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An approach to the teaching of science in the elementary grades.

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AN APPROACH TO THE TEACHING OF SCIENCE IN THE ELEMENTARY GRADES

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AN APPROACH TO THE TEACHING OF SCIENCE IN THE ELEMENTARY GRADES

BY

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INTRODUCTION

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INTRODUCTION

The emphasis upon the need for a science study at this time has been brought about by educational research as well as by newspaper and magazine articles decrying the lack of trained scientists at a time when there is a vast increase in the demand for them. Other reports that are most disturbing are those which say that most adult citizens are woefully lacking in scientific comprehension.

Science teaching is a matter of great concern both to educators and to scientists. One reason for this is the demand for the services of highly trained scientists with no corresponding increase in the supply. Magazine articles and newspaper reports state that the shortage of scientists is the chief bottleneck to scientific progress today and this bottleneck can be broken in the schools, beginning with the primary grades and going all the way up to the colleges and universities.

All scientists of whatever name or fame were once boys and girls in school. Certainly their school days have been of much consequence in their development. Many a scientist has paid tribute to the teacher or teachers who helped to unearth his talent, and inspired him to develop it. Pasteur[1]

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(1) Science Teaching and Medical Research. Health Bulletin for Teachers - Metropolitan Life Insurance Company, Vol. XXIII, No. 6. September, 1952.

has spoken for these scientists: "There is in youth an unforgettable day that lights up all the rest of our lives. That day is the day when we meet those teachers to whom we owe our first enthusiasm. Ah, what other moment, what fortune of our careers can ever be worth as much as that moment."

But perhaps the greatest challenge to science teaching today is the disturbing report that most adult citizens are woefully lacking in scientific comprehension. The schools are in the best position to remedy this situation. The pupils in our schools are young citizens. They are deeply curious. They are more ready than they will ever again be to appreciate the tactics and strategy of science, to accept the ideas and concepts of science that everyone needs to understand.

While there are different methods of science teaching, educators should all be concerned with the progress of science education. The youth of today must adjust themselves to a much more complex world than existed even a generation ago. This is a fast-moving age in which strong forces are tending to produce rapid changes.

One need consider only a small sampling of the factors at work in present-day living to secure convincing evidence that science is playing a predominant part in bringing these changes about. The radios of a decade ago are obsolete. Television rules the air waves. Travel by air has increased rapidly. Toll roads have been built and are being built to

care for the thousands of cars that are being added to our highways monthly. Frequent devastating floods recently, not only in our land but abroad, have caused enormous losses not only of life but of fertile soil. This at a time when every country in the world must produce greater amounts of food not only for the increased population in their own lands but also for the people whose countries have been practically destroyed by war. It is these forces and their ramifications that boys and girls must understand if they would live most effectively.

Science in High Schools -- The high schools have begun to meet the problem by awarding scholarships to young men who wish to further their scientific studies. Companies like the General Electric and Westinghouse have offered financial assistance to students with the understanding that after their training, they will return to the laboratories of these companies.

Science in Elementary Grades -- But what about the science teaching in the elementary grades? For many years, science in these grades was nature study, and it often was of an incidental nature. If a child brought in a flower or frog, then a lesson was taken on that object.[2] "There was no general agreement as to the topics which made up the science of

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(2) Craig, Gerald S. and Baldwin, Sara E. Teachers' Manual, Our Wide, Wide World, p. 6

the elementary school."[3] But this is no longer true.

The impact of science on daily life emphasizes the need for an organized science program throughout the elementary grades. A new subject not many years ago, science now occupies an increasingly important place in the curriculum. Science is not mysterious and is no more difficult to teach than subjects traditionally taught in the elementary grades. In fact, it is easier because motivation is never lacking in the science class. The child's natural curiosity about the world in which he lives provides the necessary interest. "Science begins in the earliest experiences of the child. Long before he can express himself in words, he is observing and reacting to things in his environment and to the conditions of his environment essential to life. Science study has already begun for the child when he enters school and it will continue for him throughout his life."[4]

Behavior -- Most educators agree that the purpose of education is to change the ways in which people think, feel and act.[5] Education ought to modify behavior. A boy or girl who has studied science should behave differently from one who

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(3) Hillman, J. E. Some Aspects of Science in the Elementary School, p. 27

(4) Shoemaker, Lois M. Teachers' Manual, Wonderworld of Science, p. i.

(5) Beauchamp, Wilbur L. and Williams, Mary Melrose and Blough, Glen O. Discovering Our World.

has not studied science. Science lessons help the child to take better care of his own health, to protect the health of the community, to adapt himself better to his natural environment, to understand the natural science allusions in the news and in literature, and above all to enjoy the wonders of nature. Every teacher should teach science so that it will become a way of living, of reacting to environment, of interpreting the world in which one lives. Science taught in this way is not just a collection of facts about the world, but it is also a method of behavior that can be used in daily life.

Desirable Modification of Behavior in Five Important Ways.-- The study of science can produce desirable modification of behavior in five important ways. These ways deal with (1) interest and appreciation, (2) understanding, (3) a scientific attitude, (4) thinking ability and (5) skills.[6]

Modification of Behavior by Developing an Interest in Our World and a Desire to Know More About It. -- The first way of modifying behavior is by developing an interest in our world and a desire to know more about it. With this interest should come an appreciation of science as a source of unbiased judgment as well as an appreciation of the methods used by scientists. The emergence of science as an area of knowledge is intimately bound up with thrilling stories of privation, persecution and adventure; - the life and work of Louis Pasteur, the suffering of Galileo in the name of science, the persistence of Edison which led eventually to the invention of many

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(6) Craig, Gerald S. and Baldwin, Sara E. op. cit. p. 6.

modern comforts.[7] Through the study of episodes in the history of science, it is likely that boys and girls will gain a better appreciation of science and the role which scientists play in today's complex society. Furthermore, boys and girls may also acquire a better understanding of the attitudes, emotions and thinking which characterize the work of a scientist and a greater feeling of confidence in the scientific method. Science is also rich in possibilities for the development of appreciations which give breadth and perspective to life and character. It has been observed that narrow-mindedness and bigotry tend to diminish as people, through the study of science, learn to appreciate the vastness of space, the tremendous sweep of geologic time, and the orderliness of nature in which effects result from natural causes.[8]

A prerequisite to interest and appreciation is a rich background of experiences with the forces, phenomena, processes, materials and living things that make up the world in which we live. There are numerous activities that the child can carry on to discover more about the world in which he lives. A classroom which has scientific exhibits as an aquarium, a terrarium, plants and a wall chart showing the wonders of the sky at night fosters this interest. A person who has acquired this interest has a never-ending source of

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(7) Heiss, Elwood D. and O'Bourn, Ellsworth S. and Hoffman, C. Wesley Modern Methods and Materials for Teaching Science, p. 24.

(8) Ibid. p. 25.

satisfaction for use now and in later adult leisure time.

Modification of Behavior Through Understanding. -- The second way in which science can modify behavior is through an understanding of the forces, phenomena, processes, materials and living things that interact to produce the world of today. A pupil understands when he is able to act, feel or think intelligently with respect to a situation. A thing, event or situation is understood only when it has acquired meaning.[9] Therefore, in science, a major type of learning that leads to understanding is the acquisition of meanings. These meanings are expressed as general concepts. By using general concepts, it is possible to carry over meanings from one situation to another. We can generalize, or form generalizations. These generalizations, or general concepts, provide a method of explanation and interpretation for particular things, events or situations. To identify a thing as a member of a certain group is to explain it or give it meaning. If a thing is a "living thing", it is known in a general way what kind of thing it is. It carries on certain activities. This is understood because a general concept of what a living thing is has been acquired. This general concept, or generalization, might be stated as follows: "All living things can move, breathe, use food, grow and produce young."[10]

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(9) Beauchamp, Wilbur L. and Williams, Mary Melrose and Blough, Glen O. Discovering Our World p. 5.

(10) Ibid. p. 5

Understanding implies the ability to use generalizations. However, the ability to state a generalization is in itself no proof of understanding. A pupil cannot just learn an understanding. "We can't learn pupils; we can only teach them."[11] Therefore, our task is to set up a learning situation in which the pupil carries on activities focused on the understanding. The pupil learns as he carries on the activities. The understanding that results is his own, because it is a product of his own thinking. What the pupil does, not what the book or the teacher says, determines what learning will take place. The more actively the pupil participates in deciding what should be done, the more purposeful the activity will be and the more likely the attainment of the desire learning becomes.

Learning, to be retained, must be used.[12] This principle of learning has two implications. In the first place, it implies that further activities must be set up which require the pupil to use the concept as a method of explaining things around him and as a guide for practical activities. Only through use does the pupil acquire an understanding and ability to use this understanding in his daily life. The more closely the kind of activity set up is related to the kind of

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(11) Beauchamp, Wilbur L. and Williams, Mary Melrose and Blough, Glen O. op. cit. p. 7.

(12) Ibid. p. 8.

situation met in daily life, the more likely the learning will be used in daily life, the more likely the learning will be used in daily living. In the second place, the principle implies the need for constant use of the concept and its reinterpretation in the light of new experiences. Old concepts must be constantly related to new concepts so that a continuous reconstruction of experience can take place. This process results in a broadening and deepening of the pupil's total experience.

Modification of Behavior Through a Scientific Attitude. -- The third way in which modifications of behavior can be brought about through science is by developing a scientific attitude.[13] Every science lesson provides opportunity for developing such attitudes. A person with a truly scientific attitude should be able to make the following statements:[14]

1. I shall look at a problem from every side before I say what I think about it.

2. I do not believe in good or bad luck and other superstitions.

3. I am careful and accurate in what I do.

4. I am tolerant toward new ideas and suggestions.

5. Everything that I read is not necessarily true; I am slow to accept as facts statements that are not supported by satisfactory and sufficient evidence.

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(13) Beauchamp, Wilbur L. and Williams, Mary Melrose and Blough, Glen O. op. cit. p. 6.

(14) Blough, Glenn O. and Brink, Ida K. and Dolman, Helen Elementary Science For All Grades p. 10.

6. I plan before I act.

7. I respect the judgment of experts.

8. I know that new things are continually being discovered. Some things in science books will be changed when scientists find out more about them.

9. I cannot be sure of an experiment if I try it only once. The next time it may happen differently. If I am to be sure of my result, I need to repeat the experiment many times.

10. I do not believe in magic. Something always makes things happen, so I shall look for the cause.

The scientific method is more precious to the human race than a collection of scientific facts.[15] The scientific method is only about four hundred years old, but it has already produced more facts and inventions than all the previous four hundred thousand years of human progress. What present scientific facts have done to our world is known; what the scientific method will do to the world of the future staggers the imagination.

A person in whom a scientific attitude has been developed, has a distinct method of reacting toward his environment - a method totally different from that of a person with no understanding of scientific values. Therefore, every available opportunity should be used to help pupils acquire a scientific attitude. Toward that end, they should be enccouraged to become more observant, to look at problems from every side before expressing an opinion, to experiment carefully

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(15) Sharpe, Philip B. "Why Not Teach the Scientific Method?" Science Education Vol. 21 (December, 1937) p. 235.

and accurately, to demand reliable sources of information, to withhold judgment until there is enough evidence to permit a conclusion to be drawn, and to react intelligently to superstitions.

