RECOMMENDATIONS

FOR A SCIENCE PROGRAM IN THE ELEMENTARY SCHOOLS

BASED UPON THE INDIVIDUAL AND SOCIAL

NEEDS OF THE PEOPLE IN HOMES

A Thesis

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by

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BIOGRAPHY

The writer was born in Homs where she received her elementary education at the "Ecole Des Soeurs Des Saints Coeurs". Her secondary school education was completed at the "American High School for Girls" in Tripoli, Lebanon. In 1954 she came to the Beirut College for Women where she studied up to her senior year, majoring in Educational Psychology.

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# TABLE OF CONTENTS

Introduction

I. The Country and Its People.

II. The Educational System And The Science Program.
   A. The System In General.
   B. The Teacher.
   C. The Present Elementary Science Program and Its Consequences.

III. Modern Trends In General Education.

IV. Objectives Of Science Teaching in General Education.

V. Field Work In Science.
   A. In General.
   B. Kinds Of Trips.
   C. The Laboratory and Its Relation To Field Work.
   D. The Teacher and the Field Work.

VI. Construction Of A Science Program.

VII. Conclusion.

VIII. Bibliography.
INTRODUCTION

Very little scientific study has been made of the educational activities in Homs. However, a few studies made recently throw some light on the events that have been developing during the last ten or fifteen years and it is to these studies that one may refer for a general overview of the educational system current in the small city of Homs.

A study of sources mentioned in my bibliography and interviews with men who are in direct contact with the Ministry of Education in Syria, cannot by justify such a research.

I believe that at the root of most of the problems today lie the ignorance of the masses and their meagre scientific knowledge about daily life and what this scientific age is bringing along with it. It is this fact that brought about this study. The science program of the schools which may be a great factor in the improvement of conditions has been left almost untouched although many of the other school subjects have been remade or improved.

This paper does not attempt to give solution to the many problems confronting education; progress is a growing process and if this paper can push a bit further our attempts towards a more adequate and improved science program as related to the existing system of education, it would have served its purpose.
To attempt definite steps to be taken in Homs today for the reconstruction of the science program to meet individual and social needs on sheer conviction would be rather unscientific. Before any such plan is given, there ought to be a survey of the needs of the country which will be served by the plan.

This being the case, one is handicapped in attempting to change present-day conditions on scientific basis. The only alternative is to study what has been written about the subject however meagre. This, coupled with interviews, may help in formulating at least in a general form a tentative plan which may serve as a starting point for the needed reconstruction of any current practice.
CHAPTER I

THE COUNTRY AND ITS PEOPLE

The Near East has undergone tremendous and sudden changes during the last twenty years. This is especially true of Syria. The small country created at the close of the First World War, as a French Mandate, and then at the end of the Second World War as a free state, has proved to the world that it is able to manage its own affairs efficiently in spite of the fact that it started with only a handful of persons competent to steer the frail ship on a stormy sea.

Though politically a new nation was born at the close of the war, yet the people have a long and rich heritage carrying them back for hundreds of years. The people of Syria are Arabs and as such their history is full of contributions to human knowledge in different areas. These contributions have greatly influenced the progress of man, a fact which can be readily understood if one wishes to go over the historical literature. But there came a time when the Arab world was overshadowed by the progress made in the West. Syria became a part of the dominions of the conquering Turks, and for hundreds of years it was blocked from the whole world. Ignorance and superstition prevailed everywhere and the people lived under a hard rule. The foreign power cared little about education except that which led to military training. The country lay in misery as far as individual and social needs were
concerned. Industry lagged, irrigation was abandoned, and the people became poorer and poorer every day. The story is a sad one until the World War came about and the Ottoman Empire was shattered to pieces. Out of its weakness developed modern Syria. (1)

The Need Of The People

Although Syria has its political independence, yet it is lacking in many raw materials. This is not the fault of the nation which has just awakened from a deep sleep during which its agricultural resources have been exploited by foreigners. Syria is a rich agricultural country. Its lands would yield abundant harvests if only water could reach them. Its cattle would multiply in numbers if they were scientifically cared for.

Syria has just started to realize what treasures the country may yield if only the people are intelligently brought to understand the potentialities existing for the happy well-being of all.

When Syria came into being, the people were confronted with a new kind of culture brought along with the western power. The markets were full with western products. The automobile, the aeroplane, the radio, different electrical appliances and machines began to be brought in and sold for the first time. Two cultures have met and the resulting clash was great. On the one hand was the age-long simple culture of people living in ignorance and superstition, and on the other the modern western culture with its complexity of problems. Here was the facing of a real life situation by a people untrained to search for new ways of life intelligently. (1) Could education take the necessary steps to meet this great challenge?
The Ministry of Education organized at the outset felt the responsibility and hastened to adapt rough and borrowed methods mainly from the west. Things were introduced wholesale. There were very few persons capable or even interested in analysing and scientifically studying the arising problems for the best way of meeting them. In order to find a better way, the Syrian government appreciated the services of the well-known Arab educator, Sati' al-Husri, a man of outstanding personality who, after making a special study of Swiss, French and Belgian systems of education, was invited by the Syrian government to study its educational system and report on possible reforms. He brought to his task a decided nationalist outlook and considerable experience with the problem of education in the Near East. His work, with very slight changes, served as the basis for the new educational organizations which are now in force. (1)

Syria is in need of national consciousness and unity, of a great appreciation of civic life and duties, of the enlightenment of the farmer so that the methods used by him would lead to good productive results, of information to be acquired by the people for preventive measures with regard to the widespread prevalence of disease throughout the country.

Syria has become an active part of the whole world, and no more a secluded section. Ignorance cannot exist alongside with modern life. Can education in general and a science program in particular, help the

(1) Akrawi, op. cit., pp. 325-326.
individual and society to realize these critical problems and attempt to solve them? Can the curriculum of the school be adapted for such an attempt? This is what I am trying to show in the following chapters.
CHAPTER II

THE EDUCATIONAL SYSTEM AND
THE SCIENCE PROGRAM

The System In General

The system of education in Syria today was taken from the west, especially from the French system, with very few modifications. It is a highly centralized system and as such everything is controlled from a central office in the Department of Education. The Minister of education who is a member of the Cabinet and thus a political appointee, heads the whole of education. Under him there is a Director General of Education, who in turn heads a number of district directors responsible directly to him. The position of the Director General is the professional one, and is not affected by changes in the Cabinet. The school principals are responsible for the local school and its teachers. (1)

Rules and regulations of any sort concerning the administration of education come directly from the Ministry of Education. All educational information including books, curricular, attendance, holidays and a hundred and more detailed items have to be sent to local centers by the central office. The whole country goes on one plan administered in the same way and by the same laws. To check on the smooth running of

education according to the laws prescribed, there is a second body of government officials called inspectors. District inspectors are directly responsible to the Chief Inspector stationed at Damascus. Their duty is to inspect the whole system in their different areas and report semi-annually or annually to the Ministry of Education. The nearest post in the American system of education to that of inspector is the supervisor and his staff. However, there is a difference between the two verbs; "to inspect" and "to supervise". One is to check and the other is to advise. (1)
The Teachers

For religious and other social reasons which we cannot dwell
upon here co-education does not exist in Syria except in the kinder-
gartens and the Syrian University.

Elementary schools as well as secondary schools operate accord-
ing to identical programs throughout the country. The curriculum is
organized into departmentalized subject matter taught by special
teachers. It sometimes happens that one teacher may be asked to teach
more than one subject as in the case of many small schools. The
point is that there are many grade teachers who teach all subjects
and stay with the children throughout all the day.

The teachers in the elementary schools of today have had
different backgrounds and preparation. When the Ministry of Education
was first organized, it took in many teachers who had no qualifications
for teaching. Men and women who had a meagre training were enrolled as
teachers throughout the country. This was and is especially true in
the elementary schools. Slowly, however, this untrained element is
being eliminated from the teaching staff; it has not yet disappeared
completely.

Besides this element, there are those who have attended the
elementary training college in Damascus. These have had an elementary
school education and a three year course in the training college.
The Ministry of Education has for a long time felt the inadequacy of
these men and women as teachers and is now trying to raise the
standards by restricting the entrance to the training college. (1)

(1) Ibid., pp. 385-387.
Science teaching in Syria is of an exceedingly poor quality, more so than the teaching of other subjects. This fact is due, perhaps to more than one reason. In the first place, the science teacher, as would be expected, has had very little preparation, perhaps no more than one course in science. In the second place, the science course itself may be of such poor quality, that it is believed anyone would be able to teach it. It is assumed that anyone could teach children about the dog, the cat, the tree and so on in the elementary school. Thirdly, the object lessons are set rigidly in the syllabi and books put in the hands of the teacher. The result is that the teacher is restricted to just what is prescribed in these syllabi and never expands beyond this. The writer got this information from personal experiences and observation in some of the government schools in Homs.

The science teacher is especially unfit to perform what is expected of him. His poor background in sciences in particular and his general training at large, his narrow view of life and his own superstitious outlook make him in many cases a doubtful teacher.

When it is realized that the new generation of Syrian boys and girls are tremendously influenced by this kind of teacher, one may doubt the high results which are expected from the educational system. We cannot hope for intelligent, alert and dynamic generations inspired for the improvement of the country under the hands of ignorant and uninspiring teachers.

