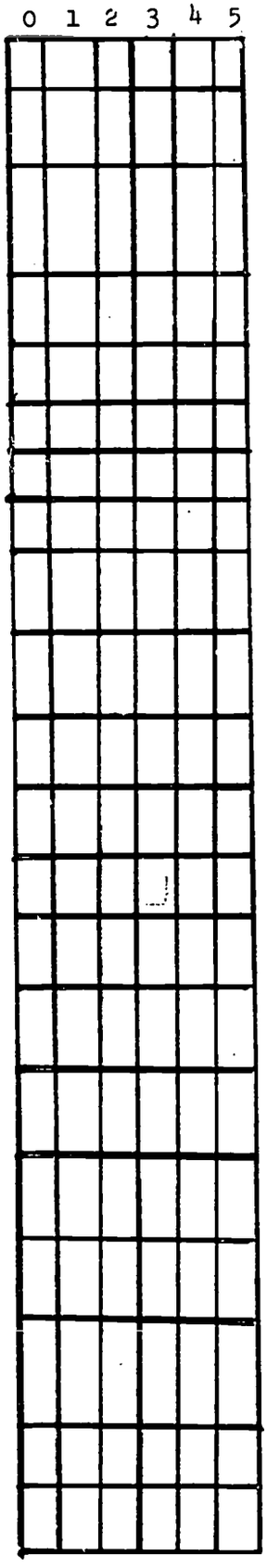


The student should be able to:

1. Distinguish between heat and temperature.
2. List agents which change the landscape.
3. Orient and use a sky map to locate constellations.
4. Define a community of plants and animals.
5. Calculate sun time of a given location given the sun time and longtitude of another location.
6. Analyze relationships between pairs of weather variables and establish predictable patterns.
7. Demonstrate factors which affect the rate of weathering of earth materials, e.g., surface area, type of material, particle size, weathering agent.
8. Read a thermometer to the nearest degree.
9. Describe and explain ways in which crustal materials may have their positions changed.
10. Explain the movement of the moon in relation to star's positions through one night and through 30 consecutive nights.
11. List the resources for which plants and animals compete.
12. Sketch the solar system showing each planet in its position relative to other planets and the sun.
13. Demonstrate through student-made models various geologic phenomena which have changed the landscape.
14. Interpret a weather map.
15. Explain and diagram how a convection current is created in a liquid or gas.
16. List evidence of a landscape agent's effect on the landscape by individually studying one of the agents.
17. Cite proof that the earth rotates on its axis and revolves around the sun.



18. List, in order, the succession of plant communites from a plowed or land to a maple forest.

19. Explain the effect of climate on natural phenomena in a given part of the world.

20. Communicate what his neighborhood might have looked like before man arrived, what it looks like now, and what it might look like 100 years from now.

21. Explain the effect of glaciation of man's activities in Wisconsin.

22. Identify symbols found on a weather map.

23. Use elements of message design to report the results of this study.

24. Use a globe to demonstrate the inclination of the earth.

25. Explain why the succession of plants occurs.

26. Test and compare heat absorption and heat retention of various materials.

27. Interpolate and extrapolate from graphs of heat absorption and retention.

28. Demonstrate day and night with a flashlight and a globe.

29. Diagram a food web in one of the following ecosystems: maple forest, wet lands, pine forest.

30. Explain the value if diversity in plant and animal communities.

31. Identify agents which caused a given landscape to change (from a photograph or other source).

32. Describe the topography of a country or area of the world as it now appears.

33. Write a descriptive essay defining environment and describing his immediate environment.

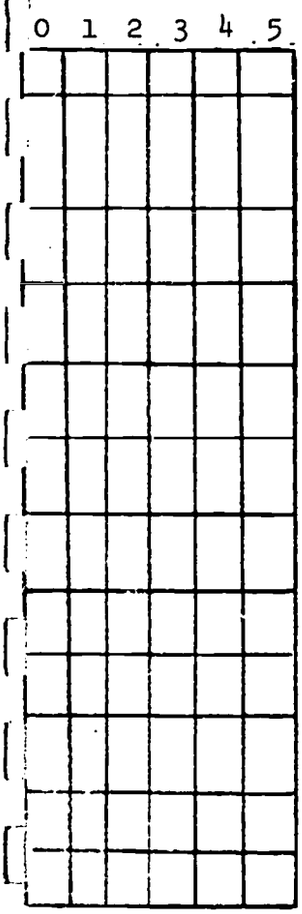
34. Identify aspects of Wisconsin geology which can be attributed to glaciation.

35. Explain the sequence of events in the water cycle (include cloud formation.)

36. Explain the topographical changes that are likely to occur if man does not interfere (based upon knowledge of climate, soil, vegetation, present topography).

37. Explain how a volcano is formed.

38. Demonstrate the effect of the earth's angle of inclination on the rate of heating of the earth.



39. List factors which affect relative humidity.

40. List examples of the building up and tearing down process on a variety of scales. (anthill building vx. volcanic mountain building; roadbuilding vs. plowing by a glacier.)

41. Explain the west-east movements of air masses.

42. Explain changes which might have taken place in that area's topography in the last million years.

43. Explain how a thermometer works.

44. Explain weather and climate conditions in terms of heat retention and absorption.

45. Explain sources and movements of air masses.

46. Associate weather types with cloud types.

47. Measure relative humidity and read relative humidity tables.

48. Infer, from plotting earthquak occurrence on a map, that earthquakes occur in defined zones.

49. Explain causes of snow, rain, hail, sleet, dew, fog.

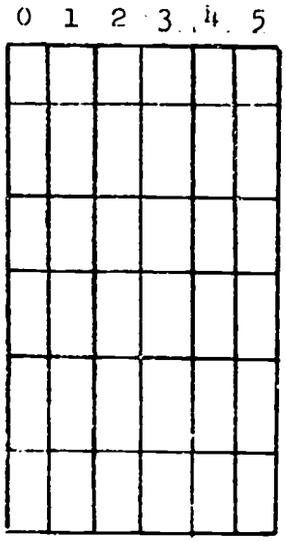
50. List evidence that the world is round.

UNIT II A Descriptive Look at the Natural Environment

Concept II Man has attempted to describe and explain his environment in many ways.

Concept II Behavioral Objectives

The student should be able to:



1. Define mythology as man's beginning attempt to make up stories answering his questions about his environment.
2. Describe how man's explanation of a physical or biotic phenomenon moved from the mythological to the "scientific".
3. Construct a myth as his attempt to explain some natural phenomenon.
4. Trace the development of one idea about the natural environment from mythology to its presently held scientific explanation.
5. Describe the way in which early Americans used art to describe their environment.
6. List examples of environmental forces that are found in major works of music, art, or dance.

Unit III Man and His Environment Interact

Concept I: Man is a changer of the natural environment.

a. Man domesticates plants and animals.
b. Man uses the resources of his environment to his immediate advantage.
c. Man supplants the natural environment with an artificial environment.
d. The natural resources of the earth are limited.

Concept II: Man adapts to his environment.

a. Locations and growth of many cities and towns were dependent upon features of the physical environment.
b. Agriculture is dependent upon many characteristics of the natural environment.
c. Industrial and agricultural technological advances have helped man adapt to his environment and have helped adapt the environment to man.

Concept III: The interaction of man and his environment is reflected in his culture.

Concept IV: Man must establish priorities with regard to the environment.

a. While deriving great benefit from their industries, industrial societies are degrading their environments through pollution of air, water, and land.
b. Reversal of this degradation may be possible if man decides it is important to do so.
c. Great increases in population will compound present environmental problems unless changes are made which diminish the degradation of the environment.

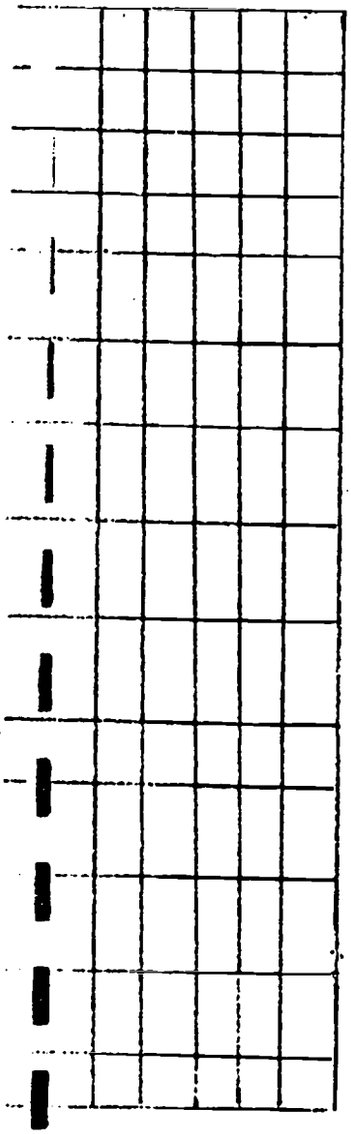
UNIT III Man and His Environment Interact

Concept I Man is a changer of his natural environment.

a. Man domesticates plants and animals.
b. Man uses the resources of his environment to his immediate advantage.
c. Man supplants the natural environment with an artificial environment.
d. The natural resources of the earth are limited.

Concept I Behavioral Objectives:

0 1 2 3 4 5 The student should be able to:



1. Recognize man's dependence upon plants and animals.
2. Identify a variety of conservation methods man uses.
3. Relate conservation methods to present local problems.
4. Locate on a map particular natural resources of the world.
5. Predict how long a given resource will last based upon an assessment of the reserve and present rate of use.
6. Compare and contrast the natural environment of 300 years ago with our natural environment today.
7. Give examples which show how man interferes with the balance of nature.
8. List present day conveniences which are causing man to use resources at a faster rate than need would demand.
9. Predict the effect of man's increasing population on the use of natural resources.
10. List local natural resources and determine the use being made of each.
11. Examine man's attitude toward the natural environment over the past to determine what changes, if any, have taken place.
12. List ways in which man has created artificial environments purposefully and by accident.
13. Evaluate the artificial environments man has created in terms of the quality of man's life on earth.
14. Describe environmental changes brought about by man's agricultural practices.

