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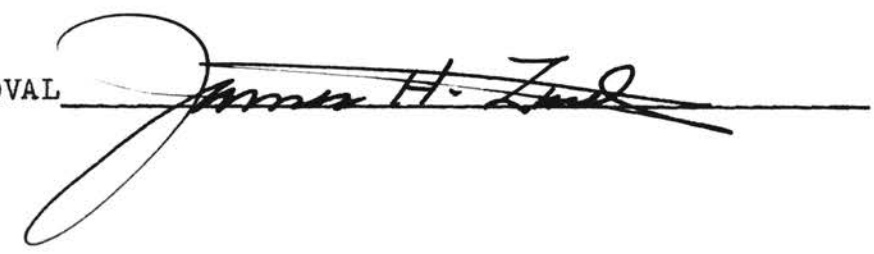
Scope of Study: The new developments in the scientific fields present a challenge to the teacher. He must meet the challenge by better preparing himself in order to improve the quality of instruction given to our youth. The purpose of this study is to suggest certain objectives for a desirable junior high-school science program and to show how the attainment of these objectives will help to satisfy the needs of the students for more effective living in the world of today. Materials used were recent publications dealing with general education of the junior high-school child, state courses of study and teaching science, and educational periodicals.

Findings and Conclusions: Many times the junior high-school age child experiences failure because he cannot reach adult standards in his awkward adolescence. The junior high-school science program can be an important factor in the general education of the pre-adolescent child and will aid in meeting his everyday needs if the program is based upon the characteristics and needs of that particular child. The use of the scientific method of problem solving will give the student an operational approach in solving, not only problems in science, but problems in his overall development. Learning experiences in science can be planned so that each student has the opportunity to progress according to his abilities.

ADVISER'S APPROVAL 

# SELECTED OBJECTIVES FOR JUNIOR HIGH SCHOOL SCIENCE TEACHERS

By

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Bachelor of Science

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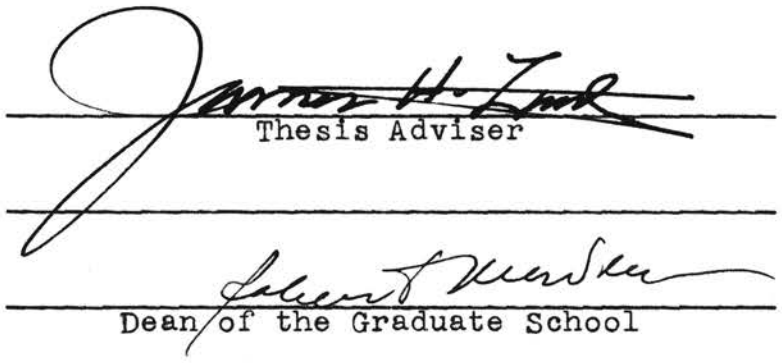

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TABLE OF CONTENTS

# CHAPTER I

## INTRODUCTION

In recent months many newspaper and magazine articles have been written which indicate an increasing interest in science and the methods of science teaching. There is general agreement among American educators that there is a need to improve the quality of science instruction to meet this new interest in our schools of today.

> For some time, scientists and educators have been aware that this altered state of affairs is inadequately represented in secondary education (and as a consequence, in higher education). The teaching of science in the secondary school has indeed changed, and changed substantially, in this half century, both in content and in technique. But on the whole, the changes have consisted in additions to the structure that existed 50 years ago, or in alterations to the existing structure. Lately there have been repeated intimations that this piecemeal reconstruction has long since failed in its purposes; that a new structure is now necessary; and that it must be designed from the ground up.[1]

For the past eight years, the author has been a teacher in the intermediate grades and in junior high-school. During the past five years, it has been an enlightening experience to teach science at the junior high-school level.

One of the great satisfactions experienced as a teacher

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[1]Elbert P. Little, "From These Beginnings," The Science Teacher, XXIV (1957), 316.

has been the interest shown by the students in the field of science. The unusual enthusiasm shown by the students at this level causes one to wonder just why there is such a shortage of scientists when there are so many students who have the interest and the talent to enter this field and consequently make a valuable contribution to the field of science.