There are countless superstitions fastened in the mind of the human race. Probably no superstition taken by itself would seriously affect the life of anyone. Nevertheless, superstitions are symptoms of a very serious condition, namely, lack of firm belief in the universality of cause and effect. This belief is one of the important contributions of science. A person who has the idea of cause and effect cannot possibly believe in superstitions, astrology, palmistry, numerology or fortune-telling with cards or tea leaves. All these false notions fall down when examined for a possible cause-and-effect relationship. A firm belief in the universality of cause and effect is thus an important aspect of a scientific attitude.

Modification of Behavior by Training in Thinking. -- The fourth way of modifying behavior through science is by training in the scientific method of thinking and working.[16] The science class is by far the best place to teach pupils to become better thinkers. For the generalizations of science are themselves products of reflective thinking. In the

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(16) Beauchamp, Wilbur L. and Williams, Mary Melrose and Blough, Glenn O. op. cit. p. 6.

science class, it is possible to retrace at least in part the steps in thinking through which the generalizations were reached. By using a problem-solving approach and an experimental method of attack, certain conditions can be set up and the effects produced observed. In the science class, pupils are led to find problems, make observations, draw conclusions, verify these conclusions and then apply them to the solution of new and related problems.

Modification of Behavior by Developing Skills -- The fifth way of modifying behavior through science is by developing skills such as making observations, doing experiments, interpreting pictures and diagrams, reading science content with understanding, reading source materials and using the instruments of scientists.[17] Pupils do not acquire these skills automatically. Each skill must be carefully developed and maintained in an effective science program.

Today's problem -- The problems which confront boys and girls today are complex. This is true not alone because the forces bringing about social and economic change are complex, but also because the adjustment of an individual to each problem or situation is different. No two individuals are set up with the same hereditary backgrounds, the same emotional patterns, the same needs, or the same sensory equipment to receive

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(17) Beauchamp, Wilbur L. and Williams, Mary Melrose and Blough, Glenn O. op. cit. p. 7.

impressions from a given situation which confronts them. This means that when a group of boys and girls are faced with the same situation demanding adjustment from all of them, different behavior can be expected from the individuals in the group. This creates an extremely difficult situation from the standpoint of teaching and there is no perfect solution in the public schools.

However, in the development of a unit, the needs and interests of many individuals are cared for. In the Unitary Method of teaching, the child is the guide for instruction. This method gives many opportunities for aiding the development of the child. Unit teaching centers around the interests and activities of children but allows for individual differences and the growth of the individual at his own rate of speed. In the units written for this problem, the approaches and the learning experiences are many and varied so that individuals studying the same material can learn in their own ways.

CHAPTER II

THE APPROACH TO THE PROBLEM

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THE APPROACH TO THE PROBLEM

This is a scientific age. Children of today are capable of orating on any and all subjects but little thought is shown in their discussions. A scientific background helps children to solve problems logically and should teach them to study both sides of any question before they come to a decision. Pupils are going to meet many problems now as well as later which will involve thinking before solving. They should be given training when they are young which will help them.

In order to arouse the children's interest in science, a story was composed. Children of all ages enjoy stories, particularly those in the realm of fantasy. Boys are fascinated by space cadets and rocket ships, while girls prefer Alice in Wonderland and Peter Pan.

The story was patterned after Aladdin and His Wonderful Lamp, but modernized by using an Atom Lamp. When the hero and heroine of the story rubbed the Atom Lamp, many strange and interesting things happened to them. Everything that occured was of a scientific nature. The children were carried back to pre-historic times and viewed the different types of dinosaurs that roamed the earth. Then they were propelled into the air for a visit to the moon. After the Atomic Twins had played on the moon for a while, they shot off for a chat with the North Star. When the North Star had answered all

their questions, they examined the sun. The twins liked his bright side but found his other side dark and dismal. A quick rub of the Atomic Lamp returned them safely to the earth which certainly looked good to them.

But, like most youngsters, the Atomic Twins were ready for further adventures a day or two later. They watched their mother preparing asparagus and strawberries to put in her new freezer. In spite of their interest in this work, it was too nice a day to linger indoors so they decided to take a walk in the woods. Jack wanted to take his compass but couldn't remember where he had left it. He finally found it on a high shelf, but in reaching for it knocked over a box of tacks which he soon picked up with a magnet. The twins enjoyed the flowers, birds and frogs but when they started for home, they knew they were lost. With the help of their compass, they reached home safely.

Mr. Charles Miller, the Superintendent of Schools of South Hadley, gave his permission to have the story read in the Fourth, Fifth and Sixth grades in the system. He was interested in the idea and asked for a report on the findings.

The Plains School has only the primary grades and one Grade Four. A copy of the story was given to the Fourth Grade teacher who read it to her sixteen pupils. Then she asked each child to write ten questions about the story which they would like answered. Naturally, the reading of the story aroused interest in certain areas of science and most of the

questions were centered about these areas. This same procedure was followed with the elementary grades in the other schools of South Hadley.

In the New Carew Street School, which has two rooms for each grade, there were twenty-five pupils in one Grade Four and twenty-four in the other. In Grade Five, there were thirty-four in one room and thirty-five in the Other. Grade Six had twenty-eight children in one room and twenty-nine in the second room.

The Woodlawn School had twenty children in Grade Four, thirty-one in Grade Five and thirty-six in Grade Six.

At the Center School, there were twenty-two in Grade Four, thirty-six in Grade Five and thirty in Grade Six.

All the teachers were very willing to cooperate in this survey as science is a required subject in the South Hadley School System and the text books now in use are old. Each teacher waited to see what questions her particular class would ask and evidenced interest in learning of the awareness of science that could be aroused by this apporach. Many of the teachers expressed a desire to study the completed problem as they felt it would assist them materially in their future science classes.

When all the questions were compiled, there was a total of one thousand seventy questions from Grade Four; one thousand three hundred sixty from Grade Five and one thousand two hundred thirty from Grade Six.

Grade Four was interested in twenty-seven different areas, and Grades Five and Six were interested in thirty-one.

The ten areas in which the most questions were asked by these groups were selected. A summary of questions based on areas selected appears in Chapter III. Ten units, based on these areas, were written for use in Grades Four, Five and Six. These units are outlined in Chapter IV.

CHAPTER III

FINDINGS

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FINDINGS

The charts on the following pages show clearly that the story "The Atomic Twins" aroused the curiosity of the children in certain definite areas of science. The pupils enjoyed the story and asked for other chapters on the life of Jack and Sue. Many of the boys who have thrilled to the stories of Space Cadet and Men from Mars hoped that in the not too distant future rocket ships or space ships would enable them to see as much of the heavens as the mythical Atomic Twins.

All around boys and girls are hundreds of things they have seen and heard about but still do not understand. To many of them, school work does not contain the fascinating interest as is contained in a radio story about Mars. However, when given a story which incorporated such wonderful ideas as trips to the moon and the sun, the students immediately began to ask questions.

These questions showed that units could be worked out which would hold the child's interest while giving him a sound basis of scientific knowledge.

The story was read to a total of three hundred sixty-six children. The children in Grade Four were more interested in the moon than any other area. Their next interest was the dinosaurs, followed closely by the weather, stars and sun. Flowers and insects had a number of questions asked about them as did magnets, compasses, birds and scavengers.

Plants, woods and animals interested quite a few of the pupils. Then a few questions were asked about space, asbestos, aquariums, the magnetic pole, freezers and the sky. Gravity and the sea each received one question.

Grade Five was interested in the weather, as was Grade Six. This is understandable because the weather has a great deal to do with after-school activities. Ball Games, hikes, bicycling, roller skating all depend on the weather. Grade Five's next interest was flowers, then magnets, the moon, stars, dinosaurs, electricity and the sun. Lesser interest was shown in planets, the earth, animals, trees, plants, air, atomic bombs, grass and insects. Other areas which received some attention were gravity, volcanoes, soil, sky, food, fish, birds, rocks, sleep and one question was asked about both clouds and mountains.

After weather, the interest of Grade Six centered on the moon, electricity, magnets, sun, dinosaurs, stars and planets. Some questions were asked about the earth, plants, animals, water, trees, insects, asbestos and compasses. A few were interested in birds, scavengers, the oceans, air, space ships, atomic bombs, rocks and clouds, One question was asked about each of the following: soil, sky, lava, whirlpool and flowers.

Each child was allowed to ask ten questions, making a

total of three thousand six hundred and sixty questions to be compiled. The ten most popular areas have been developed into workable units which are outlined in Chapter IV.

SUMMARY OF QUESTIONS ASKED BY GRADE IV.

MOON	151	ANIMALS	22
DINOSAURS	116	EARTH	16
WEATHER	106	SPACE	16
STARS	100	ASBESTOS	15
SUN	92	FROGS	12
FLOWERS	88	GRASS	9
INSECTS	86	AQUARIUM	6
MAGNETS	55	SAND	3
COMPASS	54	MAGNETIC POLE	3
BIRDS	34	HEAT	2
SCAVENGERS	28	FREEZERS	2
PLANTS	26	SKY	2
WOODS	24	SEAS	1
		GRAVITY	1

TOTAL QUESTIONS ASKED BY GRADE IV..... 1070

SUMMARY OF QUESTIONS ASKED BY GRADE V.

WEATHER	207	ATOMIC BOMB	10
FLOWERS	204	AIR	9
MAGNETS	143	GRASS	8
MOON	124	INSECTS	8
STARS	116	GRAVITY	7
DINOSAURS	110	VOLCANOES	7
ELECTRICITY	105	SOIL	6
SUN	92	DISTANCE	6
PLANET	59	SKY	4
EARTH	31	FOOD	3
ANIMALS	26	BIRDS	3
TREES	22	FISH	3
PLANTS	17	ROCKS	2
WATER	13	SLEEP	2
SCAVENGERS	11	CLOUDS	1
		MOUNTAINS	1

TOTAL QUESTIONS ASKED BY GRADE V..... 1360

SUMMARY OF QUESTIONS ASKED BY GRADE VI.

WEATHER	367	COMPASS	9
MOON	153	FISH	8
ELECTRICITY	131	GRAVITY	8
MAGNETS	115	SCAVENGERS	7
SUN	82	BIRDS	7
DINOSAURS	76	OCEAN	6
STARS	71	AIR	6
PLANET	56	SPACE SHIPS	5
EARTH	35	ATOMIC BOMB	3
ANIMALS	15	ROCKS	3
PLANTS	14	CLOUDS	2
WATER	13	SOIL	1
TREES	12	SKY	1
INSECTS	11	LAVA	1
ASBESTOS	10	WHIRLPOOL	1
		FLOWERS	1

TOTAL QUESTIONS ASKED BY GRADE VI..... 1230

TEN AREAS OF MOST INTEREST TO PUPILS IN GRADES IV, V and VI.

AREAS	TOTAL OF QUESTIONS
WEATHER	680
MOON	428
MAGNETS	313
DINOSAURS	302
FLOWERS	293
STARS	287
SUN	266
ELECTRICITY	236
PLANETS	115
EARTH	82

CHAPTER IV

TEN SCIENCE UNITS

CHAPTER IV

TEN SCIENCE UNITS

In this chapter ten units of interest to children in Grades Four, Five and Six have been developed.

The story "The Atomic Age Twins" was read to three hundred and sixty-six children in all the Grades Four, Five and Six in the Town of South Hadley, Massachusetts. Then they were asked to write ten questions about the story. These questions were all based on areas of science since the story was written with this intention.

After completion of the survey, as outlined in Chapter III, ten units were developed in the scientific areas in which the children showed the greatest interest.