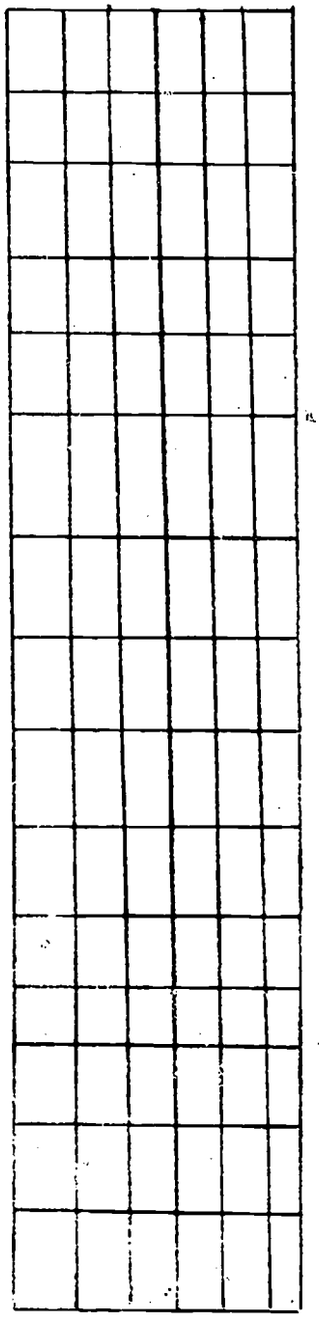
UNIT III Man and His Environment Interact

Concept II Man adapts to his environment.

a. Locations and growth of many cities and towns were dependent upon features of the physical environment.
b. Agriculture is dependent upon many characteristics of the natural environment.
c. Industrial and agricultural technological advances have helped man adapt to his environment and have helped adapt the environment to man.

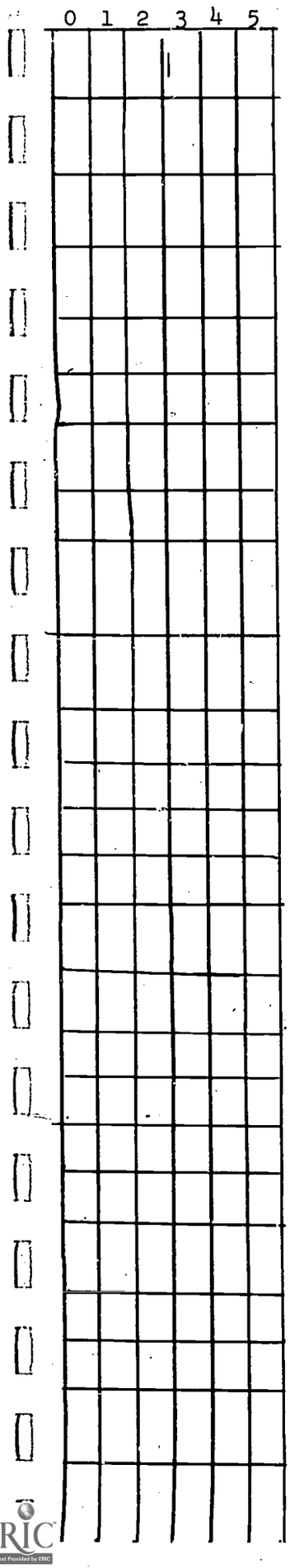
Concept II Behavioral Objective

0 1 2 3 4 5



The student should be able to:

1. Locate on a map the major urban centers in the United States and in Wisconsin.
2. Define and give examples of technology.
3. Illustrate,by successfully completing a case study, the concept of limited space and priority of usage.
4. List ways man tried to equalize food distribution in the world.
5. Compare and contrast man's attitude toward industry 100 years ago with his present attitude toward industry.
6. Use in-depth investigative techniques to explore technology in one aspect of modern life, i.e., transportation, agriculture, automation, loss of freedom, cybernation.
7. Use the elements of message design to report the results of this study.
8. List advantages and disadvantages of creating an artificial environment.
9. List positive effects of industrialization on man's quality of life.
10. List negative effects of industrialization on man's quality of life.
11. Identify factors which contribute to city growth.
12. Locate the major population centers on an outline map of the world.
13. Explain why some areas of the world have food surpluses while others suffer from food scarcity.
14. Define the terms village, town, city, metropolitan area, megalopolis and distinguish between them.
15. Locate on an outline map of the world the main areas of known mineral deposits.



16. Find the demographic trends for the city of Madison, the U.S., the world, and illustrate them.

17. Predict the future of these trends and project an outcome if population growth rates remain constant.

18. Explain from this prediction how the use of the environment will change.

19. Explain how man's diet has changed in various parts of the world because of advanced agricultural technology.

20. List guidelines for good city planning.

21. Explain the importance of soil to man.

22. Compare and contrast city life before the Industrial Revolution and life in a city today.

23. Apply mathematical procedures to calculate population densities.

24. Explain how technological advances in agriculture have affected crop production, the farm labor force, under-developed countries, natural balances, the quality of the environment, food scarcities.

25. Identify the connections and interrelationships between the people and the city functions.

26. List problems of major cities.

27. Determine and evaluate reasonable solutions to one of these problems.

28. Explain how agriculture affects diversity within plan communities.

29. Explain the relationship between resources and urban centers.

30. Identify the aspects of manufacturing which are indigenous to a given area.

31. Relate crop types to climatic regions.

32. Develop a plan for the proper allocation of space in Madison.

33. Explain why cities are located where they are.

34. Locate the major manufacturing areas of the world on an outline map.

35. Analyze a city in terms of its functions.

36. List some results of man's upsetting of the balance within the natural environment.

37. Explain the relationship of soil and climate to food production.

381 Illustrate methods man uses to get maximum benefits from the soil.

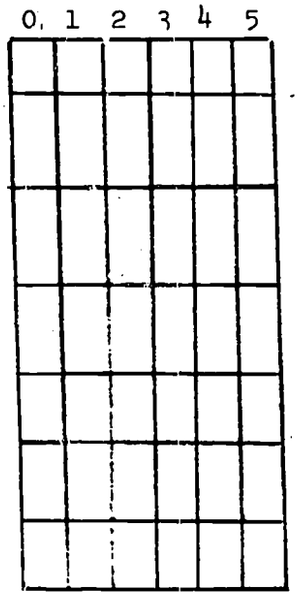
39. Identify the major aspects of manufacturing, i.e., capital, labor, resources, process, distribution, waste, product.

UNIT III Man and His Environment Interact

Concept III The interaction of man and his environment is reflected in his culture.

Concept III Behavioral Objectives:

The student should be able to:



1. Describe, from lists of words from two societies, key aspects of their environments.
2. List inferences about an environment from a study of a society's artifacts.
3. Compare and contrast the environments and artifacts of two societies.
4. Describe what an environment may be like based upon a study of a religion.
5. Describe the effect of the environment on one society.
6. List ways man's environment may affect the way he behaves toward other men in his society.
7. Identify reflections of an environment in a society's art, music, and dance.

UNIT III Man and His Environment Interact

Concept IV Man must establish priorities with regard to the environment.

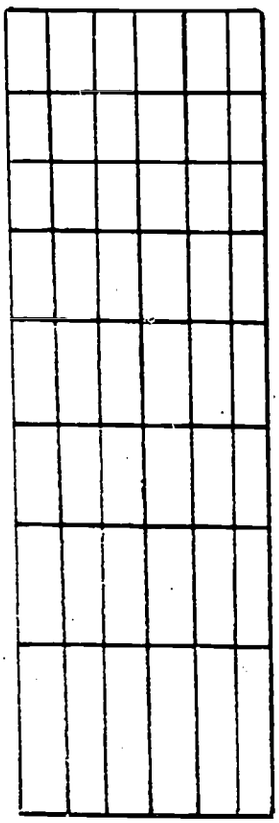
a. While deriving great benefit from their industries, industrial societies are degrading their environments through pollution of air, water and land.

b. Reversal of this degradation may be possible if man decides it is important to do so.

c. Great increases in population will compound present environmental problems unless changes are made which diminish the degradation of the environment.

Concept IV Behavioral Objectives:

0 1 2 3 4 5



The student should be able to:

1. List major degraders of our environment on a local, state, national, and world wide basis.
2. Explain the result of major types of environmental pollution.
3. List the benefits derived from and the environmental degradation caused by 4 industries in the city of Madison.
4. Evaluate the effect of growing population on the city of Madison, the state of Wisconsin, and the United States.
5. Contrast and compare the effect of population growth on the city of Madison with the effect of population growth on the city of Chicago.
6. Evaluate the state of his environment and give the bases for his evaluation.
7. Use in-depth research techniques to investigate the causes, effects, and possible solutions to one environmental problem in this city or the state of Wisconsin.
8. Evaluate each solution from his investigation in terms of practicality, feasibility, and whether the effects of the solution on industry, etc., concerned would be of less importance to society than the benefit which may derive from the solution.

MAPPING

CONCEPTS

1. A surface location is determined by a reference point, a direction, and a distance from a reference point.

2. Landmarks are used as reference points to find surface locations.

3. Direction can be given in many different ways.

4. Points can be located on a map in many ways: simple grid; azimuth-distance; latitude-longitude.
   a. Simple grid.
   b. Azimuth is an angular measurement from fixed north and when combined with a distance can be used to find location on the ground or map.
   c. A location can be found by knowing latitude, longitude and directions of a point.

5. Scaling permits man to represent the size of a shape conveniently.

6. A map is a scaled graphic representation of a surface.

7. Symbols can be used to represent natural features or man-made objects as indicated by the legend on a map.

8. The purpose of a map affects the scale and symbols to be used.

9. A map can be oriented to the earth's surface using known landmarks and directions.

10. Variation in the altitude of the earth's surface can be represented in a number of ways: contour lines, color, shading.

11. A contour line is a line connecting points of equal altitude on the earth's surface.

12. The shape of the land can be determined with simple equipment.

13. Distances can be measured indirectly by triangulation.

14. Complete information about an area cannot be placed on a simple map.

OBJECTIVES

The student should be able to:

1. identify essential elements of giving locational directions (direction from a reference point, distance from a reference point, significant landmarks).