Therefore, the science teacher perhaps more than any other should have a sound and correct philosophy of life about this world and the universe. He should have a wide general knowledge not only of his
subject, but of the different sciences and their relations and constitutions to what is essential to an intelligent individual living in an age crowded with scientific as well as social complexities.

A good science teacher should know more about adjusting his science teaching to the needs and interests of his students. He should be a science teacher and a scientific investigator at the same time. He should not be merely a science teacher, but he should have the interest in presenting more knowledge about the subject matter and teaching it with a primary interest in developing young people to whom it is taught. (1) "Also he must always be, a skillful and appreciative interpreter, keenly alive both to what is being done in the line of broad scientific advance and to its significance in world development." (2)

Beyond and above this he should have the interest and enjoyment to work with young people.

"A teacher of science needs the spirit of discovery, the habit of observation, the ability to make accurate reports, enterprise in seeking for answers to problems, and some ability to draw conclusions from evidence. One more quality should be mentioned and that is humility.

In many places in the past, the teacher was regarded as the source of all information. Thus the child is told all what he needs to know, his part is only to memorize the facts which the teacher gives him.

(2) Ibid., p.3.
This method should be abolished and replaced by giving the child a chance to search for facts and ask questions, and thus with the help of the teacher find out the truth. If the teacher with the student succeed in finding the answers of most of the questions, it will create an immediate increase of interest in the subject, and the teacher at the same time would be developing in the child, that eager inquiring mind which will help to make a good citizen. (1)

The Present Elementary Science Program

The science taught in the elementary schools is labeled "Object Lessons" in a program issued by the Ministry of Education. The following introduction is given at the beginning of the section about object lessons.

The aim of the study of object lessons is to acquaint the pupil in observing and thinking about things that are around him as well as natural occurrence. This would be done from the point of view of giving the child the knowledge about matters of health, agriculture, and techniques. Therefore the object lessons should be objective as well as observational in all their phases. (1)

To achieve this the teacher should observe the following recommendations:

1. The teacher should first show the pupils the objects about which he is speaking and then actually demonstrate to them the experiments which are necessary to draw the required conclusions.

2. The teacher should do his best as far as possible to allow the child to touch the objects with his own hands and sense them with all his senses and do the experiment himself.

3. The teacher should collect samples of objects around which the lessons will center and should build up a museum to include raw materials and products as well as the different intermediate stages through which these materials have passed in their manufacturing.

4. The teacher should plant in the garden or in boxes, flowers and plants, so that he will accustom the pupil to take care of them, to beautify the school with them and serve as materials for the object lessons and class drawings.

5. The teacher should take the children out to gardens and teach them lessons there to get the pupils to acquire first hand experience with living things. (1)

Next follows the science material as it is taught at present:

**First Year** (Two hours a week)

1. Conversations and observations about the human body, the external members of the body, their service and function, the work and movements that they perform. Simple hygiene lessons about these parts.

2. Conversations about domestic animals: the cat, the dog, the chicken, the rooster, the duck, the sheep, the cow, the ox, the hen, the donkey, the camel. Characteristics of and use for these animals.

3. The study of local plants, flowers, grasses, vegetables, fruits, giving examples of each according to the seasons.

4. Conversations and observations about objects in common use; chalk, pencils, books, bread, meat, lamps, candles, charcoal, wood, clothes, shoes, carriages, cars.

Second Year (Two hours a week)

1. Repetition of the work of the first year with more details.

2. Conversations and observations about domestic and wild animals, pigeons, mice, bees, rabbits, butterflies, monkeys, wolves, foxes, lions, elephants.

3. The study of nature in farms and gardens.

4. Conversations and observations about things like ink, paper, bricks, stone, cement, timber, lime, wool, hair, cotton, silk, hide, iron, copper, zinc, lead, honey, cheese, butter, eggs, baskets, jars, bicycles, trains, sailboats, ships.

5. Conversation and observation about trades and the workers in these trades, the tailor, the carpenter, the baker.

Third Year (Two hours a week)

1. Conversations and observations about flowers of each month, the fruits as related to seasons.

2. Observations and conversations about houses; variety, and parts, the method of construction and materials used in building.


4. Lessons about hunting, and its methods. its kinds.

5. Detailed studies of domestic animals; sheep, goats, etc., characteristics of each, their use, variety, products and care.

6. Conversations about local wild animals, the harmful ones and the useful ones. Their best products.

7. Means of writing and printing; the pencil, ink and paper.
Fourth Year  (Two hours a week)

1. Water and air. Kinds of water, air and its pressure and movement, condensation and evaporation, freezing and melting as causes of rain and snow.

2. The method of lighting and heating, burning and combustion, fire and light, wood and charcoal, coal, candle oil.

3. Conversation about agriculture. The life of plants and their need, soil, its kinds. Agricultural methods. The local plants in the garden, beans, peas, cucumbers, etc. On the farm, wheat, barley, rice, etc.


The same type of materials follow for the fifth and sixth years on a more advanced and detailed scale.

The teaching of science should be given a much more significant place in the curriculum of the schools than the way this meagre knowledge of facts is stuffed nowadays in the mind of the child. There are deeper meanings and developments of larger concepts in an adequate science program. From what has been described one can find no underlying educational philosophy which will lead the teacher to make the science program serve a need felt in a country which is struggling to stand on its own feet through the help of its educated rising generation. A
generation of young men and women who will be able to react intelli-
gently to the changing conditions of this modern complex life and
social environment. The existing theoretical instruction
produces an unthinking generation. The Syrian boy or girl coming out
into the world can hardly think for himself and solve his own problems
in the new situations confronting him. His cultural education is
mainly composed of unrelated facts learned in school. Of course,
this is the result of an ancient idea of the meaning of a cultured
individual. He was one who knew many things about existing knowledge.
We have moved far away from such a concept of education. The
substance embodied in the courses of study have to be carefully picked
up on the basis of values, those that are of most worth to the growing
individual. In a science program those things should be included. They
may help individuals in their daily life by giving them an insight
towards a happier life for themselves and the society of which they are
members. (1) Syria today needs individuals who can think for themselves,
and who are able to cooperate with others in lifting the standards of
living in all its aspects.

The science program described above cannot accomplish such an aim.
It is a compartment by itself dealing with unrelated facts and the
individuals going through such a course cannot get an insight and un-
derstanding of what may help him to be a better member of society.

(1) Craig, Gerald S., Science For the Elementary School Teacher, copyright
However, it is not the textbook used which makes a science
course of study a success in modern education. Moreover, as it will
be described in later chapters, our science program ought to be based
on the experiences of the children, and the book would be used as
another source of information when the necessity arises. In this
sense books can be used anywhere in the world provided it is understood
that the general principles of science are the same, but the experiences
of the individuals for the understanding of these principles may be
different to a great extent.

Science courses as taught at present are totally separated from
daily experience. The students are made to memorize laws and give
conspicuous examples illustrating them. This procedure can well de-
scribe the whole science program through the elementary and secondary
schools. Thus the science course consisting of memory work makes the
subject disliked by the majority of students. Here and there we
might find pupils absorbed and interested in science, but that is more
due to individual interest rather than an attractive set-up. "The whole
aim of the teaching and learning process revolves itself into one
objective, namely to pass successfully the government examinations set
up by the Ministry of Education. The questions in such examinations
are based on the subject matter of each course. The knowledge of
detailed facts determines success or failure. The result of these
examinations decides wholly the passing from school to school. There is
no need to discuss the effects that this system has on the general
development of the student. Education is merely a mechanical give-and-
take process where the individual person is rarely changed as a result of schooling. (1)

(1) Akrawi, M., op. cit., pp. 348-349.
CHAPTER III

MODERN TRENDS IN EDUCATION

In this discussion written primarily on a science program not much space can be devoted to a lengthy discourse on modern trends in education. The science program is only one phase of the general education program and if it is to serve its purpose as a factor in determining the outcome of education it has to give consideration to and be in accordance with what educationors today assume to be the best philosophical and psychological theories governing the education of the child and his learning.

I believe, that when thinking of these fundamental questions, the locality, with its physical, cultural, economic and social background in which this philosophy is to be applied must be taken into full account. I have given a clear picture of Syria and conditions prevailing nowadays and the way in which these conditions have developed. However, I also believe that certain basic ideas are somewhat universal and would serve as cornerstones in any educational enterprise.

The old school is characterized as theoretical and it is not particularly practical. Modern education tends to make definite efforts to relate education more closely to matters of everyday life. The students under the old school system study artificial problems. The
modern school deals, insofar as possible, with life problems. Education has been classical, it has had little to do with actual life. It was maintained that the study of a subject was primarily to discipline the mind. The modern school is concerned with the present life of the learner and with the life in which he would engage when he becomes an adult.\(^1\)

The prevailing practice in the old school was to learn and accept the text book or the word of the teacher dogmatically, while modern education attempts to develop the children's attitude of mental aggressiveness, of originality, of useful pursuit of knowledge. Commanding and enforcing the intellectual acceptance on the part of the child is being displaced by child questioning, inquiring, testing, accepting and rejecting. The majority of schools are characterized with authoritarian teaching in spite of the fact that the teacher himself is narrow-minded and ill-informed even in his own field. The children are strictly controlled and their powers repressed. Pupil questions are not encouraged. The teacher is the active member of the class, he is dominating the situation. The children's part is to listen and accumulate the knowledge pronounced by the teacher or the book.\(^2\) They may speak only when are asked, in concise well-memorized sentences. Learning is assumed to have taken place when the child can repeat the words handed down to him. Our newer school gives a different picture.