These ten units are outlined in the following pages in this order:

I. SCOPE

According to Mark Twain, "Everybody talks about the weather but no one does anything about it." To only a limited extent is this a true statement. We can live where the climate is most to our liking. We cannot change the weather out-of-doors but we can make conditions as we like them inside our homes. We cannot prevent zero weather, but we can prepare for it. We cannot prevent a hurricane, but we can warn our ships at sea to keep out of its path. We cannot prevent summer droughts to any great extent, but we can anticipate them.

Since the earliest times, man has attempted to predict weather and numerous weather proverbs have grown in every country. Some of these contain an element of truth based upon observation; many are without any foundation.

Today we have a Weather Bureau which is run according to scientific principles. Observations of temperature, air pressure, humidity, wind speed, wind direction and other phenomena are taken at hundreds of local stations. These are reported to the Central Bureau at Washington, D. C. Data are tabulated and predictions are made. About ninety per cent of the predictions prove to be correct. Ships, airplanes, farmers, merchants and many others depend upon these

predictions for the success of their undertakings.

Climate is the sum total of weather conditions in a given place over a period of years. Climate has been defined as average weather but this definition is incorrect in that extremes and types of variations in weather are as important in determining climate as is the average weather.

II. TITLE: -- " GRADE FIVE CHILDREN LEARN ABOUT WEATHER AND CLIMATE."

III. OBJECTIVES

A. UNDERSTANDINGS AND KNOWLEDGES

GENERAL:

1. Climate is relatively stable while weather changes occur from day to day.
2. The Weather Bureau performs varied and very important services.
3. Man's way of life depends on the climate.
4. Meteorologists use various instruments in their studies.

SPECIFIC:

1. (a) Climate is the sum total of weather conditions in a given place over a period of years.

   (b) Weather means the state of the air or atmosphere as to cold, heat, wetness, dryness.

   (c) The sun is the most important factor in weather.

   (d) Other weather factors are air temperature, air moisture, air motion and air pressure.

2. (a) The United States Weather Bureau issues weather forecasts and weather maps.

   (b) It plots the paths of storms.

   (c) It warns and advises farmers, fruit growers, seamen and aviators.

3. (a) Man's food, shelter, clothing, fuel and work all depend on the climate.

   (b) Fewer people live in places where it is extremely hot or extremely cold.

4. (a) The meteorologist uses the thermometer for measuring temperature and a barometer for measuring the pressure of air.

   (b) A hygrometer determines the amount of moisture or humidity in the air.

   (c) Other delicate instruments which help the meteorologist are the weather vane, anemometer or wind gauge and a rain or snow gauge.

B. SKILLS AND ABILITIES

1. Improving reading speed
2. Greater accuracy in all work
3. Using scientific methods in other fields
4. Ability to secure information through visual aids
5. Ability to distinguish between scientific facts and superstitions
6. Ability to get exact meaning from a science passage.

C. ATTITUDES AND APPRECIATIONS

1. Active and intelligent curiosity
2. Basing judgment only on facts
3. Willingness to modify ideas upon the basis of

newly discovered, reliable evidence

4. Confidence in one's own ability to approach a new problem

5. Appreciation of the work of scientists on weather

IV. APPROACHES

1. Display Our Weather Chart from Scott-Foresman and Company. Let children mark the weather each day.

2. Visit the weather reporting station at Westover Field.

3. Present pictures of unusual weather conditions.

4. Discuss the cost of fruits and vegetables after a spring frost.

5. Visit the observatory at Weston, Massachusetts.

6. Visit the new hydro-electric station in Holyoke.

7. Display pictures of man-made clouds and other weather conditions procured from Photo News Service, General Electric.

V. LEARNING EXPERIENCES

1. Make a wind vane and record findings on weather chart.

2. Set an open can in a place where it is not sheltered. Use this can as a rain gauge. Each time it rains, measure the rain in the can with a ruler. Find out how many inches of rain fall in a given month.

3. Experiment with two jars of paste. Close one jar, leave the other open. Water in the open jar evaporates and leaves the paste dry.

4. Have children tell stories of experiences they have had because of sudden weather changes (as having a picnic or ball game spoiled by a rainstorm).

5. Collect pictures of things that depend on wind action, such kites, sailboats, windmills, etc.

6. Have children take temperature readings at different times of day.

7. Talk over the ways in which temperature changes affect clothing and activities.

8. List as many ways as you can think of how weather forecasts help us. Compare the lists.

9. Take two plants. Water one and not the other. At the end of a few days, what has happened to the one without water?

10. Make a list of sayings about the weather. Find out whether they are true or false.

11. Learn the songs "The Rain" by Walter Evans; "The Spring Rain" by L. E. Watters and "The North Wind" by Paul Forde.

12. Watch a weather vane. In which direction is the wind blowing?

13. Make a windmill and watch it move.

14. Make a class scrap book containing newspaper and magazine articles about unusual weather conditions. (Tornado in Georgia; snow on Mt. Tom in April).

15. Collect pictures and stories of other countries which show about the climate.

16. Read the weather in the paper each day. Check to see if the forecasts are correct.

VI. EVALUATION

(Teacher)

1. Have the children learned the difference between weather and climate?

2. Have they learned to read a thermometer correctly?

3. Have they shown a more scientific attitude toward the weather?

(Pupil)

1. I am no longer afraid of thunder and lightning

because I know what causes them.

2. I read the weather forecast each day and then I know what to wear.

3. My classmates and I worked together better on this unit.

TEACHER-MADE TESTS (Discussion Questions)

1. Explain the difference between weather and climate.

2. Tell about the work of the weather bureau.

3. Explain how a barometer works.

4. A boy wearing eyeglasses on a cold winter day came into a warm room. His glasses clouded. Why did this happen?

(Completion Statements)

1. When water goes into the air, we say it _____.

2. Water changes to _____ when it goes into the air.

3. Man's way of life depends on the _____.

4. _____ are important to most of us.

5. Fewer people live in places where it is extremely _____ or _____.

6. Aviators depend on the _____ for news of the weather.

7. The temperature in a room is measured by a _____.

8. A _____ measures the air pressure.

(True-False)

1. Weather only affects the lives of aviators and sailors.

2. Snow is frozen rain.

3. Rain is very necessary to everyone.

4. The barometer measures the temperature in a room.

5. A little wind is beneficial.

6. Snow may be helpful or harmful.

7. A heavy fog is dangerous.

PUPIL BEHAVIOR

1. Keeping of index cards

2. Keeping of anecdotal records

3. Records of observed behavior

4. Rating scale of personal qualities for use by teachers and by pupils.

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VIII. INSTRUCTIONAL MATERIALS

1. Maps from the United States Weather Bureau.
2. Instruments or pictures of instruments.
3. Pictures of types of clouds from General Electric.
4. Eastman Teaching Films: The Water Cycle, Atmospheric Pressure and WEATHER FORECASTING.

I. SCOPE

Children find the moon an interesting topic. It is an important one as well. All people have used the moon as a means of determining a unit of time. The Indians say "a moon", and we say "a month". Our word month is derived from the moon, although our month does not, because of our calendar, correspond exactly to the phases of the moon.

II. TITLE: -- "THE CHILDREN IN THE FOURTH GRADE LEARN ABOUT THE MOON."

III. OBJECTIVES

A. UNDERSTANDINGS AND KNOWLEDGES

GENERAL:

1. The moon is different from the other heavenly bodies.
2. The moon is a bleak, desolate place.
3. The moon moves around the earth.
4. The moon goes through changes.

SPECIFIC:

1. (a) The moon is our nearest neighbor in the sky and is only 240,000 miles from us.
   (b) The moon is solid and not a gas as the sun.
   (c) The moon cannot give off its own light like the sun and the stars. Light from the sun strikes the moon and the moon reflects the light.
2. (a) The moon is not inhabited.
   (b) There is no air nor water on the moon.

3. (a) The moon is traveling in its own orbit around the sun.

   (b) The moon moves eastward through the sky around the sun.

4. (a) The moon has night and day due to the rotation of the earth.

   (b) The moon goes through its changes in shape once in about twenty-eight days, or about four weeks.

B. SKILLS AND ABILITIES

1. Accuracy in evaluating data
2. Reading intelligently
3. Using scientific methods in other fields
4. Ability to develop scientific attitudes
5. Ability to properly organize material
6. Ability to distinguish between fact and superstition.

C. ATTITUDES AND APPRECIATIONS

1. Attitude of interest in the moon
2. Maintaining a questioning attitude until proof is offered
3. Fortifying against superstition and unfounded beliefs
4. Appreciation of the work of scientists
5. Respect for others' opinions

IV. APPROACHES

1. Plan an imaginary trip to the moon.
2. Read the story "The Atomic Twins".
3. Display a calendar that has different shapes of the moon on it.

4. Visit an observatory.

5. Visit the Planetarium in Springfield, Massachusetts.

6. Ask the pupils what they would like to know about the moon. List their questions on the board. Then, insofar as possible, have the children find their own answers as they study about the moon.

7. Show pictures of the moon from Marvels of the Universe.

V. LEARNING EXPERIENCES

1. Use a strong light, a large ball and a smaller ball to show the reason for the moon's phases. Place the "earth" (a basketball) on a small box in front of the "sun". Fasten a string to the "moon" (a small ball) and let a child move it slowly around the "earth" in a circle. As he does this, keep watching the "moon" from the direction of the "earth". As the moon travels around the earth, the lighted part grows smaller when the moon is moving toward the sun. The lighted part grows larger when the moon is moving away from the sun.

2. Let one boy or girl play being the sun, another the moon and another the earth. Show the motions of the earth and moon.

3. Find pictures of the moon taken through large telescopes.

4. Make a list of sayings about the moon. Give the reasons why you believe or do not believe them.

5. Look at the moon through a telescope.

6. Find pictures of eclipses of the moon.

7. Look at the full moon with field glasses and see if you can find plains, valleys and mountains on it.

8. Keep a record on a calendar of the different shapes of the moon as you watch it for a month.

9. Consult an almanac.

10. Use binoculars to bring out the features of the moon.

11. Learn the song "The Lovely Moon" by Henry M. Halvorson.

12. Write stories of an imaginary trip to the moon.

13. Draw pictures showing the phases of the moon.

VI. EVALUATION (Teacher)

1. Has the class gained in ability to work together because of their activities in connection with this unit?

2. Have they gained interest in scientific exploration?

3. Do the children understand the scientific reasons for the changes in the moon?

(Pupil)

1. Do I enjoy working with others?

2. Can I follow directions better?

3. Am I sure that there are no superstitions about the moon?

4. Is it easier for me to use reference material?

TEACHER-MADE TESTS (True-False)

1. When the points of the moon are turned up, we should expect dry weather.

2. The moon's surface is much like the surface of the earth.

3. The moon is really made of glass.

4. The moon is about the same size as the sun.

5. The moon influences the weather.

6. The telescope has helped the scientists to discover many facts about the moon.

7. The moon revolves about the earth in an orbit of its own.

8. The moon is our nearest neighbor.

(Discussion Questions)

1. What does "reflect" mean?
2. How is the moon different from a star?
3. Why are there no living things on the moon?
4. Why do we see shadows on the moon?
5. How long does it take from one moon to another?
6. Why do we know so much about the moon?
7. Why could a man on the moon jump higher than he can on earth?
8. What causes the phases of the moon?
9. Why can't people live on the moon?

PUPIL BEHAVIOR

1. Keeping of index cards
2. Keeping of anecdotal records
3. Records of observed behavior
4. Rating scale of personal qualities for use by teachers and by pupils.