2. a. communicate a set of directions from a reference point which would permit another person to find a location.

   b. locate a place on a map by landmarks.

   c. communicate a location using landmarks.

3. describe in terms of the points of a magnetic compass (N. NNE. SE. etc.), the relative directions of one point from another.

4. a. find location using a simple grid.

   b. describe a location using a simple grid system.

   c. find a location using azimuth and distance.

   d. describe a location using azimuth and distance.

   e. find location using latitude and longitude.

   f. describe location using latitude and longitude.

5. a. construct a scale drawing of an object.

   b. compare dimensions of actual object and scaled object.

6. convert map distances to actual distances.

7. construct a map which: has purpose, has a title, utilizes symbols, has legend, is drawn to scale, and can be oriented to direction.

8. select the most appropriate map for a given purpose.

9. orient a map to north.

10. represent variations in altitude on a map.

11. a. find a map using contours: the steepest area, the distance between two points on a contour.

    b. draw inferences from a contour map about the topography of an area: steepness of slope, elevation of specific points, shape of landforms.

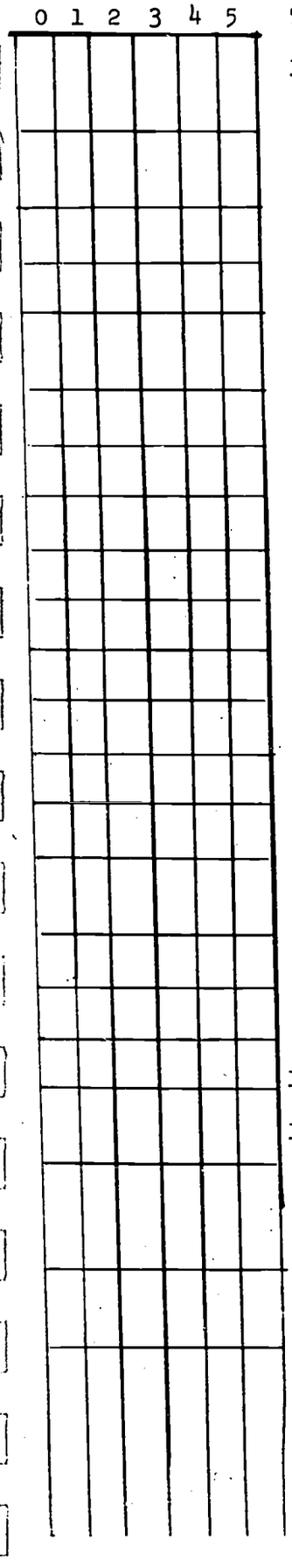
12. describe material and procedures for making a map of a topographic feature.

13. a. measure distances by triangulation.

    b. locate points by triangulation.

14. gather and select information about a particular area (city, state, country), from several kinds of maps of this particular area (city, state, country).

OBJECTIVES



The student should be able to:

1. Identify essential elements of giving locational directions (directions from a reference point, distance from a reference point, significant landmarks).

2. a. Communicate a set of directions from a reference point which would permit another person to find a location.

   b. Locate a place on a map by landmarks.

   c. Communicate a location using landmarks.

3. Describe in terms of the points of a magnetic compass (N, NNE, SE, etc.), relative directions of one point from another.

4. a. Find location using a simple grid.

   b. Describe a location using a simple grid system.

   c. Find a location using azimuth and distance.

   d. Describe a location using azimuth and distance.

   e. Find location using latitude and longtitude.

   f. Describe location using latitude and longtitude.

5. a. Construct a scale drawing of an object.

   b. Compare dimensions of actual object and scaled object.

6. Convert map distances to actual distances.

7. Construct a map which: has purpose, has a title, utilizes symbols, has legend, is drawn to scale, and can be oriented to direction.

8. Select the most appropriate map for a given purpose.

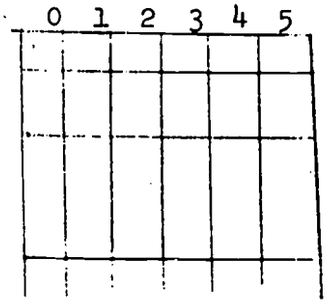
9. Orient a map to north.

10. Represent variations in altitude on a map.

11. a. Find a map using contours: The steepest area, the distance between two points on a contour.

    b. Draw inferences from a contour map about the topography of an area: steepness of slope, elevation of specific points, shape or landforms.

12. Describe material and procedures for making a map of a topographic feature.



13. a. Measure distances by triangulation.

    b. Locate points by triangulation.

14. Gather and select information about a particular area (city, state, country), from several kinds of maps of this particular area (city, state, country).

ACTIVITIES

1

I. Concept:

A surface location is determined by a reference point, a direction, and a distance from a reference point.

II. Behavioral Objectives:

Identify essential element of giving locational directions (direction from a reference point, distance from a reference point, significant landmarks).

III. Activities:

A. Treasure Hunt:

1. Group students in pairs.
2. Provide each group with a marked or numbered treasure.
3. Each group hides the treasure within specified boundaries.
4. Assign a task of writing a set of directions which would permit others to find the treasure.
5. Each pair receives a set of directions that are randomly selected and prepared by others.
6. Communicate direction - suggestions: initially the directions may be given orally to precipitate a need for written directions.
7. Students attempt to follow directions and find treasure.
8. On return, class discusses whys of success and failures. The discussion should lead to identification of essential elements of giving directions. Possible by-product: the exercise may lead to the identification of students' inability to follow directions.

2

I. Concept:

Landmarks are used as reference points to find surface locations.

II. Behavioral Objectives:

A. Communicate a set of directions from a reference point which permit another person to find a location.

B. Locate a place on a map by landmarks.

C. Communicate, using landmarks, a location.

III. Activities:

A. Communicate directions from one point to another in a familiar situation: classroom to auditorium, classroom to gym, home to school, home to shopping area, home to friend's house, etc.

B. 1. Identify local landmarks and evaluate in terms of observability, specificity...etc.
2. Pool landmark information from students' set of directions.
3. Have students classify landmarks as to specificity.

3

I. Concept:

Direction can be given in many different ways.

II. Behavioral Objective:

Describe in terms of the points of a magnetic compass (N, NNE, SE, etc.) the relative directions of one point from another.

III. Activities:

A. Students should be paired, each pair being assigned a letter marker, i.e., "A", "B", ... "C". Pairs of students then randomly scatter on the playground so still easily in view. Each pair would then identify the direction of other pairs from their use of a magnetic compass. For example, "A" is NE of "B". Accuracy of directions could be easily ascertained because if "A" is NE of "B" then "B" is SW of "A".

4

I. Concept:

A. Points can be located on a map in many ways: simple grid; azimuth distance; latitude-longitude.

1. Simple grid.
2. Azimuth is an angular measurement from fixed north and when combined with a distance can be used to find location on the ground or map.
3. A location can be found by knowing latitude, longitude and directions of a point.

II. Behavioral Objectives:

A. Find location using a simple grid.

B. Describe a location using a simple grid system.

C. Find a location using azimuth and distance.

D. Describe a location using azimuth and distance.

E. Find location using latitude and longitude.

F. Describe location using latitude and longitude.

III. Activities:

A. Apply simple grid through Battleship game.

B. Give coordinates of locations on a local map.

C. Give coordinates of objects in room; IMC.

D. Tracing the path of a sow bug or meal worm on a simple grid.

E. Evaluate the child's understanding of latitude and longitude. Given a Mercator projection grid, a set of latitudes and longitudes which have been extracted from a picture of a simple animal, have the child locate points on the end by sequentially connecting the points (follow the dots) the animal picture will be reproduced. Given cities, describe location in terms of latitude and longitude.

F. Develop a basic understanding of angular direction, arc, and circle, by having students (a) make 1/2 turns, 1/4 turns, intermediate turns, etc. (b) using a pencil and string chart a direction system.

G. Plot several points on a simple grid.

1. Draw a line from a reference point to north and label it 0.
2. Connect each point to the reference point.
3. Draw arcs from points to reference line using string and pencil compass.
4. Measure angles with protractor.
5. Measure distance from points to reference point.
6. Make a table of grid coordinates paired with azimuthal (polar) coordinates.

H. Tracking a path using a simple transit, provide a chart with a series of points, A to K, with "A" as the starting or reference point. Pair with each point a distance, and an azimuth (angular direction). If an outside activity: students can follow the charted course and retrieve markers at each point. If an inside activity: a map exercise in which a configuration is drawn using the information provided. Conversely, a route might be given and the student could chart the azimuth and distance.

I. Plot several points on a simple grid. Using an overlay of a polar grid system, the student describes the point in terms of polar coordinates.

J. Use polar coordinates to map location of objects in playground, IMC, room, parking lots, park, simulated area: objects in room, gym, or on table or desk.

5

I. Concept:

Scaling permits man to represent the size of a shape conveniently.

II. Behavioral Objectives:

Construct a scale drawing of an object.

Compare dimensions of actual object and scaled object.

III. Activities:

A. Materials: polygon, st. line picture, curved line picture, picture of student's choice.

1. Draw a grid of appropriate size on the picture.
2. Label each square on the grid.
3. Transfer to scaled grid.
4. Student completes picture and expresses scale factor.

B. 1. Student is given (or prepares) pairs of different sized polygons.
2. Student expresses scale relationship of pair by measurement.

C. Use a picture or model of an object. By measuring model or picture and actual object, compares measurements to ascertain scale factor.

D. Research project: list examples of scaling as used in different occupations: architecture, engineering. Scaling up and scaling down should be considered.

E. Using a projection apparatus, project picture at different distances. Record: distance and projected size of object. Graph and analyze.

F. Student is given a picture and is asked to scale the object several times, e.g. 2:1, 2:1/2, 1:2, 5:1, etc.

6

I. Concept:

A. A map is a scaled graphic representation of a surface.

II. Behavioral Objectives:

A. Student should be able to convert map distances to actual distances.

III. Activities:

A. Student solves a series of distance problems using a map:

1. st. distance between cities,
2. of several routes between two cities, which is shorter,
3. compare distance travelled between two cities by land, water and air,
4. trip planning.

7

I. Concept:

Symbols can be used to represent natural features or man-made objects as indicated by the legend on a map.