The author has observed that by using simple experiments and exercises the student can complete the courses with a basic understanding of the world of science around him. A student who understands the fundamentals of science will be more motivated to continue his study and will seek relationships between science and his immediate environment.

> We need a widespread understanding of science in this country, for only thus can science be assimilated into our secular cultural pattern. When that has been achieved, we shall be one step nearer the goal which we now desire so earnestly, a unified, coherent culture suitable for our American democracy in this new age of machines and experts.[2]

During the past two decades no field of human endeavor has matched the progress that has been made in natural and physical science. Developments in no other area have had a greater effect on contemporary life in the United States. We are confronted with a rising population, a demand for a higher standard of living, more leisure time and a smaller supply of natural resources. All of these factors present a challenge to the teacher to better prepare the student for the world of today.

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[2]James B. Conant, On Understanding Science (The New American Library, New York, N. Y., 1956), p. 19.

> If we are to understand science, we must study science. It is not enough that a few scientists know and understand what is going on. In a democracy the man of the street must also know the evils or benefits that may come from the powerful instruments which have become ours to use. The United States and her Allies won the last two great wars because a large number of our men understood and could use the complicated machines that were put into their hands--the machines that the few had invented. They could make use of them better than could the average enemy soldier. Are we still training the boys and girls in our schools today so they will know and understand more than the young people of other countries? Not that we want war but we must be able to defend ourselves if and when it is necessary. In times of peace we want to understand our machines and new developments so we may derive the greatest benefits possible. We have the highest standard of living in the world and we want to keep it that way.[3]

The new developments in the scientific fields present a challenge to the teacher. He must meet the challenge by better preparing himself in order to improve the quality of instruction given to our youth. It is essential that the teacher instill in his students that science is a flexible functional inquiry and exploration into a fascinating universe of facts, ideas, speculations, discoveries, and conclusions. If the teacher is able to present the purpose of science on the level of the student, more interest will be shown by the students, better work will be done in the secondary schools, all of which will insure a better prepared citizen of tomorrow.

The purpose of this report is to suggest certain objectives for a desirable junior high-school science program

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[3]O. A. Nelson, "Curriculum Practices in the Secondary School," The Bulletin of the National Association of Secondary School Principals, XXXVIII (December, 1954), p. 65.

and to show how the attainment of these objectives will help to satisfy the needs of the students for more effective living in the world of today.

Investigation by the author has indicated that a successful program of instruction in science at the junior high-school level should instill in the student an understanding of the scientific attitude; the program, based upon the characteristics and needs of the junior high-school pupil, should help orient that child to his environment. Also, the science program should have sufficient latitude so as to provide work of interest for all pupils.

As a background for this report, the sources read were not limited to objectives of teaching junior high-school science but included related literature in an attempt to establish an understanding of the overall purpose of junior high-school education. The readings selected pertained to general purposes and trends in the junior high-school curricula of today, included were methods of presentation of specific topics and suggestions for enhancing the understandings of basic science principles.

# CHAPTER II

## THE DEVELOPMENT OF A SCIENTIFIC ATTITUDE

### Introduction

Junior high-school students tend to be casual in their thinking and study habits. They must be helped to think and study in a scientific manner. It is necessary that these students learn to apply their training to both scientific and social situations.

> If every child is to develop a more adequate understanding of himself and of the complex and demanding world he lives in, then it is necessary that he gain in understanding of the important concepts of science, become skillful in using the scientific method in dealing with his problems, and gain in appreciation of the attitudes of intelligent questioning, demonstrable verification, and constructive action.[1]

Helping the students acquire the scientific attitude is one of the most common problems that confronts the modern teacher. Believing that children are grasping the right scientific attitude because they are exposed to science is a fallacy. As children grow and continue their education, there is a change in behavior and attitudes at each level of their development. At the junior high-school level, it is

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[1]V. E. Herrick et al., The Elementary School (Prentice-Hall, Englewood Cliffs, N. J., 1956), p. 236.

important for the teacher to understand, evaluate, and guide the development of the scientific attitude which in turn influences behavior patterns of the children with whom they are working.