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VIII. INSTRUCTIONAL MATERIALS

1. Calendar showing the phases of the moon.
2. Magazines - *Marvels of the Universe*; *Science News Letter*; *National Geographic*; *Barritt's Revised Celestial Album*.
3. Reference books
4. Almanacs
5. Scrapbook containing pictures of eclipse
6. Stories written by children of an imaginary trip to the moon

I. SCOPE

An important purpose of this unit is to help the children use the scientific method. There is a chance for each pupil to observe, experiment and draw conclusions.

This unit also offers opportunity for children to have fun. While "playing" with the magnets, the pupils will get many of the concepts firmly fixed in their minds. They should also be encouraged to plan experiments of their own. They will enjoy making various toys and games using magnets.

II. TITLE: -- "HOW MAGNETS AND THEIR USES INTEREST CHILDREN OF THE SIXTH GRADE."

III. OBJECTIVES

A. UNDERSTANDINGS AND KNOWLEDGES

GENERAL:

1. Magnets are of different shapes.
2. Magnets are made of different materials.
3. The force of the magnet is strongest near its ends.
4. The force of the magnet will pass through many things.
5. Magnets have many uses.

SPECIFIC:

1. (a) There are bar magnets, horseshoe magnets and U magnets.

   (b) There are also alnico magnets, electromagnets and lodestones.

2. (a) Most magnets are steel.

   (b) Pure nickel and pure cobalt are magnetic materials that can be used as magnets. In an alloy with aluminum, they make a very strong magnet.

   (c) Lodestone is a magnet found in the earth.

3. (a) The ends of the magnet where the force is strongest are called the poles.

   (b) Every magnet has two poles, a north pole and a south pole.

   (c) The north pole points toward the north and the south pole toward the south.

4. (a) The force of the magnet can go through tin and attract steel in a can.

   (b) The force of a magnet can go through the paper label on the outside of a tin can.

   (c) It can also go through cardboard, thin wood, cloth and other magnetic materials.

5. (a) Magnets are used in a needle factory to pick up bits of steel which are made into more needles.

   (b) A doctor uses a magnet to remove bits of steel from a patient's eye or from other parts of the body.

   (c) Nails and tacks are removed from highways by passing electromagnets over them.

   (d) Scrap iron is usually cleared away by means of an electromagnet.

   (e) Steel rails are often loaded into waiting freight cars by means of an electromagnet.

B. <u>SKILLS AND ABILITIES</u>

1. Increasing vocabulary

2. Using an index

3. Ability to procure definite information

4. Ability to observe details accurately and quickly

5. Ability to pursue individual interests

6. Cooperation with others in given undertakings

7. Ability to express in simple terms that which is observed.

C. ATTITUDES AND APPRECIATIONS

1. Physical and mental alertness

2. Realization that much is still unknown even to the greatest of scientists

3. Appreciation of the contributions of various scientists

4. Willingness to do any job assigned

5. Tolerance for other children's opinions

6. Cautiousness in accepting theories

7. Willingness to be convinced by evidence

IV. APPROACHES

1. Read the story of the Atomic Twins.

2. Hold up a magnet and ask what it can do.

3. Drop some steel tacks on the floor. Pick up with magnet.

4. Wrap a nail in cloth or paper and try to pick it up with a magnet.

5. Tell the story of Magnes, the shepherd.

V. LEARNING EXPERIENCES

1. Put a small wooden boat in water. Attach a small straight steel bar near the front of the boat. Pick up another straight steel bar or magnet and hold it close to the front end of the magnet on the boat. Like magic, the boat moves toward the magnet in the hand.

2. Scatter several articles as steel pins, a dime, rubber bands, chalk, glass and paper clips on a table. Which ones does the magnet pick up?

3. Make a magnetic theater. Use a cardboard box for the toy stage. Cut figures of the actors out of cardboard and fasten paper clips or tacks to their feet. Move the actors by moving a magnet under the stage.

4. Make a magnetic fish pond. Cut out little paper fish and fasten a paper clip to each. Put these in a box. Tie a magnet to a pole and then see who can catch the most fish.

5. Try to attract a small steel ball lying at a distance from a magnet.

6. Experiment to find out whether things are made of iron by trying to pick them up with a magnet.

7. Make a magnet using a steel knitting needle or darning needle.

8. Magnetize a darning needle and float it on water in a glass dish. The needle will point north and south. Magnetize another needle and hang it above the first. It will point in the same direction.

VI. EVALUATION

(Teacher)

1. Have the children learned where to find material in reference books?

2. Do they understand the importance of magnets and compasses?

3. Have they used magnets and compasses when the need arose?

(Pupil)

1. Do I understand the connection between magnets and compasses?

2. Do I realize the importance of compasses to our early navigators like Columbus and Magellan?

3. Have I participated actively in group work?

TEACHER-MADE TESTS (True-False)

1. A magnet's force will pass through a piece of leather.
2. A magnet can be used to pick iron filings out of sand.
3. Iron and steel are the only magnets.
4. A magnet attracts iron and steel.
5. All magnets are shaped like horseshoes.
6. The force of a magnet can go through tin and attract steel in a can.
7. Every magnet has a north and south pole.

(Discussion Questions)

1. Why is a compass so useful?
2. What kinds of people use compasses and why?
3. Why must you be sure that there are no magnetic materials near a hanging magnet?
4. How can you be sure that a magnet has force?
5. How can you find out whether a thing is made of magnetic material or non-magnetic material?

PUPIL BEHAVIOR

1. Rating scales of personal qualities
2. Personality inventories
3. The Journal Record

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Parker, Bertha M. Magnets. Evanston, Illinois: Row, Peterson, 1941.

Yates, Raymond F. The Boys' Book of Magnetism. New York: Harper & Brothers, 1941.

VIII. INSTRUCTIONAL MATERIALS

1. Exhibit of different kinds of magnets
2. Reference books
3. Magazines: - Popular Science; Life and National Geographic

1. SCOPE

This unit is presented in answer to the recurring question of children "What animals lived on the earth many years ago?" The animals of prehistoric times hold a peculiar fascination for children. Many of the youngsters have seen the skeletons of these animals in museums and are captivated by them. Other questions the children want answered are "What did these animals eat? How do we know that such animals lived on the earth?"

II. TITLE: -- "A FOURTH GRADE LEARNS ABOUT ANIMALS THAT LIVED LONG AGO."

III. OBJECTIVES

A. UNDERSTANDINGS AND KNOWLEDGES

GENERAL:

1. The earth is very old.
2. Life on the earth has not always been as it is now.
3. There is an interrelation and interdependence of plants and animals.
4. Some of the early animals are extinct.

SPECIFIC:

1. (a) Rocks furnish almost the sole record of the history of the earth before the historical era.

   (b) Records of the plants and animals that lived at different times in the past are found in the rocks as fossils.

(c) Four different kinds of fossils have been found: Preserved bodies or parts of bodies of plants and animals, such as the bodies found in the tar pits at Los Angeles; casts of plants and animals which duplicate the original shape; prints made by parts of plants and animals which show where they lay against clay or sand before it hardened into rock; and petrified remains.

2. (a) The first plants and animals were very simple.

(b) Most of the first plants and animals lived in water.

3. (a) As the earth grew older, new kinds of plants and animals appeared.

(b) Some of the old kinds died out.

(c) The main kinds of plants and animals have been existing on earth for a long time.

4. (a) Not one factor, but many factors caused the early animals to become extinct.

(b) Some of the causes for the extinction of the early animals were: not enough food; not the right kind of food; floods; snow; cold; and their eggs were eaten by mammals.

B. <u>SKILLS AND ABILITIES</u>

1. Reading with comprehension

2. Greater accuracy in all work

3. The ability to observe carefully

4. An open-mindedness for the reception of new evidence.

5. The ability to work cooperatively

6. The ability to use reference material

C. <u>ATTITUDES AND APPRECIATIONS</u>

1. Attitude of curiosity in things scientific

2. Confidence in the scientific method

3. Willingness to accept criticism

4. Tolerance and respect for other children's opinions

5. Willingness to cooperate with group

6. Perseverance in any task which has been accepted

7. Appreciation of the work of scientists

8. Appreciation of important changes in the scientific world.

IV. APPROACHES

1. Read the story of the Atomic Age Twins.

2. Take a field trip to see the dinosaur tracks on the highway between Holyoke and Northampton.

3. Visit the Museum at the Holyoke Public Library to see the fossil display.

4. Show pictures of the animals which lived many years ago.

5. Present pictures and story of new fossil bed found in West Virginia.

6. Ask leading questions as the following:

   (a) What kind of dinosaurs lived on the earth?

   (b) Did they live on land or in the water?

   (c) What did they eat?

   (d) Why did they disappear?

V. LEARNING EXPERIENCES

1. Make fossils using plaster of paris and some water. Find a track of squirrels, pigeons, cows, dogs or cats. When a good track is found, mix water into the plaster of paris. Pour this into the tracks and wait for it to harden. When it is dry, lift

it carefully out of the ground. On the plaster there will be a raised place like the foot of the animal which made the track. Pretend that this track was made by an animal which lived thousands of years ago.

2. Make up a story which tells how this animal met its death.

3. Take a field trip to the dinosaur tracks on the Northampton Highway.

4. Visit a limestone quarry if one is available.

5. Take a trip to Mt. Tom where layers of rocks may be seen. Try to find some rocks that contain fossils of animals.

6. Press leaves and shells into modeling clay and examine the imprints.

7. Mix cement, sand and water together and pour the mixture into a box. When this hardens, it will be an artificial rock.

8. Try to find a piece of soft coal that shows traces of the plants from which it came.

9. In modeling clay, make models of different dinosaurs. Set up on table. Use trees for background and a mirror for water. "Plant" some giant weeds similar to "horsetail". Picture a fight between a Tyrant Reptile and a Three-Horned Face. Put other kinds of dinosaurs watching the fight.

10. Write for some pamphlets on fossils that are published by the American Museum of Natural History in New York, the Field Museum in Chicago, the Carnegie Museum in Pittsburgh, the Peabody Museum at Yale University and the National Museum in Washington. Many of these pamphlets are free or available at only a small cost.

11. Make a scrapbook of pictures of fossils and of clippings from magazines and newspapers.

12. Visit the museum at Amherst College, Amherst, Massachusetts.

13. Write stories about the animals of long ago.

14. Have the children write and produce a play about the prehistoric animals. Children take the parts of the animals.

15. Many children visited the Holyoke Museum to see the display of the fossil.

16. The pupils who have television were very interested in the explosion of the atomic bomb in Nevada on March 17, 1953.

VI. EVALUATION (Teacher)

1. Have the children learned to work well together through their activities in this unit?

2. Have they gained knowledge of what the world was like in the early days?

3. Do they appreciate how old the world is?

(Pupil)

1. Have I increased my science vocabulary?

2. Do I observe things more than I did formerly?

3. Do I get along easier with my classmates?

TEACHER-MADE TESTS (True-False)

1. The earth is very old.

2. Dinosaurs lived on the earth many years ago.

3. The surface of the earth never changes.

4. Life on the earth has always been as it is now.

5. Animals which are living today are extinct.

6. Fossils are valuable records.

7. Nothing can be learned from rocks.

8. Present conditions are likely to persist a very long time on the earth.

COMPLETION STATEMENTS

1. Records of the plants and animals of long ago are found in _____.

2. All life has come from very _____ forms.

3. There is an _____ of plants and animals.

4. Changes in the earth are made very, very _____.

5. There has been a persistence of _____ upon the earth.

ESSAY QUESTIONS

1. How has all animal life grown to its present form?

2. Why has there been an interrelation and interpendence of plants and animals?

3. How have rocks told us any story of pre-historic time?

4. Why are fossils valuable records?

PUPIL BEHAVIOR

1. Records of observed behavior

2. Rating scale of personal qualities for use by teachers and by the pupils

3. Keeping of index cards

4. Keeping of anecdotal records

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Smith, E. Boyd So Long Ago. Boston: The Junior Literary Guild and Houghton Mifflin Company, 1944.