II. Behavioral Objectives:

Construct a map which: has a purpose, has a title, utilizes symbols, has legend, is drawn to scale, and can be oriented to direction.

III. Activities:

A. Repeat Treasure Hunt exercise utilizing (map): scale, landmarks, symbols, reference point, legend, title.

B. Map a survey of cars in parking lot by brand.

C. Floor plan of science room: of IMC or library.

D. Fire drill plan.

E. Path of daily class schedule.

F. Map of Capitol Square; shopping center; grocery store and contents.

G. Analyze collection of maps to ascertain what all standard maps have in common.

H. Construct a map and evaluate in terms of these criteria.

8

I. Concept:

The purpose of a map affects the scale and symbols to be used.

II. Behavioral Objective:

Select the most appropriate map for a given purpose.

III. Activities:

A. Students map according to his/her chosen purpose.

B. Students bring to class different maps and explain purpose of each map.

9

I. Concept:

A map can be oriented to the earth's surface using known landmarks and directions.

II. Behavioral Objective:

Orient a map to north.

III. Activity:

Give students maps of their school, playground or the immediate school area and ask them to "turn" the maps so that streets or corridors, etc. run as they actually do.

10

I. Concept:

Variation in the altitude of the earth's surface can be represented in a number of ways: contour lines, color, shading.

II. Behavioral Objective:

A. Represent variations in altitude on a map.

III. Activities:

A. A pyramid of books or other objects is placed on student's desk. Student has task of mapping the desk surface indicating variations in altitude.

B. Investigating maps as models, p. 109 ESCP Lab Man "Investigating Maps as Models" Invest. 3-9 (contours). Stereo photo kit, p. 109 (contours).

C. Make a model using clay, then cut out for contours.

11

I. Concept:

A contour line is a line connecting points of equal altitude on the earth's surface.

II. Behavioral Goals:

A. A student should be able to find on a map using contours: the steepest area, and the distance between two points on a contour.

B. Draw inferences from a contour map about the topography of an area: steepness of slope, elevation of specific points, shape of landforms.

11
(Continued)

III. Activities:

A. Earth Science and Space Science: Lab Man, p. 45, Wolfe, Battan, alii. Construction of a Profile From a Contour Map.

B. On contour map have students locate points of certain elevation; interpolate to find elevations between contour lines.

C. Construct profiles from contours.

D. Identify landforms; draw contours of landforms: canyon, cliff, gentle slope, etc.

E. Contour map activities from Topographic Maps for Earth Science, Brown and Thompson, Silver Burdett Company.

12

I. Concept:

The shape of the land can be determined with simple equipment.

II. Behavioral Objective:

Describe material and procedures for making a map of a topographic feature.

13

I. Concept:

Distances can be measured indirectly by triangulation.

II. Behavioral Goals:

A. Students should be able to measure distances by triangulation.

B. Locate points by triangulation.

III. Activities:

A. Assign pair of students the task of locating and indirectly measuring the distance to "Marked" objects. Triangulation using similar triangle can be used. See sketch.

STEP 1	Distance AB is measured
STEP 2	BAC is measured in degrees
STEP 3	ABC is measured in degrees
STEP 4	Construct a scaled drawing of ABC
STEP 5	Measure scaled distance to C

14

I. Concept:

Complete information about an area cannot be placed on a simple map.

II. Behavioral Objective:

Gather and select information about a particular area (city, state, country) from several kinds of maps of this particular area (city, state, country).

III. Activity:

A. Prepare a written travelogue which describes climate, topography, agriculture, industry and recreation of a hypothetical country.

B. Construct a model of a "country" out of salt-flour. Such features as rivers, lakes, cities, roads, mountains, recreation areas, etc., should be included. Draw a map or maps which communicate all features present in the model.

OPEN ENDED COMMENTS

I. UNIT: _____

II. CONCEPTS: _____

III. OBJECTIVES: _____

IV. MATERIALS: _____

V. ACTIVITIES: _____

VI. COMMENTS: (USE BACK IF NECESSARY) _____

EARTH PROCESSES

CONCEPT

1. Earth processes continually build up or tear down the earth's surface. The geologic present is a clue to the geologic past.
2. At any level observation, landscapes can be divided into areas receiving material and areas losing material...Building Up - Tearing Down.
3. Weathering is a chemical and physical adjustment of rocks and minerals to surface environment.
4. Rates of weathering depends upon the materials being weathered and forces exerted upon them.
5. Volcanoes and earthquakes can provide clues to the composition of the earth.
6. Wisconsin topography was modified by glaciation.
7. Man is a changer of the earth's surface.
8. Man uses models to help him understand complex geologic phenomenon.

OBJECTIVES

1. To list the agents which change the landscape.

2. To explain the way the force of gravity combines with water, wind, and ice to change the position of earth materials.

3. Given an independent study project about a local agent producing landscape change:

    a. locate a site where the agent is at work
    b. cite evidence of the change caused by the agent
    c. identify man's role in the change
    d. project future changes
        1. without human interference
        2. with human interference

4. To categorize landscape changes which occur in patterns and those that occur randomly.

5. List examples which illustrate the tearing down and building up process on a variety of scales (ants building an anthill vs. building a volcanic mountain, man building a road vs. a glacier plowing a continent).

6. To describe and explain the chemical and physical agents which weather earth materials.

7. To identify positive and negative effects of the weathering of earth materials.

8. To explain the factors which effect the rate of weathering earth material (e.g., surface area, materials, particle size, kind and intensity of weathering agent).

9. To evaluate the statement, "Man is a partner in the weathering process."

10. To infer from plotting of earthquake occurrence on a map, that earthquakes occur in defined zones.

11. To explain how a volcano is formed.

12. To find the epicenter of an earthquake, given seismographic readings from three stations. (ESCP Pt. 2, Lab Manual p. 446, Investigation 16-4).

13. To cite one theory of earthquake causes.

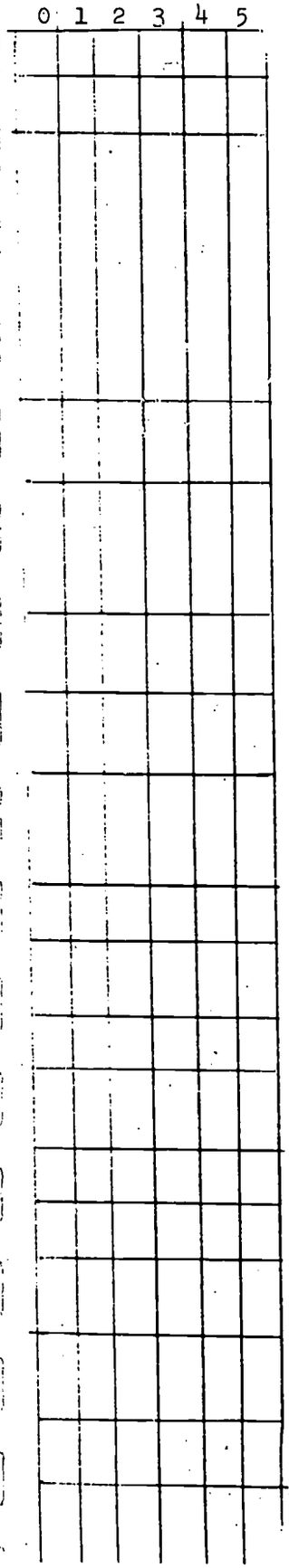
14. To explain how earthquake data is gathered.

15. To identify and explain three examples of evidence of glaciation in Wisconsin geology.

16. To identify ways in which man is changing and has changed the landscape locally and evaluate the wisdom of these acts.

17. To demonstrate, through student constructed models, geologic phenomena which change the landscape.

OBJECTIVES



1. To list the agents which change the landscape.

2. To explain the way the force of gravity combines with water, wind, and ice to change the position of earth materials.

3. Given an independent study project about a local agent producing landscape change:

   a. Locate a site where the agent is at work.
   b. Cite evidence of the change caused by the agent.
   c. Identify man's role in the change.
   d. Project future changes
      1. without human interference.
      2. with human interference.

4. To categorize landscape changes which occur in patterns and those that occur randomly.

5. List examples which illustrate the tearing down and building up process on a variety of scales (ants building an anthill vs. building a volcanic mountain, man building a road vs. a glacier plowing a continent.).

6. To describe and explain the chemical and physical agents which weather earth materials.

7. To identify positive and negative effects of the weathering of earth materials.

8. To explain the factors which effect the rate of weathering earth material (e.g., surface area, materials, particle size, kind and intensity of weathering agent).

9. To evaluate the statement, "Man is a partner in the weathering process."

10. To infer from plotting of earthquake occurrence on a map, that earthquakes occur in defined zones.

11. To explain how a volcano is formed.

12. To find the epicenter of an earthquake, given seismographic readings from three stations. (ESCP Pt. 2, Lab Manual p. 446, Investigation 16-4).

13. To cite on theory of earthquake causes.

14. To explain how earthquake data is gathered.

15. To identify and explain three examples of evidence of glaciation in Wisconsin geology.

16. To identify ways in which man is changing and has changed the landscape locally and evaluate the wisdom of these acts.

17. To demonstrate, through student constructed models, geologic phenomena which change the landscape.

ACTIVITIES

1. Local materials instructional sets on geology of Wisconsin provides excellent A-V resources as well as earth materials and field trip suggestions:

   a) Geology of Wisconsin.
   b) Glacial Geology.
   c) Geology of Devil's Lake.

2. Record on a map of the world earthquake data from epicenter cards furnished by the U. S. Geological Survey, Washington 25, D.C. Information provided by the free cards includes intensity, depth, latitude and longitude, and geographical place name. Epicenters of earthquakes are pinpointed on the map using map tacks of varying colors. Color variation can be used to designate earthquake intensity. (ESCP Investigating The Earth Lab Manual 1, p. 49 Investigation 1 - 7).

3. Demonstrate the flow properties of ice by freezing a long narrow bar of ice (45 cm by 5 cm by $2\frac{1}{2}$ cm). Place ice bar in a freezer with a support beneath each end. Place a kilogram weight in the middle of the bar. In time, the ice bar will be depressed in the middle.