\(^1\) Craig, Gerald S., *op. cit.*, p. 1.
The teacher is a stimulator, an inspirer, a guide. The children are free, since the power of function, according to our modern educational philosophy resides largely and properly in the children themselves. The student-teacher relationship is considered important for the success of learning is partly determined by the learner’s attitude toward the teacher.

Today, we have come slowly, but surely to an acceptance of child-purposing as the only feasible means of stimulating real learning and individual growth. Education today should use the problems of children themselves instead of dressing them up with the problems of older people. It is true that children will grow into adulthood, at the same time it is believed that by attending to the child’s present individual and social needs, we can best help him to be prepared to meet the needs and difficulties of later life. By teaching him science we can contribute to the growth and development of the child.

The rigid plans and outlines in a set curriculum with materials classified and arranged logically and taught in the same manner, are giving place to flexible plans and outlines. The materials are given a psychological instead of a logical organization. The approach to the education of the child is through his experiences, on the basis of reaction from and more to a child organization rather than to and adult organization. Learning, instead of being a mind-filling process with a great deal of emphasis upon facts and sheer memorization of them, should be growth of the child, through the manipulation of facts for the purpose of developing the child and his own ideas. The interest of the educator should be in the stimulation of thinking by the use of facts and the consequent development of higher forms of thinking.
The paramount concern is the active participation of the learner in the process of learning. The interpretation of the facts or ideas has to be done by the student himself. Finding, checking, discovering and criticizing are all to be done by the child. Subject matter which is the only concern of the school, as we know it, should be used as a tool for the development of the child as a whole. (1)

Here are some other trends in elementary science which Blough has mentioned.

1. There is definitely an increased emphasis on science as an integral part of the elementary school program.

2. Science experiences are being built around the solving of problems which are significant to pupils rather than on the answering of unimportant questions.

3. Effort is being made to use actual experiences whenever possible to make the learning in science more meaningful. In other words, there is more doing on the part of children and less reading and hearing about science.

4. Persistent effort is being made to fit the science offerings and the learning methods to the needs, interests, and abilities of the learners.

5. Much stress is laid on using community resources in order to bring science to life.

6. Administrators, teachers and pupils are working together to plan

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and carry out an effective program.

7. Increasing effort is being made to determine exactly how science can most effectively make its unique contribution to the development of children and fit into the total learning situations. (1)

CHAPTER IV

OBJECTIVES OF SCIENCE TEACHING

IN GENERAL EDUCATION

What is the aim of science teaching? What are the objectives which it shall try to accomplish in Syria? Before we can attempt to answer this question we should first ask what is the aim of education in Syria. This is the fundamental basis upon which we have to build our program not only of science but all the other subjects.

Akrawi, in his work on the curriculum for the elementary schools in Iraq, gives the following objectives of elementary education. It is the attainment of

1. Health and physical well-being.
2. National and political ideals.
3. Civics and personal ideals.
4. Religious ideals.
5. Social ideals.
7. Good use of leisure time.
8. Understanding of the environment.
9. Language mastery.

These objectives can also be applied to Syria because the setting is similar.
The ideal education in Syria "is that one which is conscious, critical and selective of the pupil's cultural heritage in particular and that of mankind in general; aware of the country's needs, resources and possibilities and aspirations; aiming at the development of a healthy and intelligent citizen whose total activity will eventually lead to his own happiness and that of society." (1)

It is clear now from the above statements as to the aim of education that the people in Syria are sensitive to the new demands of education. "Education can no more confine itself to the teaching of the Three R's nor can it only put all its energies into producing individuals for government service as it had to do at a certain period of its history." (2) There is a demand today of a more practical education, education which will help the individual to make of himself a worthy member of society. While there may be certain things which the schools in Syria have to emphasize more than in other countries yet the writer believes that the fundamental aim of education is essentially the same in countries where the form of government runs along democratic lines. Syria has gone far in putting to practice the democratic forms and ideals of its constitution. It is not to be expected that full responsibility can be placed on the mass of the people at the present time. This is because the mass of the population is still unable to manage efficiently the arising situations of a changed

(1) Mahbali, S., op. cit. (in Arabic), p. 3.
(2) Croxton, W.C., op. cit., p. 33.
mode of life. However, the hope is that when the people reach a stage when they can handle their problems effectively then the government will give an opportunity for any individual or local initiative. (1)

To reach this state, however, the whole responsibility lies on the shoulders of the educational system as well as on the rest of the social agencies to provide means of reaching this important aim. Education along with other welfare agencies today should aim at bringing about this necessary change in individuals and society. The program of education should be so planned as to help develop in individuals and, consequently, in society, a sense of responsibility and the ability to tackle life problems intelligently.

Bits of unrelated scientific facts could not accomplish this task. Science, broken up into unrelated divisions and taught as such aimlessly will not of itself, influence the individual in understanding life. What the school is after, is the whole child in the life he lives, and as such it has to bring to him all possible orientations which will make this life happier and richer. It is the confidence of the writer that science can contribute a great deal to this life enrichment.

It has been said that this is an age of science. What makes it an age of science? How has science contributed in changing the mode of life? How is it affecting our living today? What potentialities has it for further progress and correcting maladjustment and promoting

(1) Blough, Glenn O., op. cit., pp. 10-11.
greater individual and social happiness? Has science given a full chance to play its part in Syria? How may it improve present-day conditions? These and many other questions should be understood and answered by a science program.

Therefore in a curriculum, in a program of General Education there must be a method which should be followed to find the truth.

"We may divide the values derived from science teaching into two main categories. On the one hand there are those values which come directly from the use of facts, principles and organizations of science in everyday living, and on the other hand there are those values which are acquired from the study of science. The ability to formulate generalizations both in respect to method and scientific attitudes, are expected to develop in the mind of one who goes through a good science program."(1)

In the great civilized countries of today the kind of life lived by the people is in direct proportion to the extent of which science has been utilized to serve man. The higher standard of living has been possible only because of the contributions from the fields of the different sciences.

"The objectives of elementary school experiences, is to help children gain the ideals, understanding and skills essential to becoming a good citizen. Each pupil must have the ability to use one's hands so as to make them do what one wants them to. There is the skill of seeing things that are around you accurately. The skill of being able

(1) Ibid., p. 12.
to listen intelligently and the skill of speaking effectively so
that we can express our ideas accurately. Added to this the skill of
sensing problems and solving them in a scientific way. These things
involve the development of the thinking process to its full
potentialities - the development of a thinker who is open-minded,
fair in judgement, accurate, and free of prejudice and superstition."(1)

(1) Ibid., pp. 10-11.
CHAPTER V

FIELD WORK IN SCIENCE

IN GENERAL

The term field work, as used here, is not restricted in any sense to one area of knowledge. In this broader meaning it is applied to any work done outside the classroom, whether the study be in science, social civics, economics, or in any other area. The individual's knowledge and actual experience can be enriched by some kind of field work where he is helped to see things for himself and have first-hand experience with natural situations. (1)

Keeping this broader meaning in mind, in accordance with modern trends of breaking down subject matter boundaries field trips, although taken perhaps to study one special area, may be developed to include one, two or all of the above areas. It would be a weakness, accordingly, on the part of the teacher who took his pupils on a field trip, if he paid no attention to arising problems and situations, which, although not being issues in the primary purpose of the trip, would be helpful in developing an understanding of relationships as they occur in actual places. (2)

(2) Ibid., pp. 56-57.
As I have observed in certain schools, I noticed that a field trip results only in little more than identification of plants in botany, stars in astronomy, animals in zoology and so on in the different phases of scientific study. The time was mainly occupied in collecting and labelling a mass of material. It was then stored in beautiful glass cases, eventually to be covered with dust and forgotten. Museums up to this day are found in schools, but too frequently they are kept as exhibitions rather than for any vital use in the classroom. This should be considered of slight value. The teacher was usually satisfied when the children could name and describe birds, insects, and other objects. Very little of what we now consider an important part of science learning was developed.

What we need is a deeper understanding of the more important values to be stressed in science and we should consider the means best adapted to this development. In this sense field work has a much larger objective than mere identification. "Field work has a high educational value. It connects the somewhat theoretical study of the classroom with its practical applications in nature, it enables pupils to see materials and processes in their natural settings; it gives the proper conceptions of size and opportunity to observe not only scientific processes, but human beings at work."

(1) Prestren, Carleton E., *op. cit.*, pp. 244-245.
Teaching today is aiming at enrichment of life of the child in all the areas of human relationships by striving to build correct concepts through a variety of experiences. It is the duty of the teacher to make available to the children all possible experiences which are real through which they may become aware of their environment. Some of these situations can be and should be set up in the classroom. For instance, it would be impractical in most cases, to watch the life cycle of an insect except in the laboratory under frequent observation. \(^{(1)}\)

"Experiments and demonstrations in the classroom or laboratory may explain and clarify in a large number of cases the thinking of children about natural phenomena." \(^{(2)}\)

Science is built on the experiences of the child. The origin of these experiences may be in the classroom, the home, the meadow or any other place. These experiences may occur anywhere and the job of the teacher is to help his children to find them wherever they may exist. A great store of them is found in the field and it is our duty, if we are after the welfare of the child to get him to have contact with them, because science is much more than a collection of facts; it is a method of doing things, a system of investigation, a way of thinking. \(^{(3)}\)

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(1) Craig, Gerald S., *op. cit.*, pp. 5-6.
What Kind of Trips?