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VIII. INSTRUCTIONAL MATERIALS

1. Bulletin board with pictures of prehistoric animals.
2. Exhibit of coal, limestone, chalk, amber, petrified wood.
3. Scrapbooks containing pictures of prehistoric animals and stories about them written by the children.
4. Reference books.
5. Magazines: Life, National Geographic.

I. SCOPE

In this unit, there are many opportunities for the children to make first-hand observations that will increase their appreciations of the flowers that surround them. It is through learning about them that children can come to believe in the importance of conservation of plants and flowers, which is one of the most essential purposes for studying the unit. There should be an active interest in protecting wild flowers and each child should realize that he has an obligation to keep the world beautiful. Children love to be outdoors and they are fascinated by the wealth of beauty in nature. Field trips and all other kinds of first-hand contacts with the living things around them are very important to the realization of the purposes for teaching this unit.

II. TITLE: -- "CHILDREN IN THE FIFTH GRADE ENJOY AND APPRECIATE FLOWERS."

III. OBJECTIVES

A. UNDERSTANDINGS AND KNOWLEDGES

GENERAL:

1. The earliest blooms will be found in moist locations as the water warms faster than the earth.
2. Some flowers need more protection than others.
3. A good garden is carefully planned.

4. A flower has many different parts.

SPECIFIC:

1. (a) Most of the earliest blooming flowers are perennials.

   (b) Many of the perennials are bulb plants.

   (c) Some very small annual plants will be among the early bloomers. Bluets are a good example.

2. (a) Some blossoms of all annual plants must be left to develop seed for next year's plants.

   (b) Many of the cultivated and some of the wild annuals may be picked freely as the plants will continue to produce blossoms until seed setting is finally accomplished.

   (c) Perennial flowers have a limited blooming season. Cutting their blooms will not prolong this season and usually will not affect the following year's flowering.

   (d) Before picking any flower, note whether the entire plant will be destroyed by removing the bloom, as in trilliums. Leave these untouched, except for a possible specimen flower for study.

3. (a) For a good garden, it is important to have sufficient drainage and sunlight.

   (b) The soil should be well cultivated.

   (c) Good seed is important.

   (d) Weeds should not be permitted in a garden since they will use certain soil elements and water that otherwise might be used by the plants.

4. (a) The bright colored parts of a flower are called petals.

   (b) Sepals, which often look very much like green leaves, form a sort of cup for the petals.

(c) Pollen (yellow or brown dust) grows on the stamens. Stamens are usually slender stalks arranged in a circle about the center of a flower.

(d) At the very center of the flower is the pistil which looks like a vase with large base, a long neck and a small head.

B. SKILLS AND ABILITIES

1. Using scientific methods in planning and working a garden.
2. Accuracy in evaluating data.
3. Reading with comprehension.
4, Ability to plan and carry out details.
5. Ability to cooperate with others.
6. Ability to use information found in books and magazines.
7. Ability to establish permanent interest in flowers.

C. ATTITUDES AND APPRECIATION

1. Alertness to natural environment
2. Interest in the preservation of flowers
3. Confidence in the scientific method
4. Respect for opinions of other children
5. Proper attitude toward criticism
6. Willingness to do any task assigned
7. Realization of each person's obligation to keep the world productive and beautiful
8. Appreciation of the beauty of flowers
9. Appreciation of the contributions of scientists to gardeners.

IV. APPROACHES

1. Discuss the flowers children bring to school.
2. Visit the Mt. Tom Reservation where the mayflowers bloom.
3. Flower guides are put on the library table.
4. Flowers for Memorial Day are discussed.
5. Have children report on the flowers blooming in public parks or gardens.
6. Read the story "The Atomic Twins".
7. Read the story "Who Shall Be May Queen?" by Phila Butter Bowman in the Elson Basic Reader.
8. Visit a greenhouse.

V. LEARNING EXPERIENCES

1. Watch an insect which is visiting flowers. Find out whether it visits the same kinds of flowers or goes from one kind to another. How long does it remain on each flower?
2. Take a field trip to different localities and notice the number of species in bloom in each.
3. Start calendars of blooming dates of both wild and garden flowers.
4. Study Wild Flower Preservation Society charts of plants.
5. Make charts of flowers in your own community by cutouts or sketches and indicate need of protection. Colors on charts should indicate "pick freely" (green), "sparingly" (yellow) or "not at all" (red).
6. Read spring legends in story books.
7. Prepare parade of spring flowers, using pictures or specimens in order of appearance.
8. Where there are plants enough, collect carefully selected specimens for pressing and mounting; some

for further study and to share with others at school as specimen exhibits.

9. Make a large diagram of a flower and label its parts.

10. Write to the State Department of Conservation for information regarding laws about wild flowers in Massachusetts.

11. Sing the song "Little Man In The Woods" (Jack-in-the-Pulpit).

12. Visit a greenhouse and learn how plants are grown there.

VI. EVALUATION (Teacher)

1. Have the children become more responsible in making and carrying out plans?

2. Are the children growing in ability to work with others?

3. Are the children critical of the ideas of others?

4. Are any of the children interested in science as a vocation?

(Pupil)

1. Can I make accurate measurements?

2. Do I suspend judgment until I have tried an experiment several times?

3. Do I always have to be the leader?

4. Do I like to change my job in each unit?

TEACHER-MADE TESTS (Discussion Questions)

1. Bees and flowers are partners. Tell how each one helps the other.

2. What are some guides for good gardening?

3. Give two reasons for loosening and breaking up soil.

4. Why is it necessary to weed a garden? Give some ways of getting rid of weeds.

5. What things must scientists find out about insects before they can fight them?

6. How have scientists helped us in our gardens?

(Completion)

1. The seed-making parts of the flowers are the _____ and the _____.

2. The two main ways in which plants are pollinated are by _____ and by _____.

3. Two ways in which plants attract insects are by _____ and by _____.

4. Two insects that help to pollinate flowers are the _____ and the _____.

5. The showy bright colored parts of plants are called _____.

6. When we smell a flower, we sometimes get some yellow or brown dust on our noses. This dust is called _____.

PUPIL BEHAVIOR RECORD

1. Anecdotal records

2. Records of activities

3. Personality ratings

4. Index cards

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Parsons, Mrs. Frances S. Dana How To Know The Wild Flowers. New York: Charles Scribner's Sons, 1930.

VIII. INSTRUCTIONAL MATERIALS

1. Burbank's Catalogue
2. Flower books
3. Almanacs
4. Garden suggestions from Boston Sunday Globe
5. Plants
6. Flowers

S T A R S

Unit 6

I. SCOPE

Children are extremely interested in the stars. Through the study of this unit, they will find the answer to many of their questions. The stars that they see in the sky will take on meaning. Hazy and erroneous ideas will be replaced by understanding.

Certain radio programs and comics involving stars are imaginary and not based on fact. The pupils should be able to distinguish between fact and fancy after studying this unit. They should begin to appreciate information about the stars that has been acquired after long and careful study by scientists.

II. TITLE: -- " A FOURTH GRADE LEARNS ABOUT STARS."

III. OBJECTIVES

A. UNDERSTANDINGS AND KNOWLEDGES

GENERAL:

1. A star is a ball of hot gases.
2. Many stars are much larger than our sun but they do not give off so much light.
3. Stars have many different colors.
4. There are many constellations in the sky.
5. Our galaxy is the Milky Way.

SPECIFIC:

1. (a) Our sun is a star.

   (b) The sun looks larger and makes other stars invisible to us in the day time because it is nearer to us.

2. (a) Other stars seem smaller because they are so far away.

   (b) We get little light from the stars because they are so distant.

   (c) Stars, because they are balls of hot gases, give off light as our sun does.

3. (a) Stars have different colors because they differ in temperature.

   (b) Red stars are the coolest.

   (c) Yellow stars are hotter.

   (d) Bluish-white stars are the hottest.

4. (a) A constellation is a group of stars.

   (b) A constellation makes an imaginary picture in the sky.

   (c) The constellations that are brightest in our skies are the Big Dipper, the Little Dipper, Cassiopeia, Orion and the Pleiades.

   (d) The constellations seem to move in the sky because the earth turns on its axis.

5. (a) The Milky Way is made up of millions of stars which give off light.

   (b) These stars are arranged in the form of a wheel.

   (c) The Milky Way is given this name because it looks as if someone had spilled a pail of milk across the sky.

B. <u>SKILLS AND ABILITIES</u>

1. Interest in studying the stars.

2. Ability to establish permanent interest in constellations.

3. Reading with comprehension.

4. Ability to use information found in science magazines.

C. ATTITUDES AND APPRECIATIONS

1. Respect for opinions of others
2. Willingness to cooperate with group
3. Persistence in carrying out assigned tasks
4. Appreciation of the aid that the stars were to the early navigators
5. Attitude of curiosity about constellations
6. Appreciation of the beauties of the stars
7. Confidence in the scientific method

IV. APPROACHES

1. Read the story of the Seven Dancing Stars.
2. Visit the planetarium at the Springfield Museum.
3. Read the story "The Atomic Twins."
4. Show charts of the sky at night.
5. Encourage children to ask questions about the heavenly bodies that they see in the night sky.

V. LEARNING EXPERIENCES

1. Make a chart showing the pictures of the constellations you can find as you face north.
2. Make a chart showing the pictures of the constellations you can find as you face south.
3. Get a large piece of blue cardboard. Cut holes in the positions of the stars in each constellation. Put Christmas tree lights in the holes.
4. Cut holes in blue paper to show the positions of the stars in each constellation. Slip the paper into the open end of a box. Then hold an electric light bulb or flashlight inside the box.
5. Draw the Big Dipper and show how to find the North Star by using the pointers.

6. List the colors of the stars, beginning with the hottest stars.

7. Write a story of how the North Star helped you find your way home.

8. Learn the song "Stars", written by the Kansas City Schools.

VI. EVALUATION (Teacher)

1. Is there a more friendly attitude toward one another in the classroom?

2. Are pupils interested in studying the sky in the evening?

3. Have pupils interested their parents to make use of their leisure time in studying the beauties of nature?

4. Do pupils appreciate that the stars now shining down on us are the same that the shepherds of old knew?

(Pupil)

1. Do I observe the stars and try to find the constellations?

2. Does the North Star mean more to me?

3. Have I discovered more about the heavens than I knew before?

TEACHER-MADE TESTS (True-False)

1. A star is a ball of gas.

2. Our sun was once a star.

3. Many stars are larger than our sun.

4. Stars give no light.

5. Constellations are groups of stars.

6. The North Star can help us find directions.

7. A red star is warmer than a yellow star.

8. The Milky Way is made up of stars.

(Completion)

1. Our sun is a _____.
2. Stars give off _____ and _____.
3. Our most important constellations are _____, _____, _____ and _____.
4. A bluish-white star is the _____.
5. Stars seem small because they are _____.
6. Many stars are much _____ than our sun.