4. Demonstration of factors affecting glacial abrasion:

   Using blocks of wood of differing hardnesses, to represent bed rock, and sand papers of varying coarseness to represent rocks carried by the glacier, investigate factors effecting glacial abrasion.

5. Freeze ice cubes with and without abrasive material and demonstrate the non-abrasive quality of ice alone by rubbing a cube over clay or wood.

WEATHER

Concepts

1. Without sunlight, basic weather processes would not operate.

2. **Heat is the total amount of thermal energy possessed by a body; temperature is the average thermal energy of a body.**

3. Heated bodies expand.

4. The unequal distribution of solar energy produces the general convection circulation pattern of the atmosphere.

5. The earth's rotation modifies basic convective circulation by deflecting north-south motions and producing wind belts.

6. Land and water areas produce secondary heat sources and sinks.

7. The primary controls of evaporation are: water surface, solar energy, air moisture and air motion.

8. Relative humidity is a comparison of the amount of water vapor present in the air, and the amount of water vapor which could possibly be held by the air.

9. Air masses take their properties of temperature and moisture from regions of the earth's surface with which they are in contact over long periods.

10. Stratiform or layered clouds producing steady precipitation from broad and gradual lifting of air masses; cumuliform or vertically developed clouds producing showery precipitation result from small scale convection.

11. Scientific weather prediction is based upon the interpretation of pooled instrument readings from many weather stations.

12. A weather map is a graphic record which shows how temperature, pressure, precipitation and clouds are distributed at the earth's surface at a particular time.

13. Local landforms influence weather and climate.

14. Man is an agent of change in the environment.

Objectives

The student should be able to:

1. Explain the role of the sun in producing weather.

2. a. Distinguish between heat and temperature.

   b. Read a thermometer to the nearest degree centigrade and fahrenheit.

   c. Explain how a thermometer works.

3. a. Demonstrate experimentally that solids, liquids, and gases expand when heated.

   b. **Identify everyday applications of expansion due to heating of solids, liquids, and gases.**

4. a. Explain and diagram how a convection current is created in a liquid or gas.

   b. Design an experiment which permits the student to determine the effect of the earth's angle of inclination on the rate of heating the earth.

5. Explain west-east movement of air masses.

6. a. Test and compare the rate of heat absorption and retention of different materials.

   b. Interpolate and extrapolate from graphs of heat retention and absorption.

   c. Explain the weather and climate conditions of a geographical location in terms of heat retention and absorption.

7. a. Identify the primary controls of evaporation as water surface, solar energy, air moisture and air motion.

   b. Explain the sequence of events in the water cycle. (This will include factors related to evaporation rate and cloud formation.)

8. Measure the relative humidity, to read percentages from a relative humidity chart and to list factors which affect relative humidity.

9. Explain sources and movements of air masses.

10. a. Explain the following types of precipitation: rain (snow, hail, sleet), dew and fog.

    b. Associate weather and cloud types.

Objectives
Page 2

11. a. Gather weather data (temperature, pressure, wind speed, sky conditions, precipitation) in order.

    b. Analyze relationships between pairs of variables and to identify predictable patterns.

12. a. Identify symbols found on a weather map.

    b. Interpret a weather map (patterns).

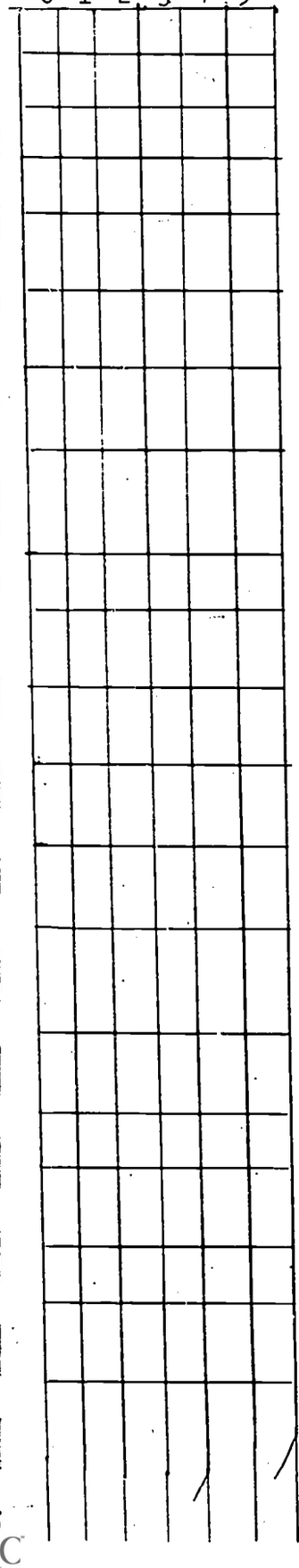
13. a. Diagram relationships of temperature and times of the day.

    b. Compare and contrast topographical features with weather.

    c. Formulate hypothesis on the influence of climate by landforms.

14. List advantages and disadvantages of manipulating the weather artificially.

OBJECTIVES



The student should be able to:

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2. a. Distinguish between heat and temperature.

   b. Read a thermometer to the nearest degree centigrade and fahrenheit.

   c. Explain how a thermometer works.

3. a. Demonstrate experimentally that solids, liquids, and gases expand when heated.

   b. **Identify everyday applications of expansion due to heating of solids, liquids, and gases.**

4. a. Explain and diagram how a convection current is created in a liquid or gas.

   b. **Design an experiment which permits the student to determine the effect of the earth's angle of inclination on the rate of heating the earth.**

5. Explain west-east movement of air masses.

6. a. Test and compare the rate of heat absorption and retention of different materials.

   b. Interpolate and extrapolate from graphs of heat retention and absorption.

   c. Explain the weather and climate conditions of a geographical location in terms of heat retention and absorption.

7. a. Identify the primary controls of evaporation as water surface, solar energy, air moisture and air motion.

   b. Explain the sequence of events in water cycle. (This will include factors related to evaporation rate and cloud formation.)

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9. Explain sources and movements of air masses.

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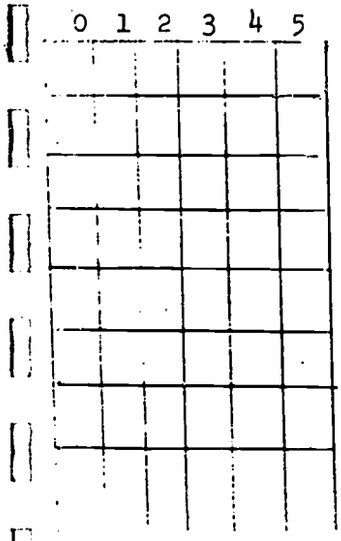
    b. Associate weather and cloud types.

11. a. Gather weather data (temperature, pressure, wind speed, sky conditions, precipitation) in order.



11. b. Analyze relationships between pairs of variables and to identify predictable patterns.

12. a. Identify symbols found on a weather map.

    b. Interpret a weather map (patterns).

13. a. Diagram relationships of temperature and times of the day.

    b. Compare and contrast topographical features with weather.

    c. Formulate hypothesis on the influence of climate by landforms.

14. List advantages and disadvantages of manipulating the weather artificially.

Activities

1.

I. Concept:
Without sunlight, basic weather processes would not operate.

II. Behavioral Objective:
Explain the role of the sun in producing weather.

2.

I. Concept:
Heat is the total amount of thermal energy possessed by a body; temperature is the average thermal energy of a body.

II. Behavioral Objectives:
A. Distinguish between heat and temperature.

B. Read a thermometer to the nearest degree centigrade and fahrenheit.

C. Explain how a thermometer works.

III. Activities

A. Heat and Temperature Science Activities, page 177.

B. 1. Two beakers of water or some material at different temperatures; the smaller amount at the higher temperature.

2. Put each into other beakers of the same material and same temperature. Record temperature.

C. 1. Heat objects of different sizes or materials to the same temperature.

2. Put objects into separate containers of water at the same temperature.

3. Record temperature rise.

D. Calibrate a thermometer.

E. Earth and Space Science Lab Manual, page 137-8.

3.

I. Concept:
Heated bodies expand.

II. Behavioral Objectives:
A. Demonstrate experimentally that solids, liquids, and gases expand when heated.

B. Identify every day applications of expansion due to heating of solids, liquids, and gases.

4.

I. Concept:
The unequal distribution of solar energy produces the general convection circulation pattern of the atmosphere.

II. Behavioral Objective:
A. Explain and diagram how a convection current is created in a liquid or gas.

B. Design an experiment which permits the student to determine the effect of the earth's angle of inclination on the rate of heating the earth.

III. A. ISCS Excursion Vol. 3A - Winds and Weather Convection - page 1-4.

B. ESCP Using an alcohol burner, the student demonstrates 3 ways in which energy can be transferred.

C. Variation in conductibility of metals, Science Activities, Mallison-Mappelink, page 185.

D. Earth and Space Science Lab Manual, page 151.

E. Device for measuring convection. Investigating the Earth ESCP, page 197 or ISCS, page 17-21.

F. A method for determining the effect of direct and indirect rays, N.Y. Handbook, Earth Science Handbook, N.Y. Education Departmemt, page 164.

G. Hold a flashlight or other light source fixed and shining through a cardboard or metal tube. Catch image of light beam on paper. Vary the angle of the paper to demonstrate how the sun's rays are spread according to the earth's inclination.

H. Hold a fixed flashlight. Mask with opening. Move mask from equator to pole. Relate latitude angle to area of light.

I. Earth Science Lab Approach (Convection currents), page 225.

5.

I. Concept:
The earth's rotation modifies basic convective circulation by deflecting north-south motions and producing wind belts.

II. Behavioral Objective:
Explain west-east movement of air masses.

III. Activities:
A. Focus on Earth (Coriolis Effect), page 184, 10-5.

B. Invert 9-5, page 197-199.

C. Focus on Earth 10-2, page 183.

6.