There are different kinds of trips that may be taken by a group of children guided by a teacher. The kind depends on the conditions and the aims. Here are a few samples:

On one occasion, the children are taken out to see what is found in the school yard, the immediate surroundings of the school, or home, or the local natural environment. In certain cases there may be still a more distant one. A teacher might start a unit of work that way. She might emphasize certain things to be observed by the group while on such a trip. The children might be helped to see things which they had never noticed before. There will be things about which they will ask questions. The teacher might answer these questions to the extent to which the level of the children permits, and perhaps keep some as problems for the children to think about and take a few things back with them for the purpose of finding out more about them.

On another occasion, the children might be studying a certain habitat of a plant or animal. Then they are taken out to see for themselves the actual habitat and have first hand experience with it. Thus it might have more meaning to them than when reading about it in books or seeing pictures of it.

These are some types of trips. They are suggestive. One trip might be a combination of all of them or of two or more. It is, of course, the teacher who can only decide what to take
and why and when. A trip should only be taken when the need arises and the children are ready for it.

The Laboratory And Its Relation To Field Work

The laboratory has an important role to play in the science program. It seems, however, that it has attempted to replace many of the possible contacts with actual situations. The modern laboratory should not be thought of as a separate room set aside for experiments and show-exhibits locked up behind glass windows. It should be more than that. It should be a work room where the children come and go at will. It is a place to which the children come when confronted with a problem and are looking for evidence, not for the performance of a set number of experiments drawn up in advance. The laboratory shares with the classroom, the library and field work in providing the children with learning situations. It is a place where certain materials are gathered and kept safe for further study. It belongs to the children and they should have the full right to work in it when the necessity arises.(1)

The Teacher And The Field Work

The most important factor in any science program is the teacher. This is especially true of field work. In order that one may conduct successfully a trip he must be familiar with and conscious of the things found in the region under discussion. This does not mean that he should be an encyclopedia of knowledge. He should know at least what he expects his children to see and observe. The teacher in field work is a guide and a good guide knows where and how to look for things. The prospective teacher should not be discouraged because he knows very little, but this fact should rather be his incentive for further study and learning of more and more adequate knowledge. (1)

(1) Ibid., pp. 247-250.
The science field is so wide that it is impossible to expect any one person to master it all. But this should not be an excuse for not having a rich background in all the fields of a science program. (1)

The hope is that the prospective teacher, especially in the elementary school, would grow with respect to the subject matter of science, whose basis is the laboratory and field work. This coupled with a good educational philosophy should be enough to put any teacher in a position to carry on a science program successfully.

(1) Craig, Gerald S., op. cit., p. 43.
CHAPTER VI

CONSTRUCTION OF A SCIENCE PROGRAM

A science program should meet the needs of all pupils. It should be based on the needs of the individuals and society.

"We can not longer afford to neglect the needs of all the people of the democracy. There is evidence that they have certain needs which only science can fulfill."(1)

"Science has produced much more than comforts and conveniences for society. Facts discovered by scientists concerning the nature of the universe or of man frequently are of such great significance that they cannot remain isolated, but, on the contrary they give rise to basic working conceptions which profoundly vitalize thinking in many fields. In fact, it is difficult to find a sphere of human activity or thought which in some way or other has not been influenced by a conception of science."(2)

The introduction of a change in any phase of the educational system, must of necessity, begin gradually. A sudden jump to the unfamiliar is perhaps as unwise as keeping the old. The best methods for teaching in the hands of an untrained teacher may be wholly a

(1) Craig, Gerald S., op. cit., p. 6.
(2) Ibid., p. 7.
failure. What we need to do at this stage of the development in our teaching is to give the teacher something with which he is already familiar, but at the same time introduce him to things which would lead in the direction of the needed change.

The program suggested in the following pages is believed to fulfill the above two conditions. It has in it elements of the old ways of teaching science, but at the same time is based on the strong points of the new approach, where the teacher has thus started on this new venture, his own experience in the science work will help him decide on further changes. It will be remembered that the recommendations to be proposed for a science program were to be based on the needs of individuals and society. These needs are to be the criteria for the choice of content of science. Having accepted this assumption it is necessary to analyze the whole of the community for the detection of these needs. In the previous chapters a rough survey has been given which may help in locating those needs. The next step to be taken is to look into the field of science for contributions which might help in the satisfaction of those needs.

The following are major concepts in science which have influenced and are influencing the thinking of man in different aspects of human living. They may be applied to give direction to the work of science.

Taking therefore these conceptions of science as guides, we can suggest certain objectives toward which the science work can be directed. Teachers at all levels should be aware of these concepts and should provide opportunities for children to grow intellectually in the direction
pointed out by them."(1) Thus learning in science will be useful both in the daily life of the child and to give him an insight into the great contributions of science to human living.

Conceptions Of Science

"Professor Keyser has called the conceptions of science the permanent massive facts of life. They are not permanent in that they do not change; they are permanent only in the sense that in the areas of thought represented by the conceptions there is permanence of human challenge."(2).

"These conceptions may be grouped about the modern scientific ideas of space, time, change, adaptation, interrelationship, variety and man's attempt to control his environment. Such conceptions cannot be listed on mere content but rather as interpretative ideas which serve to orient the individual to the natural and social events in the universe about him."(3)

Science And the Needs of Individuals

And Society

I. Certain conceptions in science, the development of which help individuals in understanding the physical environment.

1. The surface of the earth has not always had its present appearance and is constantly changing.

2. There has been profound change in the climate not only of

(1) Craig, Gerald S., op. cit., p. 10
(2) Ibid., p. 7.
(3) Ibid., p. 8.
various regions, but of the earth as a whole.

3. The earth is very old as measured in terms of our units of time.

4. The earth and its life are greatly affected by the ocean of air which completely surrounds it.

5. Every substance is one of the following.
   a. Element,
   b. Chemical compound.
   c. Mechanical mixture.

6. There are fewer than one hundred elements. (1)

II. Certain conceptions in science the development of which helps individuals in understanding the biological environment.

1. All life comes from life and produces its own kind of living organisms.

2. There are a very great variety and range in the size, structure and habits of living things.

3. Heredity is responsible for the differences between parents and offspring, as well as for the resemblances.

4. Life is dependent upon certain materials and conditions.

5. The physical environment has great influence not only upon the structural forms of life, but also upon society.

6. Through the interdependence of species and the struggle for existence, there tends to be maintained a balance among the

(1) Ibid., pp. 11-12.
many forms of life. (1)

III. Certain conceptions in science, the development of which helps individuals in understanding the causes and prevention of disease.

1. "Efficient living is dependent upon a knowledge of the principles of health and sanitation." (2)
2. "A well-balanced and varied diet is essential for the maximum development of the human body." (3)
3. "Disease is caused by one-celled animals."
4. Good health is a condition of normal functioning of the human body." (4)

IV. Certain conceptions in science, the development of which helps individuals in understanding the sources of energy and their control.

1. "The sun is an original source of energy."
2. Chemical and physical change are manifestations of energy.
3. Light is indispensable to life. The phenomenon of light and the applications that man has made of it are important to this continued process.
4. Any machine may be analyzed into a few simple types." (5)
5. "The sun largely determines conditions on the earth, variations in its radiant energy producing changes which have profound effects." (6)

(1) Ibid., p. 12.
(3) Ibid.
(4) Ibid., p. 183.
(5) Craig, Gerald S., op. cit., pp. 11-12.
(6) Croxton, W.C., op. cit., p. 42.
V. Certain conceptions in science, the development of which help individuals in understanding the relation of the earth to the rest of the universe.

1. "Space is vast.

2. Gravitation is the attraction between bodies. It has profound influence upon the movements of astronomical bodies.

3. The earth has been developed as a result of the action of natural forces.

4. The earth's position and its relation to the sun and moon are of great importance to the life of the earth."\(^{(1)}\)

5. "The earth is only a small part of the solar system."\(^{(2)}\)

VI. Certain conceptions in science, the development which help the individual in understanding the scientific attitude and method and critical thinking.

1. Man's conception of truth changes.

2. Man has become an important determining factor of the environment of all life. His continued existence and advancement are dependent upon his wise modification and control of the environment.

3. Conditions favorable to life are likely to persist on the earth for a very long time; no catastrophe for the entire earth is probable for an immense period of time.

4. Much knowledge remains to be discovered.

\(^{(1)}\) Ibid., pp. 11-12.

\(^{(2)}\) Ibid., p. 54.
5. It is important to have confidence in the scientific method. (1)

**Integrating Themes Of Modern Science**

The curriculum investigations that have been conducted in science reveal certain integrating themes. These themes are so comprehensive in character that on the one hand they offer guidance to the teacher in his role as an instructor in science, and on the other to the adult who is following the development of modern science for his own cultural improvement. (2)

The following are presented as examples of these integrating themes. These are not narrow in their significance; rather they are universal in character and therefore may offer orientation in other subject-matter fields.

I. **Space.**

The modern conception of space is revolutionary in man's thinking. The child's first contact with this concept may merely teach him that the earth is a very big place as compared with the familiar vicinity. Later the concept may take the turn that the earth is very small as compared with the stars and space. (3)

"It is not memorization of facts that should be considered the goal but the growth of the individual along the lines of the profound truths of science." (4) It is important that children should be started properly along this path, rather than be allowed to absorb inaccurate

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(1) Croxton, W.C., *op. cit.*, pp. 70-73.
and unscientific ideas of the universe and astronomical bodies and to grow up with geocentric conceptions in an age of modern science.