(Discussion Questions)

1. Why is it important to know about the North Star?
2. How did people first happen to think of stars as being in groups?
3. Why do we not see the stars in the daytime?
4. If you were lost at night, how could you use the stars to help you find your way home?
5. How do scientists learn new things about stars?
6. How are shooting stars different from real stars?
7. Some of the stars are larger than our sun. Why do they look smaller than the sun?

PUPIL BEHAVIOR

1. Records of observed behavior
2. Keeping of index cards
3. Keeping of anecdotal cards
4. Rating scale of personal qualities for use by administrators and by pupils.

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Writer's Project, Pennsylvania A Dream of Stars. Whitman, 1940-1941.

VIII. INSTRUCTIONAL MATERIALS

1. Charts showing the night sky
2. Exhibits of meteors
3. Reference books
4. Magazines: Nature Magazine and Junior Natural History

I. SCOPE

This unit is designed to give children some understanding of the importance of the sun. It is our source of heat, light and energy. It makes no difference whether we burn wood or coal, or whether we use water power or electricity, the source of the energy is the sun. The trees would not grow without sunlight. Therefore, without the sun there would be no wood nor coal. There would be no water power without evaporation. The sun aids evaporation by furnishing essential heat. Electricity is dependent upon coal or water power. Therefore, electricity too depends upon the sun. The sun is the original source of all light, energy and heat.

Excepting the little light we receive from the stars, we can start anywhere in our experience and trace our light, heat and other forms of energy back to the sun.

II. TITLE: -- "CHILDREN IN GRADE FOUR LEARN ABOUT THE SUN."

III. OBJECTIVES

A. UNDERSTANDINGS AND KNOWLEDGES

GENERAL:

1. The earth could not exist without the sun.
2. The sun is far, far away from us.
3. The sun is an enormous body.

SPECIFIC:

1. (a) The sun is our source of heat. The largest stove in the smallest room could not heat it without the sun.

   (b) The sun gives us light. No electricity could light our homes without help from the sun.

   (c) The sun is our source of energy. We get our energy from food. Food is made by plants. The plants need sunlight to grow and produce food.

2. (a) The sun is about ninety-three million miles away from the earth.

   (b) An automobile going sixty miles an hour would take one hundred seventy-seven years to travel ninety-three million miles.

3. (a) The sun is more than a million times as large as the earth.

   (b) The sun looks small because it is so far away.

B. SKILLS AND ABILITIES

1. Accurate reading habits
2. Skill in reading pictures for scientific information
3. Skill in obtaining information from charts and globes
4. Skill in following directions
5. Ability to distinguish between fact and assumption.
6. Ability to discern inconsistencies in data
7. Ability to seek data from several types of sources

C. ATTITUDES AND APPRECIATIONS

1. An active, intelligent curiosity

2. The disposition to note dissimilarities as well as similarities

3. Developing perseverance in seeing a problem through to its logical conclusion

4. Proper attitude toward criticism

5. Willingness to do cheerfully all assigned work

6. Appreciation of the work of scientists

7. Appreciation of man's dependence upon the sun.

IV. APPROACHES

1. Read the story "The Atomic Twins."

2. Lock at the sun through a piece of smoked glass.

3. Set up a shadow stick in the playground and note position of the shadow at 9:00 A.M., 12:00 Noon and 3:00 P.M.

4. If a sundial is available, read the time on it with the children.

5. Have the children watch an airplane until it is a mere speck in the sky. The fact that the plane is only a few miles distant, while the sun is millions of miles away, will help to develop the size and distance of the sun.

6. Read The Sun Heats the Earth, Craig and Baldwin, Pathways in Science II, pp. 138-141.

V. LEARNING EXPERIENCES

1. Display pictures of the sun from the General Electric Company.

2. Make up a verse based on "This is the House that Jack Built" as:

"This is the wheat the sun made
This is the bread that was made
from the wheat the sun made"

Other verses can be made describing cereals,

butter, vegetables or fruits.

3. Notice the time the sun appears in our classroom each day.

4. Watch the leaves of a plant which is growing in a window. Note which way they are turned. Turn the plant around. Watch the leaves again. How long does it take them to turn completely around so that they are again facing the light?

5. Find out how people told time before they had clocks. Find out whether people still use any of these ways of telling time.

6. Have the children compare the size of a tree a few feet away with one several blocks away. The trees are the same size but the one farther away looks much smaller.

7. Make two drawings on the board. Draw a circle a quarter of an inch across the board. Next to it, make another circle twenty-seven inches across. Write "The Earth" over the small circle and "The Sun" over the large circle. This will help to show how big the sun is.

8. Have the children touch an electric light bulb that is not lighted. Then turn on the current to light the bulb. A few minutes after it has been lighted, ask a few children to touch it carefully. Children will then understand that if a thing is hot enough, it will give off light.

9. Grow two plants under the same conditions except to give one sun and keep the other in the shade.

10. Make charts of shadows in the morning, noon and in the evening.

11. List what animals and people eat.

12. Lead children to see that if plants depend on the sun for food then we do, too, for animals and people depend on plant life.

VI. <u>EVALUATION</u> (Teacher)

1. Have the children improved in ability to attack problems?

2. Are the children becoming more responsible in making and carrying out plans?

3. Do the children work better together?

(Pupil)

1. Do I accept any job willingly?

2. Do I want to consider new facts?

3. Am I willing to change my ideas if new evidence is offered?

4. Do I suspend judgment until all available facts are in?

TEACHER-MADE TESTS (Discussion Questions)

1. Why is the sun important to us?

2. What does the sun have to do with day and night?

3. What effect does the sun have on seasons?

4. Where does the sun get its heat?

(True-False)

1. The sun is larger than the earth.

2. A large stove could heat a small room without any help from the sun.

3. We get our energy from the sun.

4. No electricity could light our homes without help from the sun.

5. The sun is near us.

6. Plants, animals and people depend on the sun.

PUPIL BEHAVIOR

1. Anecdotal records

2. Personality ratings

3. Records of activities

4. Index cards

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VIII. INSTRUCTIONAL MATERIAL

1. Almanacs
2. Calendars
3. Children's encyclopedias
4. Hourglass
5. Pictures of eclipse of the sun from newspapers and General Electric Company
6. Reference books
7. Magazines: *Science News Letter* and *National Geographic*

I. SCOPE

Most people do not like to be out in a storm, particularly when lightning flashes and thunder crashes. If they knew what really causes lightning to strike and why the thunder rolls, they would have less to worry about. They might also learn to protect themselves during a storm.

For thousands of years, no one knew much about thunder and lightning. Many strange explanations were given for this phenomena including one universally believed that the gods were angry at the people. Today we know that none of the stories are true.

Many years ago, Benjamin Franklin tried to discover what lightning really was. He believed that lightning was the same as electricity and through his experiment with a kite he proved his theory.

Three thousand years ago, the Greeks knew how to get electricity by rubbing but electricity that comes from rubbing things together is of little use. It took a long time before scientists learned how to put electricity to work but now, thanks to the experiments of Edison and others, our way of living has been greatly improved.

Man's knowledge of electricity has come about through the discoveries of many scientists in many different countries, each of whom took account of the work of the

others in their field.

II. TITLE: "CHILDREN IN THE SIXTH GRADE STUDY ELECTRICITY."

III. OBJECTIVES

A. UNDERSTANDINGS AND KNOWLEDGES

GENERAL:

1. Electricity can be produced in different ways.
2. Electric current can be made in two ways.
3. Electric current moves along a path.
4. Electricity can be a source of danger.

SPECIFIC:

1. (a) Chemical action can produce electricity. Electricity can be generated by suspending a copper rod and a zinc rod for two-thirds of their length in a solution of sulphuric acid. When the tops of these rods are connected with a wire, electricity will flow through the wire from the copper to the zinc. This is called a simple Voltaic cell.

(b) A storage battery produces a chemical reaction that forms electricity. After the reaction has gone through to completion, these original substances have disappeared and can no longer perform the reaction that generates electricity. To "charge" the battery, electricity is allowed to flow through the battery, which causes the original substances to re-form.

(c) A dry cell is a modification of a Voltaic cell. In place of the copper rod, it has a carbon post. In place of the zinc rod, it has a container made of zinc. In place of surphuric acid, is a paste of manganese dioxide and ammonium chloride. The dry cell is the only safe source of electricity for experimenting in schools.

2. (a) Electric current is made to flow by a generator that is run by some other force.

   (b) Electric current is made to flow by an electric cell.

3. (a) A circuit is the path along which electrical current moves.

   (b) If there is a continuous metallic path from the dry cell, or other source of power, through a light, or bell, or toaster or other device and back to the source of power, we have a closed circuit.

   (c) Electrical devices will work only while the circuit is closed.

   (d) If the flow of electricity is broken, the device stops working. Switches, buttons and chains are devices which will break a circuit.

4. (a) Amateurs should never attempt to repair radio or television receiving sets.

   (b) Wires which are connected to a source of high voltage are very dangerous.

   (c) It is very dangerous to touch electric fixtures when the body or hand is wet.

B. <u>SKILLS AND ABILITIES</u>

1. Interpreting graphs and charts
2. Skill in keeping records
3. Skill in making careful observations
4. Skill in using reference books
5. Improving reading ability
6. Ability to use scientific knowledge
7. Ability to make accurate measurements
8. Ability to perform simple experiments with reasonable accuracy.

C. ATTITUDES AND APPRECIATIONS

1. Willingness to consider new evidence
2. Unwillingness to compromise with truth as known
3. Interest in science as a hobby
4. Appreciation of the contributions of scientists
5. Appreciation of basic cause-and-effect relationships

IV. APPROACHES

1. Read the story "The Atomic Twins."
2. Visit a farmhouse where there is no electricity.
3. Read the story of Franklin and his experiment with a kite.
4. Visit the hydro-electric plant in Holyoke.
5. Visit the electric plant in South Hadley.

V. LEARNING EXPERIENCES

1. Walk across a carpet, shuffling your feet, until you reach a radiator. Then bring the tip of your finger slowly toward the radiator. If the room is dark, you will see a tiny spark jump between your finger and the metal. You will also feel a slight shock which will not hurt.
2. Comb your hair when the room is warm and the air is dry. You may hear a crackling sound as you move the comb.
3. At night, comb your hair while looking in a mirror. You may see hundreds of little sparks.
4. Stroke a cat's back before a warm fireplace. You will feel the tingle, hear the crackle and see the sparks from many tiny lightning flashes.
5. Visit a generating station.

6. Collect pictures of lightning flashes and put them on the bulletin board. (General Electric Company)

7. Write a letter to a friend about experiments you did with electricity.

8. Find out the source of the electricity used in the school.

9. Collect pictures of generators that produce large amounts of electricity. (General Electric and Westinghouse)

10. Make a collection of different kinds of cells, batteries and fuses.

11. Draw a picture showing a waterfall, a water wheel, a generator and wires carrying electricity to a home.

12. Connect a cell with a toy electric motor and make it run.

13. Wire a doll's house for electricity. (Full directions are given in Cornell Rural School Leaflet, Vol. 31, No. 4, March, 1938, New York State College of Agriculture, Ithaca, New York.