I. Concept:
Land and water areas produce secondary heat sources and sinks.

II. Behavioral Objectives:
A. Test and compare the rate of heat absorption and retention of different materials.

B. Interpolate and extrapolate from graphs of heat retention and absorption.

C. Explain the weather and climate conditions of a geographical location in terms of heat retention and absorption.

III. Activities:

A. ISCS Exercise 1-2, Heat and Temperature.

B. 1. Melt a beaker of ice.

2. Record the temperature at fixed time intervals.

3. Graph and analyze.

C. 1. Have students in pairs, research mean temperature; land temperature; lake freezing date; and lake thawing date.

2. Graph.

3. Predict date of thaw.

D. ISCS Excursion 1-I Vol. 3A, page 8, Unequal heating of various materials (short answer questions not a lab activity).

E. Exercise 10, page 69, Patterns and Processes of Science, Lab Text #2, Weisbrack, Brach, Paulson.

F. Investigating the Earth, ESCP, Lab Manual I, Investigation 7-10, Heating of Earth Materials.

G. ISCS Exercises 1-1, Page E1-E6, Heat transfer.

H. Given two substances, have the student predict as to which absorbs or reflects heat.

I. Heating of Materials Earth Science Handbook, N.Y. Education Department, page 165, Heating and Cooling of Land and Water Surfaces.

J. Water and Climate, page 183, Earth and Space Science, Lab Manual.

K. Earth and Space Science, Jacobson, page 191-192.

7.

I. Concept:
The primary controls of evaporation are: water surface, solar energy, air moisture, and air motion.

II. Behavioral Goal:
Explain the sequence of events in the water cycle. (This will include factors related to evaporation rate and cloud formation.)

III. Activities:

A. Geographical Influences on Weather and Climate, page 143, Science Activities, Mallison-Mappelink.

B. ISCS, Vol. 3A, Much Ado About Dew and Relative Humidity, page 30-47.

C. Investigating the Earth, Addison-Wesley, page 60-3, Lab. Determination of Dewpoint.

D. Variation of Activity A:

1. Different location in room

2. Different rooms

3. Outside-inside

4. Shade-sun

5. Hour-hour

6. Day-day.

E. Evaluate humidifiers or dehumidifiers in terms of effect over time.

F. Chemical dehumidifiers (desiccators). Evaluate over time ($CACL_2$) in terms of effect.

G. 1. Use single beam double pan balance.

2. Suspend sponge cubes wetted but not dripping.

3. Suspend from opposite end.

4. Operate on one end (by fanning) to cause imbalance.

Change liquids used: or different liquids on each pan.

H. Student design an experiment to investigate the influence of factors introduced by man into water on evaporation rate.

Suggest container: pizza pan, petri dish.

I. Factors Affecting Relative Humidity.

1. Fan on one side to stimulate wind.

2. With fanning, take dry and wet bulb reading for relative humidity.

3. Without fanning, take dry and wet bulb reading for relative humidity.

9.

I. Concept:
Air masses take their properties of temperature and moisture from regions on the earth's surface with which they are in contact over long periods.

II. Behavioral Goal:
Explain sources and movements of air masses.

III. Activities:

A. 1. Construct a rectangular glass container with a perpendicular divider that will provide two chambers.

2. Fill one with water and one with oil.

3. Gently remove divider. Results demonstrate interaction between two air fronts.

10.

I. Concept:
Stratiform or layered clouds producing steady precipitation from broad and gradual lifting of air masses; cumuliform or vertically developed clouds producing showery precipitation result from small scale convection.

II. Behavioral Objectives:
A. Explain the following types of precipitation: Rain (snow, hail, sleet), dew.

B. Associate weather and cloud types.

III. Activities:
A. Investigating the Earth, page 187-91, Cloud Observation Record: date time, cloud motion (direction and speed), surface wind (direction and speed), air temperature, barometric reading, dew point, cloud description.

B. Measure height of cloud with triangulation and similar triangles.

C. ISCS Excursion 3-1, How High Are Clouds, page E35-E36.

D. Earth Science - Singer Series, Lab Manual, page 49-51.

E. Billboards of the Sky Excursion 1-5, ISCS, Vol. 3A, page E19-26.

11.

I. Concept:
Scientific weather prediction is based upon the interpretation of pooled instrument readings from many weather stations.

II. Behavioral Goals:
A. Gather weather data (temperature, pressure, wind speed, sky conditions, precipitation), in order.

B. To analyze relationships between pairs of variables and to identify predictable patterns.

III. Activities:
A. Inquiry into Earth Science, page 203, Jacobson, Willard.

B. Instrument Construction, Earth Science Handbook, N.Y. Department of Education, Bureau of Curriculum Development, page 147-56.

Note: for a good humidity chart, use ISCS.

C. UNESCO Course Book, page 75-89

D. 1. Investigating the Earth, Addison-Wesley, page 96 "balloon barometer."

2. Cartesian Diver could be used to indicate air pressure.

3. Construction of a "balloon barometer," ISCS, page 22-9.

12.

I. Concept:
A weather map is a graphic record which shows how temperature, pressure and clouds are distributed at the earth's surface at a particular time.

II. Behavorial Goals:
A. Identify symbols found on a weather map.

B. Interpret a weather map (patterns).

III. Activities:
A. Investigating Variations, Vol. 3, Winds and Weather, ISCS, Silver Burdett, Chapter 5, pages 64-76 (Weather symbols on a map)

B. Microclimate weather map, Investigating the Earth, Addison-Wesley, pages 65-70.

C. Collect daily weather maps from consecutive newspapers, relate temperature, precipitation, cloud cover to frontal patterns.

D. 1. Reorder an undated series of weather maps.

2. Consolidate the movement of a front from a series of dated or ordered weather maps.

E. Evaluate the symbols used by local TV weathermen as to their authenticity.

F. Indicate relationships of fronts and violent weather phenomena.

G. Construct two sets of signs one of which has weather map symbols and the other a verbal description of the symbols. Students' task is to pair match the items.

H. ESCP, Investigating the Earth, Lab Manual, page 233, Part 1, Correlating Weather Phenomenon.

13.

I. Concept:
Local landforms influence weather and climate.

II. Behavioral Goals:
A. Diagram relationships of temperature and times of the day.

B. Compare and contrast topographical features with weather.

C. Formulate hypothesis on the influence of climate by landforms.

III. Activities:
A. Chart day-night temperature relationships, e.g.: desert, mountain, Hawaii, San Francisco, Mammoth Cave, some jungle area. Chapter 8 of BSCS Green Version Biology would serve as a resource for BIOMES.

B. Simulated mountains:

1. Take pan of water.

2. Put different stacks of books around pan to simulate different elevations.

3. Use fan to simulate wind.

Variation: put detergent in water; oil in water.

I. Concept:
Man is an agent of change in the environment.

II. Behavioral Goal:
List advantages and disadvantages of artificially manipulating the weather.

III. Activities:
A. Choose cities of widely different geographical and topographical location. Relate weather data (minimum-maximum temperature, precipitation, wind direction, cloud cover, etc.) to topographical data (altitude, proximity to water, altitude, etc.).

B. Independent Research: Man's Attempt To Manipulate the Weather or History of Rainmakers.

MEDIA

Weather Unit

Topic
Weather

No.	Title	Time
F-89	How Weather Is Forecast	11
F-182	Origins of Weather	13
F-373	How Weather Helps Us	11
F-391	Let's Learn To Predict the Weather	11
F-413	Weather: Why It Changes	11
F-414	Weather: Understanding Precipitation	11
F-415	Weather: Understanding Storms	11
F-426	Climate and the World We Live In	13 1/5
F-499	What the Frost Does	11
F-1056	Climates of the U. S.	11
F-3131	Weather Satellites	15
F-3133	What Makes Clouds?	19
F-3134	What Makes the Wind Blow?	16
F-3201	Above the Horizons	21

ASTRONOMY

CONCEPTS

1. Brightness, color, comparative size, detail, motion, and other clues are used in estimating sizes and distances of objects on earth and in space.

2. Apparent brightness of a luminous body is determined by its intensity, size and distance from the viewer.

3. The apparent size of an object can be estimated if the distance and angular diameter are known.

4. Through geometry, one is able to study the size-position-motion relationships of celestial bodies.

5. The position of an object in space is determined by its bearing and elevation.

6. The stars form a useful fixed background in which motion of objects in the solar system can be observed.

7. The earth is a member of a complex community of celestial bodies known as the solar system.

8. There is evidence to support the notion that the earth is round.

9. There is evidence to support the notion that the earth revolves around the sun and that the earth rotates on its axis.

10. Sun time at a given longitude may be determined if one is given the longitude and sun time of some other location.

11. The interaction of gravitational force among earth-sun-moon causes tides.

12. Present day space discoveries are built upon significant discoveries of early scientists such as: Erathosthenes, Copernicus, Galileo and Newton.

13. Space exploration has had an effect on man's life on earth.

3/9

OBJECTIVES

1. a. Use clues: size, brightness, clarity of detail, color intensity and apparent motion to determine the size and distance of common objects.

   b. Identify factors which affect observation of motion of:
      1. objects in everyday life
      2. earth-moon-sun
      3. solar system; retograde motion

2. a. Identify the relationship between light intensity and distance from the source.

   b. Identify factors which affect apparent brightness of stars.

3. a. To identify relationships between true size, distance and angular diameter.

   b. Use arbitrary units (as thumb, hand span, pencil, fist, string) or degrees to estimate the angular diameter.

4. a. Measure an angle to the nearest degree.

   b. Label vertical corresponding angles; opposite interior.

   c. Construct similar triangles.

   d. Identify a third angle, given two angles of a triangle.

   e. Identify circumference, radius and diameter on a drawing of a circle.

   f. Identify the numerical relationship between the circumference and the diameter of a circle.

   g. Sketch and explain how the circumference of the earth was calculated.

   h. Calculate the distance to a satellite, given two points on the earth's surface, their latitudes and the sighting angles to a satellite.

5. a. Locate an object in space using bearing and elevation.

   b. To apply the concepts of bearing and elevation to descriptions of the positions of the moon and/or the sun during 1 day or night and over a period of 30 days.

6. Orient and use a sky map to locate constellations.

7. a. Order planets by size or distance from the sun.

   b. Sketch a scale model of the solar system.

8. List evidence to support the notion that the earth is round.

9. Cite proof that the earth revolves about the sun; and rotates on its axis.

10. Calculate sun time or a location given the longitude of this location and the longitude and sun time of another location.