II. Time.

The concept of the great age of the earth and of the universe has come to mankind as a revolutionary idea. It has not only profoundly influenced scientific areas but has permeated still wider areas and has altered the attitude which man takes toward himself, other living things, and his physical environment. It was natural to primitive man to think that the earth was formed just a short time prior to the traditions of his people. Much of this primitive belief still exists and controls in scattered areas. The child in his early years may learn that soil is made from rocks, and through activities, observations and experience discover that it took a very long time to make soil. He may also learn something about the forces which operate upon the earth to produce changes. Later the child may learn something about what had happened to the earth, and the causes of the natural features of the earth. (1)

III. Change.

The concept of change permeates all fields of knowledge. Man has looked at the hills and thought they were everlasting. Modern geology reveals that our physical environment does not remain constant, but that the history of the earth is a story of change, change in climate and in the succession of living things, and the continuous operation of natural forces. (2)

(1) Ibid., pp. 8-9.
(2) Ibid., p. 9.
IV. Adaptation.

Adaptation is a theme which permeates the entire realm of living things, for wherever there is life there is adaptation. It is a theme of great significance in the modern world. Indeed man's problem today is to adapt his social, economic, political structure to the conditions of environment and to himself. In the early grades the child can learn something about the homes of some animals and how animals are adapted to live in certain places. The young child can also gain an introduction to the idea that animals are adapted through their structure. As the child matures, the scope of his concept of adaptation is further broadened through a study of migration, hibernation, and of the struggle for existence. (1)

V. Interrelationship.

This is an illustration of a theme which is practically universal in character. We see the significance of interrelationships as an integrating theme in the descriptions of the astronomical bodies, weather, other physical phenomena; forces operating on the earth, the independence and interrelation of living things to each other and in turn to their physical environments; the causes of ill health, and the relation of pests and parasites to economic loss in the agricultural world. (2)

VI. Variety.

Nature is exhibited in a very great variety of forms. Differences are everywhere seen in the structure, size, habits, and life history of plants and animals. They range in size from infra-microscopic organisms to the gigantic forms of the redwoods and whales. The life span

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(1) Ibid., pp. 159-161.
(2) Ibid., pp. 231-233.
of some living things is momentary, while others live for several hundreds of years. Some animals swim, others run and still others fly. There are numerous different kinds of living things. (1)

Variety is manifested in the physical world as well as in the biological. There are many systems of organizations, the atom, the element, the molecule, the compound, the substance, the planet, the solar system, the galaxy. There are ninety-two different elements and there are thousands of different compounds. There is variety in the manifestations of energy. (2)

A Suggestive List of Learning Elements Which May Be Used In the Elementary School

From what has been said through all the preceding pages one may consider that the most critical job of the curriculum maker is the choice of material to be placed in a course of study. But in spite of all the difficulty there is no escape from some kind of organization which shall help the teacher in profitably carrying on the science program.

The material which follows is only an attempt to suggest what might go into the grades according to the fundamental considerations already discussed. The lists of learning elements are chosen because they contribute to the understanding of some one or more of the concepts in the field of science essential for the welfare of the individual and society. They are, moreover, grouped around the six integrating themes of space, time, change, adaptation, interrelationship and variety. These elements

(2) Ibid., p. 166.
of learning are not placed in each grade as principles to be memorized by the children. But, rather they are meaningful in the sense where they may be developed by the children through experience, activities, or projects, because children learn only by doing, and doing is nothing more than living. We want the child to live through rich experiences and through them acquire meanings which will be built up into larger and larger meaning, through the help of the teacher and the opportunities which he provides for experimentation. The children will acquire these meanings and incorporate them in their own structure for further use.

It is with this idea in mind that the following elements are given here and in this way they should be taken by the reader. The attempt has been made that these elements develop gradually through the grades.

It may be sufficient to mention here that this analysis gives only a picture of the attack being made and the method used in science education. The following materials would have served their purpose if they show the direction in which science teaching should go for the reconstruction of a science program.
Grade I

Space
1. "The sun shines above the clouds on cloudy days."
2. The sun is very large.
3. Our sun is a star."(1)
4. "The sun is very, very far away.
5. The moon is nearer to us than the sun."(2)
6. Stars are suns,(3)
7. "The moon reflects the sunlight, somewhat like a mirror.
8. The moon has days and nights just as we do here on earth."(4)
9. We live on a big ball, the earth.
10. Air, water, rocks, and soil are all a part of the earth.
11. Air is all around us.
12. The earth is always moving very fast.(5)

Change
1. "Water can be changed into water vapor or into ice. Both water-vapor and ice can change back into water.
2. Water contains air.
3. Air occupies space.
4. Air is needed for burning.
5. Water flows downhill."(6)
6. "A thermometer is used for measuring hot things are."(7)
7. The sun gives us light and heat; it does not depend on any other star for these.(8)
8. "A machine is a device used to do work."
9. Machines have made life more pleasant, more comfortable, and more enjoyable than it has ever been before.\(^{(9)}\)

10. Magnetism can pass through many substances.\(^{(10)}\)

11. "Heat changes liquid water into steam."\(^{(11)}\)

12. "Running water washes away stones and soil."\(^{(12)}\)

13. "Steam is used to move things."\(^{(13)}\)

**Adaptation**

1. Different animals live in different environments; some in water, others on land, others both on land and in water.

2. There are many kinds of homes. Some animals make their own homes fit for their needs.

3. "Some animals are inactive during periods of dryness."\(^{(14)}\)

4. "Migration is a distinctive phase of bird life."\(^{(15)}\)

5. Trees have leaves, but some trees lose their leaves in the dry or cold seasons.\(^{(16)}\)

6. "Certain animal structures are used for protection."\(^{(17)}\)

**Interrelationship**

1. "Soil is made from rocks and from plant and animal remains."

2. There is air in the soil.

3. Plants need good soil for growth.\(^{(18)}\)

4. "Every garden needs sunshine."

5. Every garden needs water.

6. Weeds are just plants in the wrong places.\(^{(19)}\)

7. "Moisture, light and heat affect plants."\(^{(20)}\)
8. "Plants are alive. They must have water, sunlight and good soil to keep them alive and make them grow well."(21)

9. All living things need water and air.(22)

10. "All foods we eat come from plants and animals.

11. We use plants and animals for clothing.

12. Many medicines come from plants."(23)

Variety

1. "The environment is composed of two kinds of things. Those that are alive and those that are not.

2. There are different kinds of plants.

3. There are different kinds of animals.

4. Everything that is living and that is not a plant is an animal."(24)

5. "Some objects float in water and some sink."(25)

6. There are different kinds of machines. They are made by man for different purposes.(26)

7. "Most of the plants we see started from seeds."(27)

8. People need a variety of food, for healthful living.

9. Poor food may cause certain diseases.

10. There are many kinds of germs all around us."(28)
Footnotes

(1) Craig, op. cit., p. 529.
(2) Joseph, op. cit., pp. 73-91.
(3) Craig, op. cit., pp. 60-61.
(4) Ibid., p. 536.
(5) Ibid., pp. 528-529.
(7) Ibid., p. 127.
(8) Craig, op. cit., p. 536.
(9) Ibid., p. 547.
(10) Ibid., p. 537.
(11) Ibid., p. 533.
(12) Ibid., p. 528.
(13) Ibid., p. 530.
(14) Ibid., p. 270.
(15) Ibid., p. 360.
(16) Joseph, op. cit., p. 60.
(17) Craig, op. cit., p. 280.
(20) Ibid., p. 341.
(22) Ibid., p. 93.
(23) Craig, op. cit., p. 535.
(24) Ibid., p. 528.
(26) Beauchamp, op. cit., p. 245.
(27) Craig, op. cit., p. 528.
Grade II

Space

1. Light comes to the earth and moon from the sun.
2. People need the heat and the light from the sun.(29)
3. Without the sun there could be no life of any kind upon the earth.
4. "Without the sun the world would be a cold, dark place."(30)
5. "The sun gives off vast quantities of radiant heat, most of which goes off in space."(31)
6. The brightest and warmest hours of the day are when the sun is highest in the sky.
7. We receive more heat from the sun during summer than we do in winter.
8. "The moon appears to change its shape throughout the month. These changes are called phases of the moon.
9. The earth's rotation causes the apparent motion of the sun, moon and stars."(32)

Time

1. The earth is very old, and has undergone great changes during this lifetime.(33)
2. The soil has been formed from rocks.(34)
3. "Rivers are very old."
4. The earth is very old.
5. The ocean is salty.
6. It takes thousands of years for a river to dig the valley which is its bed. (35)

7. People have learned a great deal about the life of the earth. (36)

Adaptation

1. Animals and plants prepare themselves for the dry or cold season.

2. Animals usually move about in search of their food, they run, climb, swim, fly, crawl or jump.

3. Various parts of plants serve as food for men and animals. (37)

4. Most insects are not active in winter. (38)

5. "Plants store food for future use." (39)

6. "People prepare for the change of seasons.