14. Watch electricians wiring a new house. What safety devices do they use?

15. Find out where the electricity used in your home comes from.

16. Make an electric bell. (Directions can be found in The Book of Electricity by A. F. Collins.)

17. Read an electric meter.

18. Figure out the last electric bill at home. The rates of the company are usually listed on the back.

VI. EVALUATION (Teacher)

1. Have the children improved in ability to attack a problem?

2. Are they capable of coming to a satisfactory conclusion in regard to a problem?

3. Are the children reading science content with understanding and enjoyment?

4. Do they understand the contributions of science to the life of our times - radio, telephone, etc.

(Pupil)

1. Do I share in the work of carrying out our plans?

2. Can I do simple experiments by myself?

3. Do I like to work with others?

4. Can I take and follow directions?

TEACHER-MADE TESTS (Discussion Questions)

1. What is lightning?

2. What causes thunder?

3. What did Franklin discover?

4. What is a fuse?

5. What is a battery?

6. How many things in your home use electricity to make heat? To make a motor run?

7. How does the electric light bulb in your home give light?

8. How is the cost of your electricity determined?

9. How would your work and play be different if you did not have electricity?

(True-False)

1. Electric current can be made in two ways.

2. Dry cells will run toys.

3. Electricity has to run along wires.

4. Electricity is used to run many things in our homes.

5. We could still have bright lights without electricity.

(Completion)

1. A house can be protected from lightning by a _____.

2. A clap of _____ is like the crackle of an electric spark.

3. The rolling of thunder is due to _____.

4. Generators may be turned by either water wheels or _____.

5. Electricity that comes from _____ is the most useful for doing the world's work.

6. Electricity can flow most easily along _____ paths.

7. Wires that carry electricity are often covered with _____.

PUPIL BEHAVIOR

1. Reading records
2. Anecdotal records
3. Record of tests and examinations
4. Personal ratings

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VIII. INSTRUCTIONAL MATERIALS

1. Pictures of lightning flashes (General Electric Company)
2. Pictures of generators (General Electric and Westinghouse Electric Companies)
3. Cornell Rural School Leaflet, Electricity and Magnetism.
4. Electric train and tracks
5. Doorbell
6. Display of batteries, cells and fuses

1. SCOPE

Planets have a very understandable fascination for children. Certain radio programs and comic books glorifying the men from Mars have stimulated their interest. The pictures and stories of rocket ships have also fired their imagination. This unit should turn their interest toward the scientific knowledge gained after diligent work by scientists and away from the false impressions gained by unscientific means.

II. TITLE: -- "GRADE FOUR STUDIES THE PLANETS."

III. OBJECTIVES

A. UNDERSTANDINGS AND KNOWLEDGES

GENERAL:

1. Planets are different from the stars.
2. Planets are at different distances from the sun.
3. Scientists are still learning about the planets.

SPECIFIC:

1. (a) All planets travel around the sun, but no stars do.

   (b) A planet does not give off light of its own as a star does. A planet reflects light from the sun just as the moon does.

2. (a) Mercury is the planet nearest to the sun and its journey takes only eighty-eight days.

(b) Pluto is farthest away from the sun and takes two hundred and fifty of our years to travel around the sun.

(c) The Earth is a planet and its journey takes three hundred and sixty-five days.

3. (a) The scientists know that there are nine planets but there may be more that have not been discovered yet. Pluto, the last planet discovered, was first seen in 1930.

(b) Scientists do not know whether there are living things on the planets. Some scientists think that there is a kind of life on Mars. This planet seems to have air, seasons and at certain times, parts of the planet look green. This may be caused by some kinds of growing plants.

(c) With the giant telescopes that are now available, perhaps some day scientists will learn a great deal more about the planets.

B. <u>SKILLS AND ABILITIES</u>

1. Ability to use library facilities.
2. Ability to secure exact information from books.
3. Ability to secure information from visual aids.
4. Ability to distinguish between scientific facts and superstitions.
5. Greater accuracy in all work.
6. Development of the habit of verifying information.
7. Ability to pursue scientific study individually.

C. <u>ATTITUDES AND APPRECIATIONS</u>

1. Realization that many things about the planets are still unknown to scientists.

2. Attitude of curiosity toward scientific experiments.

3. Appreciation of the constant vigil of scientists.

4. Appreciation of the beauty of the planets.

5. Appreciation of the role scientists play in our complex society.

6. Confidence in the scientific method.

IV. APPROACHES

1. Visit the planetarium in Springfield, Massachusetts.

2. Read stories about Mars.

3. Show chart of night sky and the positions of the planets.

4. Display newspaper clippings about Venus and Jupiter.

5. Recall the radio version of the invasion of the world by "Men from Mars."

V. LEARNING EXPERIENCES

1. Make a chart showing the planets in our sky.

2. Tell stories of what life on the planets might be.

3. Use field glasses to see the planets clearly.

4. Read stories about the planets.

5. Learn to find Mars, Venus, Jupiter and Saturn during the months when they can be seen.

6. Draw a picture of the sun and show each planet travelling around the sun.

7. Show pictures of Venus changing its shape.

8. Have a debate on the subject of life on Mars.

9. Visit an observatory.

10. Make a small telescope. Directions are found in "Astronomy for Amateurs" a Do-It-Yourself book.

11. Take an imaginary trip to one of the other planets and tell about it.

12. Make a frieze that will show the sun and the planets.

13. Make a planetarium in the classroom. Use balls of different size to represent the planets.

14. Make a graph, showing the sizes of the planets. Use a convenient scale such as: 1 inch = 10,000 miles.

VI. EVALUATION (Teacher)

1. Have the pupils gained an interest in the planets?

2. Can they explain certain facts which they did not understand before?

3. Do they know how to distinguish between facts and superstitions?

(Pupil)

1. Do I find it easier to look up new material?

2. Do I do each experiment several times before I come to any conclusion?

3. Can I listen to the radio and know whether the stories are real or fiction?

4. Do my classmates and I work better together?

TEACHER-MADE TESTS (Discussion Questions)

1. Why is it very cold on Pluto and Neptune?

2. Why do some scientists believe that Mars may have living things on it?

3. What two materials must a planet have before it can have living things on it?

4. Why do we say that there are nine known planets?

5. In what two ways are planets different from stars?

(Match)

1.	The planet with rings	Mercury
2.	The largest planet	Venus
3.	The red planet	Earth
4.	The planet farthest from the sun	Mars
5.	The planet that is about the size of the earth.	Jupiter
6.	The planet nearest the sun	Saturn
7.	The planet with four moons	Uranus
8.	The planet we know most about	Neptune
9.	The planet between Uranus and Pluto	Pluto

(True-False)

1. Venus is closest to the sun.
2. Saturn has rings.
3. Pluto was discovered last.
4. Jupiter is the largest planet.
5. Mars is farthest from the sun.
6. Mercury is called the Earth's twin.

(An "est" test)

1. The hottest planet
2. The largest planet
3. The brightest
4. The smallest
5. The best known
6. The nearest to the earth
7. The newest

(Completion)

1. _____ is the planet nearest to the sun.
2. _____ is the planet farthest from the sun.
3. _____ is the planet most like the earth.
4. Planets shine by light _____ from the sun.
5. The earth is one of a group of _____ that revolve around the sun.

PUPIL BEHAVIOR

1. Keeping of index cards
2. Keeping of anecdotal records
3. Records of observed behavior
4. Rating scale of personal qualities for use by teachers and by pupils.

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VIII. INSTRUCTIONAL MATERIALS

1. Telescopes
2. Field glasses
3. Reference books
4. Magazines - Science Education, Science News Letter, School Science and Mathematics and Children's Digest.
5. Wall charts of the planets in the sky, borrowed from Westinghouse Electric Company.
6. Star maps from Nature Magazine every month.

I. SCOPE

For centuries people have had geocentric ideas of the universe - that is, they believed that the earth was the center of the universe. It seemed to them that the earth was the largest body and that the stars and moon moved about it. Children are apt to think the same thing. To them, the earth seems to be the largest body in the universe.

This unit is designed to give the pupils some comprehension of the size of the earth as compared with the part that he knows best - namely, his village, town or city. It attempts also to give a comprehension of the size of the earth as compared with the rest of the universe.

Though the purpose of this unit is not to give the causes of the seasons (as these concepts in general are too difficult for children of this age), the pupils should be aware of the fact that because the earth moves as it does, we have day and night. We also have long days (summer) and short days (winter) during the year and the long days are the warm days. The children should also begin to understand the method of discovery used by scientists through the ages, that is, careful observation, experimentation and accurate thinking.

II. TITLE:-- "FIFTH GRADE CHILDREN LEARN ABOUT OUR EARTH."

III. OBJECTIVES

A. UNDERSTANDINGS AND KNOWLEDGES

GENERAL:

1. The earth is shaped like a big ball even though it does not seem to be.
2. The earth is very big.
3. The earth is very small.
4. The earth rotates on its axis.
5. The earth is helped by the sun.

SPECIFIC:

1. (a) The earth does not look round because it is so very large.

   (b) You cannot see enough of the earth to be able to tell that it curves.

   (c) Because the earth is shaped like a ball, only half of the earth is lighted at one time.

2. (a) In cities, the parks, the streets and the buildings seem to be all there is to the world. In the country, the hills, the woods, the fields and the farms seem to reach everywhere. But great places like these are just tiny specks compared to the rest of the world.

   (b) Cut a piece of paper the size of the United States. The United States is a very large country. Lay the paper over other places on the world map. How many, many pieces of paper this size you would need if you were trying to have enough to cover the whole world map.

   (c) A fast boat takes about four days and nights to cross the Atlantic Ocean. This is not the largest ocean.

3. (a) The sun is thousands of times bigger than our earth.

(b) Some of the stars are much bigger than our earth. In fact, many of them are brighter and larger than our sun is.

4. (a) The earth's axis is an imaginary line through the earth.

(b) The earth rotates from west to east.

(c) When the earth faces the sun, we have daylight and when it turns away, we have night.

(d) The sun's rays fall more directly on the half of the earth tilted towards the sun and less directly on the half of the earth tilted away from the sun. This causes the seasons. It is colder in winter than in summer because the days are shorter and the sun's rays strike our Northern Hemisphere less directly.

(e) The earth's journey around the sun takes a year.

5. (a) The earth is lighted by the sun.

(b) The earth is heated by the sun.

(c) The earth's energy comes from the sun.

B. <u>SKILLS AND ABILITIES</u>

1. Skill in working consistently and carefully
2. Skill in picking relevant material from references
3. Skill in reading rapidly with understanding
4. Ability to distinguish between fact and superstition
5. Ability to evaluate data
6. Ability to secure first-hand information by experiments
7. Ability to secure information through visual aids

C. ATTITUDES AND APPRECIATIONS

1. Direct and relevant approach
2. Attention to details
3. Recognizing and controlling personal prejudices
4. Freedom from superstition
5. Willingness to change ideas upon presentation of reliable evidence
6. Appreciation of the contributions of scientists
7. Appreciation of basic cause-and-effect relationships

IV. APPROACHES

1. Ask the class why we have day and night. Write the answers on the board. As the children study the unit, have them refer to these answers, see if they are correct and correct them if necessary.
2. Read the story of Columbus who believed the world was round.
3. Read about Magellan who, by sailing around the world, proved that it was round.
4. Read the poem "Bed in Summer" by Robert Louis Stevenson.

V. LEARNING EXPERIENCES

1. Have one child hold a lighted flashlight on one side of a globe. Have the other children notice the darkened side.
2. Have the globe slowly turned from west to east. The children will then see how the dark side is brightened when it faces the light.
3. Watch a top spin.
4. Turn a globe around very fast and watch it spin, too.

5. Roll an orange on a table. It turns this way and that. Now push a short, stiff piece of wire through the orange and whirl the orange around on the wire. It deeps spinning around in the same place. It spins around on the wire. The orange on the wire can be the earth turning on its axis.