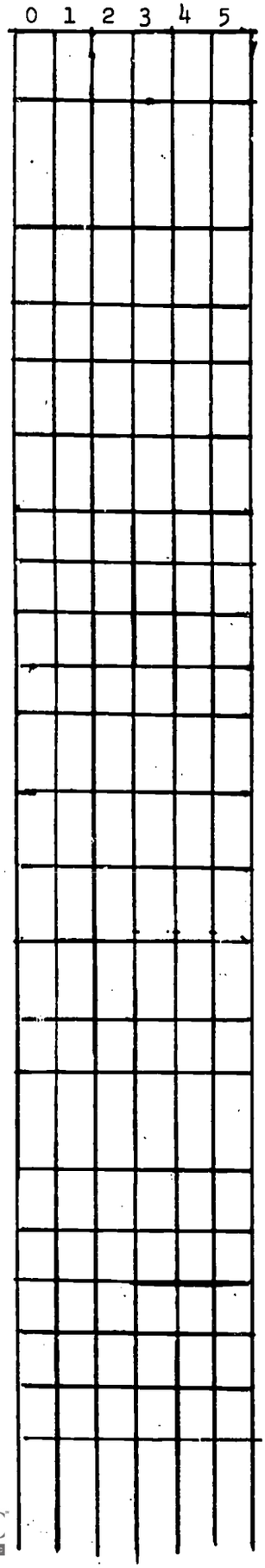
11. Explain the causes of tides.

12. Cite major achievements of the following astronomers: Erasthothenes, Copernicus, Brache, Kepler, Galileo.

OBJECTIVES - Page 2

13. Space exploration has had an effect on man's life on earth.

OBJECTIVES



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   b. Identify factors which affect observation of motion of:
      1. objects in everyday life
      2. earth-moon-sun
      3. solar system; retograde motion.

2. a. Identify the relationship between light intensity and distance from the source.

   b. Identify factors which affect apparent brightness of stars.

3. a. To identify relationships between true size, distance and angular diameter.

   b. Use arbitrary units (as thumb, hand span, pencil, fist, string) or degrees to estimate the angular diameter.

4. a. Measure an angle to the nearest degree.

   b. Label vertical corresponding angles; opposite interior.

   c. Construct similar triangles.

   d. Identify a third angle, given two angles of a triangle.

   e. Identify circumference, radius, and diameter on a drawing of a circle.

   f. Identify the numerical relationship between the circumference and the diameter of a circle.

   g. Sketch and explain how the circumference of the earth was calculated.

   h. Calculate the distance to a satellite, given two points on the earth's surface, their latitudes and the sighting angles to a satellite.

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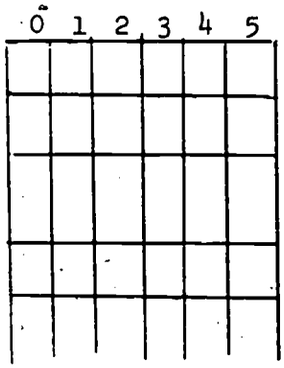

10. Calculate sun time or a location given the longtitude of this location and the longtitude and sun time of another location.

11. Explain the causes of tides.

12. Cite major achievements of the following astronomers: Erasthothenes, Copernicus, Brache, Kepler, Galileo.

13. Space exploration has had an effect on man's life on earth.

ACTIVITIES

1

I. Concept:
Brightness, color, conparative size, detail, motion, and other clues are used in estimating sizes and distances of objects on earth and in space.

II. Objectives:
A. Use clues: size, brightness, clarity of detail, color intensity and apparent motion to determine the size and distance of common objects.

B. Identify factors which affect observation of motion of (1) objects in everyday life, (2) earth-moon-sun, (3) solor system; retrograde motion.

III. Activities:
A. Display a large landscape picture or the front page of a newspaper on the board. Have students begin at the back of the room and slowly walk toward the picture, describing as much detail as possible with each step. This activity demonstrates the effect of distance upon size and clarity of detail. (Chapter 1, p. 11 of University of Illinois Astronomy Program, Charting the Universe.)

B. Follow the same procedure using candles (lighted) instead of the newspaper.

C. Use an array of straight pins in cardboard to develop the notion of perception, apparent size, and apparent motion. The student holds the cardboard at eye level in front of him and must determine which pins are farther away and which are nearer. How does he know? Have the student move his head from one side of the cardboard to the other which pins seem to move faster and which seem to move slower? (University of Illinois, Charting the Universe, p. 8.)

D. Inferring shape from shadow: Show the class the shadow shapes of a series of unknown objects (cubes, cylinders, pyramids, cones, egg, hot dog, etc.). Ask the students to draw or name the shape of the real objects based upon the shadow. (University of Illinois, Charting the Universe, p. 12-13.)

E. Investigating Science With Children, p. 9, describes activities which demonstrate the effect of relative location upon observation.

2

I. Concept:
Apparent brightness of a luminous body is determined by its intensity, size and distance from the viewer.

II. Objectives:
A. Identify the relationship between light intensity and distance from the source.

B. Identify factors which affect apparent brightness of stars.

III. Activities:
A. Learning why the stars do not shine in the daytime: Let a bright electric lamp represent the sun. Have children compare the brightness of the light in a darkened room and in a well-lighted room. Take the lamp out of doors on a sunny day. Does it look as bright as it did in the classroom? Have one child view the lamp from across the school yard Does it look as bright from a distance Hold a flashlight next to the bright lamp. Is the flashlight beam clearly distinguishable next to the bright lamp? What happens to the stars during the day? Do they still shine? (Investigating Science for Children, Vol. 6 Space, P. 26.)

B. Using brightness as a clue to distance is extensively developed in pp. 74-79, UIAP.

C. An excellent investigation on using the inverse square law as applied to light intensity and distance is developed on p. 55 of Jacobson, Inquiry, ABC. Also Investigating, Vol. 6, p. 11 suggests similar activities which focus upon light intensity and distance.

3

I. Concept:
The apparent size of an object can be estimated if the distance and angular diameter are known.

II. Objectives:
A. To identify relationships between true size, distance, and angular diameter.

B. Use arbitrary units (as thumb, hand span, pencil, fist, string) or degrees to estimate the angular diameter.

III. Activities:
A. Measurement of the moon's apparent diameter: Mount a card with a 1/4 inch slot in it on a meter stick. Hold the tip of the meter stick against the cheek. Use one eye to sight the moon through the slot. Move the card on the stick until the moon's horizontal diameter just fits across the slot. This position of the card will be found to be correct no matter what the moon's position in the sky is. Sighting in two positions, when the moon is on the horizon and when it is overhead, should demonstrate that any increase in apparent size is an illusion. (Earth Science Handbook, New York State Ed. Dept. p. 113).

B. A similar exercise in calculating the diameter of the moon is suggested on p. 272 of Inquiry into Earth and Space Science (American Book Company).

C. Use of angular diameter to estimate apparent size: UIAP, 46-50, provides a series of activities develop the notion of angular diameter as a clue to apparent size.

4

I. Concept:
Through geometry, one is able to study the size-position-motion relationships of celestial bodies.

II. Objectives:
A. Measure an angle to the nearest degree.

B. Label vertical corresponding angles; opposite interior angles.

C. Construct similar triangles.

D. Identify a third angle, given two angles of a triangle.

E. Identify circumference, radius and diameter on a drawing of a circle.

F. Identify the numerical relationship between the circumference and the diameter of a circle.

G. Sketch and explaim how the circumference of the earth was calculated.

H. Calculate the distance to a satellite, given two points on the earth's surface,

III. Activities:

A. Identifying and measuring angles: In this activity, children become familiar with vertical angles, interior, exterior, corresponding angles. (UIAP, p. 26). Also, Greater Cleveland Math.

B. Finding the number of degrees in the 3 angles of a triangle: Have students draw any triangle using a straight edge. Then have them tear off each of the three vertices of the triangle and arrange them so the torn vertices form a half circle. Pose the question: Is this possible with any triangle? Have the students try other triangles to answer this question. Apply knowledge of the number of degrees in a circle to finding the number of degrees in a half circle and thus to the number of degrees in the sum of the angles in a triangle. (UIAP, p. 27).

C. Providing meaning for pi: Using a collection of objects which are circular and can be rolled (spools, dowels, movie reels, tape rolls, etc.), have the child measure the diameter of one. Then have him mark a point on the circumference of the object and roll it one complete revolution. He should then measure the distance which the object rolled. The next step will be to divide the distance the object rolled by the diameter and record this data. The child should carry out several such exercises to see if the same quotient results. This relationship (between the diameter and circumference of a circle) is called pi. (Pooling of class data for each "try" and calculating the class mean will provide an approximation of pi.)

D. The following sources provide excellent activities which develop the concept of indirect measurement by triangulation. Jacobson, Inquiry into Earth and Space Science, p. 66; Investigation Science With Children, Vol. 6, p. 13-14; UIAP Charting the Universe, p. 33-40 (excellent triangulation device); p. 40-45 (application of triangulation with satellites and the moon).

E. Developing an intuitive feel for arc and degrees: Students should think of an angle as a figure swept by a line rotating about a point. In this activity, a clock is used to illustrate the idea. Such questions as what part of a circle is swept by the minute hand between 12 and 12:30; 12 and 12:15; 12 and 12:10; 12 and 12:05 can be asked. This activity could be extended by having children extend both arms horizontally and having them turning arcs equal to 15, 30, 10, and 5 minutes on the clock. At this point introduction of the concept of degrees could be made. (UIAP, p. 23-25).

5

I. Concepts:

The position of an object in space is determined by its bearing and elevation.

II. Objectives:

A. Locate an object in space using bearing and elevation.

B. To apply the concepts of bearing and elevation to description of the position of the moon and/or the sun during 1 day or night and over a period of 30 days.

III. Activities:

A. Directions for constructing an astrolabe: ESCP Investigating the Earth, Lab Manual Part 1, p. 123. Also, UNESCO Sourcebook, p. 69. UIAP, The Universe in Motion, Chapter 2 provides a series of activities which deal with motion of the sun and the moon.

B. Jacobson, Inquiry, ABC, has an exercise in which the length and direction of shadows are measured for plotting the course of the sun.