7. Plants and animals are adapted to the different seasons." (40)

8. We are able to prevent the spread of many diseases. (41)

9. The bud, leaf, stem and root of plants serve different purposes in a plant. (42)

Interrelationship

1. "Many plants are used for food." (43)

2. Germs might get to our bodies through different ways. (44)

3. Boiling kills many kinds of germs. (45)

4. "We have many different kinds of weather." (46)

5. "Air surrounds us at all times."

6. Air is a mixture of several gases." (47)

7. "Water is essential to life."
8. Water, air, heat and light are important to all living things. "(48)
9. Too much of any kind of weather is harmful.
10. People living together depend upon each other for good health.

Change
1. "Man cannot control the weather; he can only do his best to prepare himself for it.
2. Moisture in the air is called water vapor.
3. The temperature of the air is not the same everywhere on the earth. "(49)
4. We must take precautions against changes in the weather.
5. "There is water vapor in the air.
6. There is always moisture in the air.
7. There is also always dust in the air." (50)
8. Running water is a means of wearing rocks into soil.
9. Wind, water, and other chemicals may also wear away rocks. (51)

Variety
1. "Plants make some adjustment to survive the adverse seasons.
2. Moisture, light and heat affect plants." (52)
3. Fog is another kind of moisture. (53)
4. "Rest, fresh air, exercise, are all necessary for good health.
5. A balanced diet is necessary for good health.
6. There are substances in the blood that are able to destroy germs unless there are too many of them." (54)
7. Scientists have discovered many kinds of diseases.
8. Scientists have found how many diseases spread. (55)

9. Sneezing, coughing, spitting, may spread certain kinds of germs.

10. Running water on the surface of the earth may carry many kinds of germs harmful to people. (56)
Footnotes

(29) Craig, op. cit., p. 529.
(31) Craig, op. cit., p. 540.
(33) Ibid., p. 131.
(34) Ibid., p. 126.
(36) Ibid., p. 82.
(37) Joseph, op. cit., p. 78.
(38) Craig, op. cit., p. 306.
(39) Ibid., p. 342.
(40) Ibid., p. 528.
(41) Ibid., p. 385.
(42) Blough, op. cit., p. 221.
(43) Beauchamp, op. cit., p. 137.
(44) Ibid., p. 185.
(45) Ibid., p. 233.
(47) Ibid., p. 182.
(48) Ibid., pp. 260-262.
(49) Ibid., pp. 540-541.
(50) Ibid., p. 186.
(51) Blough, op. cit., pp. 126-127.
(52) Craig, op. cit., pp. 341-342.
(53) Ibid., p. 218.
(54) Ibid., p. 535.
(55) Ibid., p. 882
(56) Beauchamp, op. cit., p. 188.
Grade III

Space

1. "The sun is very large and very far away." (57)
2. "The sun shines all the time, in the day time and at night, giving out its light in all directions."
3. The sun is very large. It is many times larger than the earth. (58)
4. "The sun is a star and stars are suns." (59)
5. "The sun is believed to be a mass of very hot gases." (60)
6. "The heavens are vast and the stars in the heavens seem numberless.
7. Most stars cannot be seen without a telescope.
8. Stars are very far apart, even though they appear to be close together." (61)
9. "The moon reflects the sunlight, somewhat like a mirror.
10. There is no air and no water on the moon." (62)
11. The moon is smaller than the earth. (63)
12. "The moon is the earth's nearest neighbor."
13. "The moon is very, very small compared to the sun."
14. "The moon rotates, once in about every thirty days."
15. "The moon has days and nights just as we do here on earth."
16. "There is no air and no water on the moon."
17. "The sun gives us light and heat; it does not depend on any other star for these." (64)
18. "The earth rotates on its axis once in every twenty-four years.
19. The rotation of the earth causes day and night.
20. The earth rotates from west to east.

21. Since the earth is round, only half of it can be lighted by the sun at one time.

22. Not all places on the earth are having noon at the same time."(65)

Time

1. "The earth is millions of years old."(66)

2. "The changes have been extremely slow.

3. Great changes have taken place in the physical appearance and conditions of the earth during its development.

4. Fossils tell us many things about animals of yesterday and about conditions on the earth in past ages."(67)

5. Fossils are valuable records.

6. "Fossils show what living things looked like, and help us to learn how the earth itself has changed through the ages."

7. "Fossils are found in hard rocks."(68)

Change

1. "Air is real; air has weight.

2. Air is all around us. We use air in many ways; man lives and breathes in air.

3. Air is in motion.

4. Water evaporates into the air and cannot be seen."(69)

5. "Many animals that once lived on the earth have entirely disappeared.

6. The development of living things upon the earth has been from the very simple organism to the complex one. Modern life developed from animal life."(70)
7. "Air can expand or press out."
8. "Wind is air in motion."
9. Air is not just one gas; it is a mixture of gases."(71)
10. "There are many different kinds of magnets.
11. Magnetism can pass through many substances.
12. One end is the pole; the other end is the south pole."

Adaptation

1. "Winter days are cold, and food is hard to find.
2. Many animals have some way of caring for themselves in the winter.
3. Some animals build winter homes.
4. Some animals take long winter naps.
5. Some animals store away food for winter.
6. Some animals hunt food all winter."(73)
7. Animals have methods of protecting themselves against hunger."(74)
8. Animals have many ways of protecting themselves from their enemies."(75)
9. Some animals take very little care of their young."(76)
10. Some animals take great care of their young."(77)
11. "Mammals are animals that feed on their mother's milk when they are young."(78)
12. Some plants do not grow in winter."(79)
13. "Many plants grow from seeds."(80)
14. The seeds of plants are well protected."(81)
Interrelationship

1. "People need the heat and the light from the sun."\(82\)
2. Plants and animals need the sun in order to live."\(83\)
3. "Without the sun's heat, all living things would freeze.
4. Without the sun's light, green plants would not make food."\(84\)
5. "All the foods we eat come from plants and animals."\(85\)
6. Every kind of animal depends on green plants for its food.\(86\)
7. Some animals eat other animals which are plant eaters.\(87\)
8. Water is essential to life. It is essential to plants, animals and people.\(88\)
9. Man lives and breathes in air.\(89\)
10. Plants and animals must have air.
11. Man has not the danger of starvation which faces the animals because man can think and plan.
12. "Many bacteria are harmful to man, others are useful."\(90\)

Variety

1. Light is not just light, but it is a combination of six different colors.\(91\)
2. "There are many forces at work in nature.
3. Electricity is a kind of force which we use for many purposes."\(92\)
4. "Fossils give evidence that many different kinds of animals have lived on this earth.
5. Fossils found in different parts of the world show that there were different kinds of man living in the early part of the Pleistocene epoch."\(93\)
6. "There are many ways in which different diseases spread."
7. Flies and other insects may be carriers of germs.
8. Our bodies are built up from different materials."(93)
Footnotes

(57) Joseph, op. cit., p. 73.
(59) Ibid., pp. 55-60.
(60) Blough, op. cit., p. 138.
(61) Craig, op. cit., p. 539.
(62) Ibid., p. 536.
(63) Ibid., p. 74.
(64) Ibid., p. 536.
(65) Ibid., p. 531.
(66) Ibid., p. 530.
(68) Ibid., pp. 87-89.
(69) Craig, op. cit., pp. 529-531.
(70) Blough, op. cit., p. 109.
(71) Craig, op. cit., pp. 529-531.
(72) Ibid., p. 537.
(73) Ibid., p. 528.
(74) Ibid., p. 277.
(75) Joseph, op. cit., p. 93.
(76) Craig, op. cit., p. 322.
(77) Ibid., p. 324.
(78) Ibid., p. 534.
(79) Ibid., p. 350.
(80) Ibid., p. 528.
Footnotes

(57) Joseph, op. cit., p. 73.
(59) Ibid., pp. 55-60.
(60) Blough, op. cit., p. 138.
(61) Craig, op. cit., p. 539.
(62) Ibid., p. 536.
(63) Ibid., p. 74.
(64) Ibid., p. 536.
(65) Ibid., p. 531.
(66) Ibid., p. 530.
(68) Ibid., pp. 87-89.
(69) Craig, op. cit., pp. 529-531.
(70) Blough, op. cit., p. 109.
(71) Craig, op. cit., pp. 529-531.
(72) Ibid., p. 537.
(73) Ibid., p. 528.
(74) Ibid., p. 277.
(75) Joseph, op. cit., p. 93.
(76) Craig, op. cit., p. 322.
(77) Ibid., p. 324.
(78) Ibid., p. 534.
(79) Ibid., p. 350.
(80) Ibid., p. 528.
(81) Ibid., p. 280.
(82) Ibid., p. 529.
(83) Ibid., p. 536.
(84) Ibid., p. 535.
(85) Ibid., p. 544.
(86) Ibid., p. 545.
(87) Ibid., p. 260.
(88) Ibid., p. 531.
(89) Joseph, op. cit., p. 123.
(90) Craig, op. cit., p. 544.
(91) Croxton, op. cit., p. 42.
(92) Craig, op. cit., p. 162.
(93) Beauchamp, op. cit., p. 167.
Grade IV

Space

1. "Scientists tell us there are three parts to the earth.
2. The land part of the earth, the solid, part, is our home.
3. The waters of the lakes, oceans, and rivers make up the liquid part of the earth.
4. The air, or atmosphere, that is all around the land is the gaseous part of the earth."(94)
5. "Gravity is the force which pulls all things toward the earth.
6. All things are pulled toward the center of the earth."(95)
7. "Falling objects possess energy.
8. Gravity makes energy available."(96)
9. "We live at the surface, or top part, of the land.
10. Scientists now tell us that the inside of the earth is quite firm or rigid.
11. The inside of the earth is very hot.
12. About three fourths of the surface of the earth is water."(97)
13. We live at the bottom of the ocean of air."(98)
14. "The 365\(\frac{1}{4}\) days that it takes the earth to revolve around the sun make one year."(99)
15. "The earth rotates on its axis once in every twenty four hours.
16. Since the earth is round only half of it can be lighted by the sun at one time."(100)
17. "The clouds we see in the sky are in the earth's atmosphere."
18. The clouds seem far away, but they are really very near the surface of the earth.