6. Take a quarter and hold it on edge. Snap it with your fingers so that it will spin on the table. There is no wire through the coin but it is spinning on its axis, too. Imagine that there is a line running through the coin. The earth rotates on an axis in the same direction just as the coin did. There is no rod running through the earth. The earth's axis is an imaginary line through the earth.

7. Find out what two days of the year have exactly the same amount of daylight and darkness.

8. Ask a jeweler how he finds out the correct time. How often does he get the correct time?

9. Children are interested in studying the globe. See if they can figure out what proportion is land and what proportion is water.

10. Have children tell stories of their own or others' experiences in telling time by the sun.

11. Charts may be made giving the time of sunrise and sunset on the first day of each month for the remainder of the school year.

12. Have oral talks to have the children show how their activities in summer and in winter differ because of the length of days.

13. The class should keep a record of daylight and darkness. This furnishes an excellent opportunity for the children to record data and draw conclusions from them.

14. Turn a flashlight on and put it inside a paper tube. Hold the flashlight straight down on the table. Then slant it. When the flashlight is slanted, the light is spread over a larger space than when it is held straight down. So the spot is brighter when the flashlight is straight up and down above the table. The sun is straightest overhead in summer so the earth gets more heat at that time.

VI. EVALUATION (Teacher)

1. Have the experiments been conducted so that they will cause pupils to think?

2. Do the pupils have respect for the rights and contributions of others?

3. Is there cooperation in the planning and execution of the work?

(Pupil)

1. Do I use my time wisely?

2. Can I depend on myself and not seek unnecessary help when working?

3. Do I respect the property of others?

4. Do I return everything I have borrowed to its proper place?

TEACHER-MADE TESTS (Completion)

1. The imaginary line around which the earth turns is called the earth's _____.

2. The path of the earth around the sun is called its _____.

3. The earth rotates in a _____ direction.

4. The time which the earth takes to travel around the sun is called a _____.

5. The days and nights are equal in length all over the earth on _____.

6. The turning of the earth on its axis is called _____.

7. The movement of the earth around the sun is called _____.

(True-False)

1. The sun is nearest the earth in summer.

2. There are twenty-four hours in a day.

3. December 21st is the coldest day of the year.

4. The revolution of the earth causes day and night.

5. The earth and the hands of a clock both turn in the same direction.

6. During spring and summer, the waters in the oceans get cooler.

(Discussion Questions)

1. How did the people who lived long ago count time?

2. What are the two principal motions of the earth?

3. How many times does the earth rotate on its axis while it revolves once around the sun?

4. Why are summer days warmer than winter days?

5. Why is the time different in different parts of this country?

6. Why is the spinning of the earth more like the spinning of a coin than the spinning of an orange?

7. What are some reasons for believing that the earth is shaped like a ball?

PUPIL BEHAVIOR

1. Anecdotal records

2. Personality ratings

3. Records of activities

4. Index cards

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1. Magazines - National Geographic; Science News Letter; Life
2. Globes and maps
3. Reference books
4. Stories of the early explorers - Columbus, Magellan
5. Stories children have written about seeing the world by different means of transportation - planes, ships, trains and automobiles
6. Jigsaw puzzles of the world

CHAPTER V

CONCLUSIONS

CHAPTER V

CONCLUSIONS

Areas of Interest -- This study revealed the areas of science in which intermediate grade children expressed the greatest interest. Units were developed with experiences designed to help pupils learn about the fields of interest.

The story of the Atomic Twins dealt with a number of scientific areas. Questions were asked by the children and weather was found to be first on the list. Weather was not mentioned by name but by inference. The stars, planets, moon and sun would not have been visible during inclement weather. The conclusion that can be drawn from the numerous inquiries is that the children included in this study were concerned to a considerable degree with the weather.

The moon was second on the list of the children's favorites. It has always been of interest to people of all ages and from the earliest times.

Magnets were mentioned in the story but not stressed. Magnets appeal to children because of the tricks that can be played with them and they were in third place in this survey.

The interest in the dinosaurs, which were given prominence in the story, is manifested by its place of number four in the list. This proves that the children are fascinated by the world in pre-historic times. They often ask about the animals that lived in the world many years ago, what they looked like, what they ate and what happened to them.

Flowers were mentioned in the story and the interest of the children placed this area fifth in the survey.

The stars were given quite a bit of attention in the story and they rated sixth place.

The sun, with a brief mention in the story, was given seventh place in the survey.

Electricity is necessary to modern living and is recognized as being of importance by elementary school children. This area reached eighth place.

Planets were mentioned in the story but not stressed. Children are very interested in this subject because of the radio stories and comic books. Planets rated ninth place.

The story told a little about the earth and the interest of the children placed it tenth on the list.

Traditional Science Teaching -- The traditional program of science teaching was based on nature study, with emphasis on observation and collection. The children brought flowers to school which were pressed and placed in notebooks. They fed squirrels and delved into the lives of frogs or studied birds and their habits. There was a lack of continuity and scope in this limited procedure.

This study reveals that when given an opportunity to indicate where their interests lie, elementary school children place great stress on many other areas besides nature study. In this problem, these other areas of science have been emphasized. The story of the sky is studied and the phenomena of

the heavens have been found to interest the children included in this study. This interest can be capitalized upon by encouraging such out-of-school activities as studying the stars, the moon and the planets.

Ten Areas of Greatest Interest -- The ten areas shown to be of greatest interest in this survey are as follows, in order of preference: Weather, The Moon, Magnets, Prehistoric Animals, Flowers, Stars, The Sun, Electricity, Planets and The Earth.

Demands of Modern Education -- Modern education demands a continuous and correlated program of study. The new theory requires a curriculum in which learning experiences shall be presented in such a manner that, as the child progresses through the grades, he will have opportunity for continuous growth in scientific knowledge. The units growing from expressed interests within this study are designed to include experiences which help promote understanding of (1) the manner in which natural forces are continually changing the surface of the earth; (2) the relationship of the earth and other astonomical bodies; (3) situations where true cause-and-effect relationships exist; (4) the underlying causes for certain scientific phenomena. This problem has been based on the above plan and the ten units developed according to these principles.

The hope for a better world rests upon the extent to

which science can replace bigotry, superstition, ignorance and prejudice. In attaining this objective, the teaching of science,beginning at the primary grades and continuing through the pupils' total school experiences, can play an important part.

APPENDIX

The story "The Atomic Age Twins"

THE ATOMIC AGE TWINS

One warm afternoon Jack and Sue, the Atomic Age twins, wandered around looking for some excitement. They had already visited the sandstone bank along the river road between Holyoke and Northampton and saw there in the stone the large three-toed tracks of a dinosaur.

"I wonder what the earth was like in the beginning?" questioned Sue.

"Let's rub our Atom Lamp and find out, " answered Jack.

Lo and behold! - they were carried back millions of years! My but the world was a lonely place without people, animals, trees, grass or plants of any kind. Millions of years were needed for the air, water and soil to form. Millions and millions more years went by before trees, grass, lakes and rivers covered the earth to make it beautiful. After that, many animals roamed through the land.

"What's that terrible shaking in the ground?" asked Jack.

"That's only the Thundering Reptile," answered the lamp. "But don't you worry about him. He's too slow and too lazy to do much fighting."

"Look at that fierce fellow!" said the twins.

"He is called the Three-Horned Face," the lamp told them.

"Why it does have three horns, two on his head and a shorter one on his nose. And he has a short, sharp beak like that of a huge bird. What an ugly beast he is!" said Sue.

"Let me show you the Tyrant Reptile and then we'll whisk out of here mighty fast," said the lamp. "He's larger than

most and he has terrible claws, jaws and teeth."

"Oh, brother, there's one now and that's enough for me," said Sue. "Let's get out of here! I'd much rather just see their tracks."

In their haste to leave these prehistoric animals, Jack rubbed the lamp a little too vigorously and they shot up far into space - way up into the air.

They thought the moon was a friendly fellow and decided to pay him a visit. It was getting mighty cold up there so they rubbed the lamp for some warm flying suits. When they reached the moon, they found him in terrible shape with enormous holes all over him.

Sue exclaimed, "My goodness, what happened to you?"

"Oh, those are just my craters," said the moon. "But they sure make swell slides. Why don't you try one?"

Jack and Sue sat at the edge of a big one, gave a push and off they went - down, down, down. This was lots more fun than sliding on the earth because they went so fast they shot clear up to the top of the other side of the crater. They wandered around the moon for a while but there was little to see except the holes in it.

"Let's go over to see that bright star," said Jack. "Perhaps he might have some fun for us." And off they shot to the star.

"What's your name?" Sue asked, "And are you very old?"

"I'm the North Star and I helped those young fellows

Magellan, Columbus, Cabot and the rest of them. They never would have known where they were going if I didn't light their way."

"He's a mighty cocky piece, isn't he, Sue? Let him brag away and let's see what Mr. Sun is doing. He sure looks nice and bright from here."

Mr. Sun certainly looked happy because from that side, he was showing his sunny face to half the world, brightening everything and helping things to grow. But what a two-faced monster he turned out to be! His back was very dark and he was scowling at the other side of the world. What a difference it made! Everything looked dark and dismal.

It was terribly hot so the twins had to don asbestos clothes as they neared the sun. But even with this protection, the heat was terrific so they begged the lamp to return them to the good old earth.

After their exciting trip by way of the Atomic Lamp, home sure looked good to Sue and Jack and they agreed that all future tours would be via Television in the comfort of their livingroom.

However, a couple of days later, Sue and Jack were ready for further adventures. They wandered into the kitchen and watched Mother who was busy preparing asparagus and strawberries to put in her new home freezer.

It was too nice a day to stay indoors, so they decided to take a walk in the woods. Jack wanted to take his compass but

of course couldn't remember where he had left it. After rummaging around for a while, he finally found it on a high shelf. In reaching for it, he knocked over a box of tacks which crashed to the floor and seemed to fly all over the place.

"What a mess, Jack! Now we'll spend half the day picking these up," grumbled Sue.

"Just watch 'Magician Jack' one, two, presto!" and in a second the tacks were all gathered up.

"What do you have in your hand?" queried Sue suspiciously.

"It's a magnet," explained Jack. "It will pick up only things made of iron and steel. Let's go now."

The woods were very cool and pleasant.

"Something smells like perfume," said Sue wrinkling her nose.

"That's coming from those Mayflowers," explained Jack. You know those are our State Flower. There used to be many of them but people picked them and after a while they almost disappeared. Now we may just look at them but never pick them."

The woods were filled with the twittering of birds. A downy woodpecker stopped its drumming beat and pointed its sharp bill at them, then abruptly flew off as a bluejay started to squawk from the same treetop.

The twins finally came to a small pond. Grandfather Frog was sunning himself on an old stump nearby. Jack wanted some animals and plants for his aquarium. He collected a few tadpoles and a lone snail.

"Why do you want those, Jack?" Sue asked.

"We need some scavengers for our aquarium," Jack replied.

"Scavengers? What are they?" queried Sue.

"They eat up any extra food or refuse in our aquarium. We don't have to clean it because the snails, tadpoles and some kinds of insects take care of that for us," answered Jack.

"We'd better head for home,Sue. It is getting late."

"But gosh, Jack, we've wandered off the path now and we'll have to use your compass to find our way home."

"That's all right, Sue. A compass always points North. These woods are north of our house so if we just turn our backs to the north, we'll be home in no time."

It took them a little longer than Jack expected because they had gone further than they realized. But they arrived home just as Dad drove into the yard and immediately started to tell him of their day's adventures.

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