C. Investigating the Earth Lab Manual Part I, p. 56, Investigation 1-9 provides a similar activity.

D. ESCP Investigating the Earth Lab Manual Part I, p. 123, Investigation 4-1 uses a homemade astrolabe and a plastic hemisphere to plot the positions of stars.

E. Jacobson, Inquiry, ABC, (Chapter-The Solar System and Universe), p. 26 Investigation-motions of the moon.

6

I. Concept:
The stars form a useful fixed background in which motion of objects in the solar system can be observed.

II. Objectives:
Orient and use a sky map to locate constellations.

III. Activities:
UIAP, Universe in Motion, p. 27-37 students develop familiarity with major constellations, sky maps, and the motion of stars. Activity 20, page 23, of Investigating Science also provides activities which familiarize children with the constellations. Jacobson, Inquiry, p. 69 suggests study of motion of the stars through photo study.

7

I. Concept:
The earth is a member of a complex community of celestial bodies known as the solar system.

II. Objectives:
A. Order planets by size or distance from the sun.

B. Sketch a scale model of the solar system.

III. Activity:
p. 61-62 UIAP provides data, on two different scales, regarding distances of planets from the sun and diameters of the planets. These data could be used by students to construct solar system models. A related activity which compares the distances of planets from the sun is provided on page 25 of Investigating vol. 6. Similarly, an activity which develops relative size comparison of planets is described on page 26 of the same source.

8

I. Concept:
There is evidence to support the notion that the earth is round.

II. Objective:
List evidence to support the notion that the earth is round.

III. Activities:
A. Communicate with the "Flat Earth" Society, London, England. Students might debate the issue, listing evidence to support points of view.

B. Students might investigate "early" notion and lore surrounding the shape of the earth.

C. Students could prepare an oral graphic presentation of "Eratosthene Proof" that the earth is round.

9

I. Concept:
There is evidence to support the notion that the earth revolves around the sun and that the earth rotates on its axis.

II. Objectives:
A. Cite proof that the earth revolves around the sun; and rotates on its axis.

III. Activities:
A. Students could use a light source and a globe to create all "possible" models to explain: day-night, seasons.

B. Students might hypothesize about the effect if "no tilt" upon the earth, an earth year of 720 days, or an earth which didn't rotate.

10

I. Concept:
Sun time at a given longitude may be determined if one is given the longitude of and sun time of some other location.

II. Objective:
Calculate sun time of a location given the longitude of this location and the longitude and sun time of another location.

III. Activities:
A. Construct a sun dial - Investigating Science with Children Vol. 6, p. 16-17, UNESCO Sourcebook, p. 64.

B. Analyze the rationale used for international time zones.

C. Using a globe and a light source have the child position the globe for sunrise, noon, sunset, midnight.

11

I. Concept:
The interaction of gravitational force among earth-sun-moon causes tides.

II. Objective:
Explain the causes of tides.

III. Activities:
Investigating Science With Children, Vol. 6, p. 55-56, provides a series of activities which demonstrate the gravitational attraction of the earth.

12

I. Concept:
Present day space discoveries are built upon significant discoveries of early scientists such as: Erathosthenes, Copernicus, Galileo and Newton.

II. Objective:
Cite major achievements of the following astronomers: Erasthothenes, Copernicus, Brache, Kepler, Galileo.

III. Activities:
A. Students may do a small scale research paper on one or more of the individual scientists.

B. A group of students may present the contribution of these men to the class through a group presentation.

C. Students may research the life of a scientist and role play a significant event in his life.

D. Students may research and chart contributions made by these scientists to determine what relationship exists (if any) between their discoveries.

13

I. Concept:
Space exploration has had an effect on man's life on earth.

II. Objectives:
A. To evaluate the effect of space exploration upon life on earth.

B. To identify 3 examples of space technology which have been applied to everyday life.

C. To describe how life support problems on earth are similar to life support problems on manned space vehicles.

III. Activities:
A. Students may find the cost of our space program and compare such cost with the amount of money spent on education, health, welfare, etc., and draw their own conclusion about the validity of this assignment of our monetary resources.

B. Students may research, by letter to knowledgeable people or reading the types of space technology which have been applied to other areas of life.

C. Students may develop the idea of the earth as a space ship through investigating the life support systems in a space vehicle.

Reference Key	Source
ESCP 1	Investigating the Earth, Teacher's Guide, Part 1, Houghton Mifflin Co, Boston, 1967.
UIAP 1	Charting the Universe, Book 1, University of Illinois Astronomy Program, Harper Row, New York, 1969.
UIAP 2	The Universe in Motion, Book 2, University of Illinois Astronomy Program, Harper Row, New York, 1969.
ABC	Jacobson, et. al., Inquiry into Earth and Space Science, American Book - Van Nostrand Co, New York, 1969.
UNESCO	UNESCO Sourcebook for Teaching Science, United Nations, 1956.
N.Y.	Earth Science, New York State Education Department, Albany, 1961.
Space	Investigating Science With Children, Vol. 6, Space, Teachers Publishing Corporation, Darren, Conn., 1964 (national Science Teachers Association).

MEDIA

University of Wisconsin
BAVI

16mm films

No.	Title	Time	Price
0623	Earth: Rotation and Evolution	10	$ 2.00
0684	Exploring the Universe (motion, telescopes)	10	2.25
1439	Moon	11	2.00
1471	Nautical Astronomy	23	2.00
2091	Star Identification	16	2.00
2122	Story of Talomar	40	14.25
3676	Exploring the Night Sky (constellations)	11	2.00
4466	How We Explore Space	16	5.50
4625	How Many Stars (Galaxies)	11	3.50
4826	Galileo	14	5.00
4943	How We Know the Earth Moves	11	4.00
4956	Planets in Orbit	10	2.25
4958	How We Know the Earth's Shape	11	3.75
5152	Horizons of Science: Realm of Galaxies (instruments)	19	3.50
5361	Planets	11	3.75
5471	Exploring the Universe with Telescopes	11	2.25
5560	Space Science: Comets, Meteors, and Planetoids	11	2.25
5774	Portrait of the Sun (sun-earth relationship)	18	6.75
5977	Charting the Universe (instrumentation)	13	5.00
6291	Moon-Motion, Gravity, Tides	13	4.00
6985	Space Science: Studying the Stars	11	2.25
7004	What Is an Eclipse?	11	4.00

LOCAL IMC

F-109	Beyond Our Solar System	11
F-114	The Big Sun and Our Earth	11
F-124	Causes of the Seasons	11
F-163	The Solar Family	11
F-397	Space Science: An Introduction	13½
F-416	Sun and How It Affects Us	11
F-469	Moon and How It Affects Us	11
F-485	Space Science: Comets, Meteors, and Planetoids	11
F-486	Space Science: The Planets	10
F-498	What Is Uniform Motion	13
F-813	Eclipses of the Sun and Moon	11
F-819	History and Development of the Rocket	16
F-831	First Men Into Space	16
F-832	Rockets: How They Work	16
F-1005	Frontiers in Space	11
F-1021	Exploring the Night Sky	11
F-1022	Exploring the Universe	11
F-1030	Space Probes: Exploring Our Solar System	11
F-1071	The Stars at night	11
F-1123	Shadows On Our Turning Earth	10
F-1125	How We Know the Earth's Shape	11
F-1135	Space Science: Man Made Satellites	11
F-3103	Charting the Universe with Optical and Radio Telescopes	13
F-3128	A Trip to the Planets	15
F-3246	Stars and Star Systems	16

Audio Tapes (Available for reproduction in Central IMC)

New Advances in Space Research
Moon
Big Eye - Mt. Palomar
Lost in the Sky - Galileo
Exploring the Universe
Our Solar System
The Planets
Beyond the Earth
The Sun
Nicholas Copernicus
Great Genius Isaac Newton

SUGGESTED MATERIALS LIST

Recommended Material

Space

Item	Source	Cost	Suggested Quantity
Astrolabe Kit	Hubbard Scientific Company, Northbrook, Illinois 60062	$15.00/15 or @ 1.25 each	Class set
#SC-400 Star Chart Reversible Northern & Southern Skies	"	$12.95	1
Project or Testing Charts for Star Chart	"	$ 1.50	50 per pad
Seasonal Star Charts	"	$ 2.95	1

Earth Processes

Student Stream Table #BST-926	Hubbard Scientific Company, Northbrook, Illinois 60062	$75.00 or $16.00 each	5
Earth Quake Watch Kit #ECP-3045	"	$ 4.00	1 kit
Silica Sand	Wisconsin Brick Madison, Wisconsin	$ 1.25	100 lb. bag

Earth Materials

Earth Materials Kit #ECP-320	Hubbard Scientific Company, Northbrook, Illinois 60062	$74.00	1 kit
Rock Composition Kit	"	$ 9.75	set of 15
Crushed Granite from Earth Materials Kit	"	$ 1.20	100CC
Screen Sieves	"	$13.75 each	---------

Mineral Kit

		Price per lb.	
Clear Quartz	Stansi Scientific Company, Chicago, Ill.	$ 1.75	determined by class size
Milky Quartz	"	$ .75	
Feldspar Albite Pink White		$ .90	

Item	Source	Cost	Suggested Quantity
Mica	Stansi		
Black	"	$ .95	
White	"	$ 1.10	
Green	"	$ .85	
Magnetite	"	$ 1.00	
Hematite	"	$ .75	
Talc	"	$ .75	
Pyrite	"	$ 2.00	
Contour Model Kit	Hubbard Scientific Company, Northbrook Illinois 60062	$34.50	set of 15
Stereo Photo Kit	"	$117.00	set of 30
Landform Map Kit	"	$ 1.50	1 pad of 50 maps per class
Globe Laboratory	"	$47.50	set of 5
Topographic maps North America Wisconsin Dane County Madison Local School Area	Local Materials		Class set of each sheet
Magnetic Compasses #3800	Stansi Scientific Company, Chicago	$9.00/doz. $1.00/each	class set
Protractor #875	"	$ .30 each	class set
Compass #685	"	$ .25 each	class set
Plastic Column Kit	Hubbard Scientific	$41.25	set of 15
Map Reading I	"	$22.50	set of 4
" " II	"	$32.00	set of 8
Clay	Central Stores		