19. They are often within a mile or two and rarely above six or seven miles from the earth."(101)

Time

1. "The earth is millions of years old."(102)
2. "No one knows exactly how old the earth is."(103)
3. "The invention of the steam engine is of very recent time.
4. James Watt was the inventor of the steam engine."(104)
5. "The gas engine was invented a very short time ago."(105)
6. "For centuries man tried to invent a flying machine.
7. The invention of the gas engine made airplane flying possible."(106)

Change

1. "Heating water drives the air out of it in the form of bubbles.
2. Heat also changes liquid water into steam.
3. Heat causes water to expand; cooling causes solids to contract."(107)
4. Solids have a definite shape; liquids take the shape of the container they are in.
5. Gases have no shape. They try to fill all available space.
6. "The earth has changes its looks many times."(108)
7. "The earth is constantly being changed by erosion and weathering."(109)
8. "Oxygen makes things burn."(110)
9. Air expands when heated.(111)
10. "Plants help supply air with oxygen."(112)
11. "Electricity may be used as a source of heat."
12. "Electricity may be used as a source of light." (113)
13. "Electricity can flow only in a closed circuit." (114)
14. "Dry cells can be used to furnish electricity." (115)
15. "Steam is used to move things."
16. "Water can be used to make wheels turn."
17. "Electricity causes many things to move." (116)

Adaptation
1. "People live upon the solid part of the earth." (117)
2. "Man is a social animal."
3. "Other animals besides man are social."
4. "Honey bees are the best example of a highly organized society." (118)
5. "Ants have social life somewhat like the honey bees." (119)
6. "Many birds and other animals band together to migrate."
7. "Some kinds of birds join for feeding." (120)
8. "Every garden needs sunshine."
9. "Every garden needs water."
10. "Every garden plot must have good soil."
11. "A good garden plot needs plenty of humus." (121)

Interrelationship
1. "Each part of the earth is essential to life; the solid, the liquid, the gas." (122)
2. "Air is important to life."
3. "Oxygen is very important to all living things." (123)
4. "Man lives in a complex society."
5. Each one depends upon others for many things he enjoys and uses.
6. Honey bees cooperate with one another. This has helped them to survive. (124)
7. "Ants also cooperate in their work." (125)
8. "Animals give us food, clothing and shelter." (126)
9. "Some plants help to enrich the soil.
10. Plant growth depends greatly upon the type of soil." (127)

Variety
1. "There are three states of matter; solid, liquid and gas" (128)
2. "Air is made up of gases.
3. Oxygen, nitrogen, carbon dioxide and water vapor are in the air.
4. Air is one fifth oxygen and four fifths nitrogen." (129)
5. "There are different kinds of bees.
6. Here are three kinds of bees in a hive. The queen, drones and workers. Each has a definite job to do." (130)
7. "Ants are true insects.
8. Ants also have queens, drones and workers." (131)
9. Sand, clay and loam are kinds of soil." (132)
Footnotes

(95) Ibid., p. 529.
(96) Ibid., p. 392.
(97) Ibid., p. 530.
(99) Ibid., p. 530.
(100) Ibid., p. 531.
(101) Ibid., p. 532-533.
(102) Ibid., p. 530.
(103) Ibid., p. 96.
(104) Ibid., p. 414.
(105) Ibid., p. 428.
(106) Ibid., p. 549.
(107) Ibid., p. 533.
(108) Ibid., p. 134.
(109) Ibid., p. 114.
(110) Ibid., p. 167.
(111) Ibid., p. 191.
(112) Ibid., p. 183.
(113) Ibid., p. 548.
(114) Ibid., p. 467.
(115) Ibid., p. 461.
(116) Ibid., p. 530.
(117) Ibid., p. 85.
(118) Ibid., p. 308.
Footnotes (Contd.)

(119) Craig, op. cit., p. 311.
(120) Ibid., p. 534.
(121) Ibid., p. 535.
(122) Ibid., p. 85.
(123) Ibid., pp. 180-182.
(124) Ibid., p. 307.
(125) Ibid., p. 311.
(126) Ibid., p. 535.
(127) Ibid., p. 264.
(128) Ibid., p. 213.
(129) Ibid., p. 182.
(130) Ibid., p. 307.
(131) Ibid., p. 311.
(132) Ibid., p. 535.
Grade V

Space

1. "The air is a mixture of oxygen, nitrogen, carbon dioxide. It also contains dust and water vapor." (133)
2. "Stars are suns; therefore our sun is a star." (134)
3. "Stars shine because they have their own light and heat." (135)
4. "Certain groups of stars that seem to outline figures of gods, goddesses and heroes are called constellations." (136)
5. "The sun is the most important star to us for it gives us our light and heat." (137)
6. "The sun, with the planets and the other bodies that move around it, make the solar system." (138)
7. "The planets differ from the stars in that planets have no light and heat of their own. They reflect the light and heat from the sun." (139)
8. "At present we know of nine planets that revolve around the sun, each going around in its own orbit.
9. Some of the planets have moons or satellites that go around them." (140)
10. "The moon is a small body that revolves around the earth."
11. "The moon shines by reflected light from the sun."
12. "It takes the moon about one month to complete both its journey around the earth and its rotation on its axis." (141)
Time
1. In ancient times people did not experiment as they do now.
2. Galileo was among the first to use the experiment to find the truth.
3. During the early years if anyone doubted the words of a wise man, he was persecuted. Some were even burned to death.
4. Results of experiments slowly began to show that many beliefs which people had were false.
5. Today scientists always try to prove by experiments what they think is the truth about anything.

Change
1. "Air has weight or pressure." (142)
2. "Wind is caused by the air flowing from a place where the air pressure is great to a place where the air pressure is low." (143)
3. "Rains, snow, hail, dew and frost are made in different ways from the moisture that is in the atmosphere." (144)
4. "Weather Bureaus are stations from which changes of weather are given to the people.
5. The information given the weather bureaus is very important to the farmers." (145)
6. "Unlike poles of magnets repel each other, like poles attract.
7. Sunspots can affect us here on earth." (146)
8. "The moon and the sun cause tides in the ocean." (147)
9. "Water expands as it freezes.
10. Water warms up and cools off very slowly." (148)
Adaptation

1. "Many living things prepare for winter."
2. While many living things die down to the ground as winter comes, their roots still live in the soil.
3. Some kinds of plants live through the winter months as bulbs.
4. Many trees lose their leaves in the autumn.
5. Plants grow well when there is light for food making and when the water in the soil is not frozen."
6. "Many birds spend the winter in the south where it is warm and where there is food." (149)
7. "Most insects are not active in winter." (151)
8. "Some animals build winter homes.
9. Some animals take long winter naps.
10. Some animals store away food for winter.
11. Some animals hunt food all winter.
12. The covering of some animals changes in color as well as thickness during the year.
13. Many of our insects are active in summer. When winter comes many die.
14. Many animals hibernate through the cold winter months." (152)

Interrelationship

1. "Man uses the compass to help him find direction.
2. Compasses point toward the earth's magnetic poles." (153)
3. "Light is the energy the plants use in making food.
4. The sun is about 93,000,000 miles away; yet it is the most
important source of light on earth.
5. Light helps us to see things. It is important that we know how to take care of our eyes."(154)
6. "Water is important to the life of the earth.
7. It is important to drink plenty of water."(155)
8. "Plants need water, warmth, air, soil and food for growth.
9. All the foods we eat come from plants and animals.
10. We use plants and animals for clothing."(156)
11. Animals help some seeds to be carried away to a place where they can grow.
12. "Many seeds are carried from place to place by means of water and wind."(157)
13. "Forests may be a great help in preventing floods storing up moisture.
14. Forests make homes for all kinds of birds and other animals."(158)

Variety
1. "There are different kinds of seasons; the summer days are long, warm and sunny.
2. Winter days are shorter than summer days and often cold and snappy."(159)
3. Trees grow a great deal during the spring and early summer because of long, warm days.(160)
4. "Some birds travel great distances.
5. Some animals are warm-blooded, others are cold-blooded.
6. Some animals hibernate all winter."(161)
7. "Air is a mixture of different things; oxygen, nitrogen, carbon dioxide and other gases."(162)
8. "There are many different kinds of magnets.

9. A magnet has a north pole and a south pole.

10. A compass needle is a small bar magnet which can turn around freely." (163)

11. "Electricity travels through substances known as conductors. Metals are good conductors.

12. A substance which does not allow electricity to pass through is known as an insulator." (164)

13. "The parts of a plant are the root, stem, leaves, buds, flowers, fruit and seeds." (165)
Footnotes

(133) Craig, op. cit., p. 182.
(134) Ibid., p. 60.
(135) Ibid., p. 61.
(136) Ibid., p. 62.
(137) Ibid., p. 61.
(138) Ibid., p. 64.
(139) Ibid., p. 66.
(140) Ibid., p. 64.
(141) Ibid., p. 73.
(142) Ibid., p. 531.
(143) Beauchamp, op. cit., p. 220.
(145) Ibid., p. 224.
(146) Ibid., pp. 536-537.
(147) Ibid., p. 77.
(148) Joseph, op. cit., p. 139.
(150) Ibid., p. 359.
(151) Ibid., p. 356.
(152) Ibid., pp. 355-360.
(153) Ibid., p. 537.
(154) Ibid., p. 536.
(155) Ibid., p. 530.
(156) Ibid., p. 535.
Footnotes (Contd.)

(157) Ibid., p. 531.
(158) Blough, op. cit., p. 316.
(159) Craig, op. cit., p. 533.
(160) Ibid., p. 534.
(162) Ibid., p. 182.
(163) Ibid., p. 537.
(164) Blough, op. cit., p. 424.
Grade VI

Space

1. "Most stars cannot be seen without a telescope."
2. Astronomers picture the stars as large hot gaseous masses, millions of miles in diameter and thousands of light-years apart."(167)
3. "Stars are suns."
4. "Stars shine by their own light."
5. Stars vary in size, temperature and color.
6. There are millions and millions of stars.
7. Stars appear very small because they are very far away."(168)
8. "Our sun is a part of the galaxy."(169)
9. All stars are moving in space.
10. Stars shine by their own light, while planets by reflected light from the sun.
11. Planets and comets revolve about the sun in their own regular orbits."(170)

Time

1. "Man has always been extremely curious about the objects in the sky."(171)
2. Arabs were among the first people to study the stars.
3. Men have studied and are still studying the universe because there is so much that has not been discovered.
4. "Stars are so far away that it takes light, traveling at the rate of 186,000 miles per second, thousands of years to come from them." (172)

5. Scientists think that the earth was once a part of our sun. (173)

6. We do not know just how the earth was formed. (174)

7. "The sun is very old." (175)

8. Fossils show the size, shape and structure of plants and animals that lived long ago. (176)

9. Early people had strange beliefs about natural phenomena.

10. They knew very little about lightning.

11. Early men were hindered in their travel by lack of travel devices.

12. Early men had only his arms and shoulders for carrying burdens on land.

13. The steam-engine was then invented: trains.

14. Then came the gas engine: automobile.

15. The invention of the gas engine made the flying machine possible. (177)

Change

1. "When two bodies rub together then there is friction which may cause great heat." (178)

2. Volcanoes were formed which threw out gases, lava, volcanic ash and dust upon the surface. They were so numerous at one time that the period is called the age of volcanoes. (179)

3. Most of the volcanoes have become extinct.

4. "Man is learning how to protect himself against the destruction caused by earthquakes.

5. Great movements of the earth have at time caused earthquakes." (180)
6. Ocean water has been found to contain many kinds of different substances. (181)

7. "Rocks are made of different minerals."

8. Each mineral forms its own kind of crystal."(182)

9. "Current electricity travels in complete circuits."

10. We can change one kind of energy to another.

11. Some materials do not conduct electricity. The covering of rubber and cloth on wires does not conduct electricity and is called an insulator."(183)

12. "Sound is caused by vibrating bodies."

13. Sound travels in waves in all directions from its source.


15. Sounds cease to be pleasant when they are caused by more than 5000 vibrations a second."(184)

16. "Air pressure changes from time to time."

17. We use air in many ways. We live and breathe in air.

18. Air can expand or press out."(185)

Adaptation

1. The kinds of plants and animals that had effective ways of protecting themselves and their kinds succeeded in living for a long time.

2. Only those animals that were able to become more or less adapted to their environment continued to live. (186)

3. "Most amphibians spend a part of their life on land."

4. Reptiles and insects began living in the coal age."(187)
5. "Birds and mammals were the first animals that ever gave their young much care.

6. Mammals produce milk in their bodies with which to feed their young.

7. Many animals were protected by fur and feathers." (188)

8. "Only green plants can make their own food." (189)

9. "Boiling kills bacteria." (190)

10. Scientists say that man can live on the earth for thousands of years if he uses his intelligence wisely.

11. Man's happiness and health depend, in the future, upon man himself.

Interrelationship

1. An atmosphere is essential to life on earth.

2. All life must have heat, moisture and air in order to grow. (191)

3. Animals are dependent upon plants for food.

4. Some plants and animals reproduce so rapidly that they upset the balance of nature.

5. Plants influence the life of people. They are used as food.

6. "Trees can retard the erosion of soil by lessening the danger of floods." (192)

7. Animals could not live without oxygen. (193)

8. "Machines have given people many comforts." (194)

9. Man uses electricity for lighting his home, streets and other places.

10. "Electricity will put machines to work that may be used for cooling."

11. "Electricity may be used as a source of heat." (195)

12. "Pure water is essential to life."
13. Usually cities and villages must purify the water to make it fit for drinking. "(196)

14. "Scientists have learned how to prevent certain diseases by vaccination and other treatments."(197)

15. Children today will be men and women of tomorrow and can make the future of Syria what they wish by using science.

Variety

1. "Every living thing is either a plant or an animal."

2. "We have two great divisions: the plant kingdom and the animal kingdom."(198)

3. "The surface of the earth is uneven. There are high mountains on the continents and great depth in the oceans."(199)

4. "No two living things are exactly alike."(200)

5. "Life evolved from simple forms."(201)

6. Animals with backbones are called vertebrates; those without backbones are called invertebrates."(202)

7. "Birds and mammals are warm-blooded animals."(203)

8. "The earth is made up of substances which cannot be broken into other substances. They are called elements."(204)

9. "Oxygen is the most common element in the world."(205)
Footnotes

(167) Craig, op. cit., p. 539.
(168) Ibid., pp. 59-62.
(169) Ibid., p. 540.
(170) Ibid., pp. 66-68.
(171) Ibid., p. 49.
(172) Ibid., p. 79.
(173) Ibid., p. 82.
(174) Ibid., p. 84.
(175) Ibid., p. 56.
(176) Ibid., p. 140.
(177) Ibid., p. 428.
(178) Blough, op. cit., p. 403.
(180) Ibid., pp. 102-103.
(181) Ibid., p. 97.
(182) Ibid., p. 532.
(183) Ibid., p. 537.
(184) Ibid., p. 536.
(185) Ibid., p. 531.
(187) Craig, op. cit., pp. 142-143.
(188) Ibid., p. 157.
(189) Blough, op. cit., p. 223.
(190) Beauchamp, op. cit., p. 191.
Footnotes (Contd.)

(191) Craig, op. cit., p. 341.
(192) Ibid., p. 538.
(193) Ibid., p. 254.
(194) Ibid., p. 547.
(195) Ibid., p. 548.
(196) Beauchamp, op. cit., p. 229.
(197) Ibid., p. 190.
(198) Craig, op. cit., p. 231.
(200) Ibid., p. 231.
(201) Ibid., p. 234.
(202) Ibid., p. 239.
(203) Ibid., p. 242.
(204) Ibid., p. 166.
(205) Ibid., p. 167.
CONCLUSION

We are today passing through a great intellectual revolution. I don't know whether to call it a revolution or evolution. But I think an evolution would fit more to the present situation because we are passing step by step through this intellectual change. The school is attempting to meet this situation through a reconstruction of the older curriculum and bringing in what may help to give the rising generation the sense and the spirit of the day. Authoritarianism is giving place to inquiry and scientific investigation. In place of fixed and unchangeable subject-matter the more modern schools are trying to adapt their courses to the needs and interests of the pupils and the surrounding environment.

An attempt has been made in this work to show how the science program in the elementary schools can be made to contribute to the general education of the pupils. I have tried to point out certain basic considerations in the evaluation of content in the field of science. Three factors have been taken into consideration. First, the child, his needs, experiences and his interests. Secondly, the needs of society in which the child lives and moves and has his being. Thirdly, the major conceptions of science which have had great influence on human lives and living. When these three factors can be utilized in selecting what goes into child-science learning, it is believed, would give maximum service to the rising generation.

This work has tried to point out that an important part of any program is the continuous thinking through of the values which the
teacher sees in what the children learn. Moreover, it has been emphasized that the science program should be looked at not as an isolated area, but rather as a part of the whole educational process. It is only when the teacher sees the relation of his work in science to the whole work of the school that he will be able to better serve the general education of the child.

Science today is transforming society, through its modern inventions and discoveries, bringing into the country a multitude of conveniences, comfort in transportation, communication and healthful conditions. But the intelligent use of these conveniences depends to a great extent on an understanding of them, both their benefits and dangers. Moreover, science has given us much more than mere comfort, and convenience. The scientists have discovered facts about the nature of the universe and of man, which have great significance in many fields of human welfare and has caused a radical change in the thinking of man and his activities. The major conceptions of science have influenced almost all the areas of human thought.

In this work it has been suggested that these conceptions be grouped around integrating themes of modern science, space, time, change, adaptation, interrelationship and variety. These concepts are not listed as mere content but rather as interpretive ideas which serve to enrich the individual in the natural and social events in this universe of ours. It has been also suggested that these concepts may be analyzed for the purpose of finding learning elements suitable to the level of the pupils. Then through experience, activities and
projects, the children are helped and guided to formulate in their own minds generalizations which may help them for more intelligent living.
BIBLIOGRAPHY