> But if scientific attitudes are to influence the child's behavior, something more than knowledge and sympathy is required. The attitudes must begin to function in practical situations, in issues that arise, in problems that are considered, in opinions that are expressed.[2]

It can be readily seen that a child who has developed without the study of science will be different from one who has had the opportunity to study science. Also, a child who understands and uses practical science in his daily life will be different from one that has been exposed to science, but does not understand how it can be used to help him in his living.

The development of an attitude of scientific study, the scientific method of problem solving, and a scientific vocabulary will certainly help any child to better fit into the complexity of both the physical and social environment at this level of his development.

> Science is today on a plane of high significance and importance. It is no longer, if indeed it ever was, a mysterious and occult hocus pocus to be known only to a select few. It touches, influences, and molds the lives of every living thing. Science teachers have a great opportunity and responsibility to make a large contribution to the welfare and advancement of humanity. The intellectual aspects of this responsibility are at least coequal in importance with the material. Science is a great social force as well as a

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[2]Clark Hubler, Working with Children in Science (Houghton Mifflin, Boston, Mass., 1957), p. 96.

> method of investigation. The understanding and acceptance of these facts and this point of view and their implementation in practice will, more than anything else, make science teaching what it can and should be.[3]

In developing the scientific attitude, the scientific method of problem solving and the development of a scientific vocabulary are so closely related that it is not feasible to separate them as individual objectives. But, for the purpose of this report, individual consideration will be given each.

## The Scientific Method of Problem Solving

In the development of a scientific attitude, it is necessary to give a definition of the scientific method of problem solving. In a study of the methods used by various scientists, it becomes evident that there are about as many methods of study as there are scientists. But, of these many methods, there are a few basic elements that are present in all; they may be used as a definition of the scientific method of problem solving. As listed by the National Society for the Study of Education, they are:

1. Sense a problem
2. Define the problem
3. Study the situation for all facts and clues bearing upon the problem
4. Make the best tentative explanations or hypotheses
5. Select the most likely hypothesis
6. Test the hypothesis by experimental or other means
7. Accept tentatively, or reject the hypothesis and test other hypotheses
8. Draw conclusions[4]

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[3]Nelson B. Henry, ed., Science Education in American Schools (University of Chicago Press, Chicago, Ill., 1947), p. 39.

[4]Ibid., p. 29.

A person who has the idea of cause and effect is not the same as one that does not have this understanding. The ideas of superstitions and false notions are destroyed when examined by this technique of problem solving. The conviction of the universality of cause and effect is part of the scientific attitude. The holding of a viewpoint as tentative until all evidence is examined, and the habit of looking for problems to be solved are also components of this scientific attitude.

> Science holds a position of preeminent authority in the world of today. It provides the best possible answers as to why our world is what it is. It is tested experience. The scientist recognizes the fact that future discoveries may change generalizations that today are the best conclusions, and that no finality is obtainable, no matter how well supported by the available evidence. The kind of mind that holds scientific truths to be tentative is in itself the product of the modern scientific method.[5]

It is necessary that the teacher use every available opportunity to help children acquire the scientific attitude. They should be encouraged to look at a problem from all sides before they express an opinion, to test and experiment carefully and accurately, to observe exactly, and to withhold a final decision until there is sufficient evidence to support the drawing of conclusions.

If teachers are to teach the scientific method of problem solving, goals and objectives should be set up with that in mind. It is the job of the teacher to present the material

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[5]Ruby H. Warner, The Child and His Elementary School (Prentice-Hall, Englewood Cliffs, N. J., 1957), p. 226.

in such a manner that the student can discover a problem to solve. The child should have the opportunity to explore his specific problems by using the scientific method of problem solving.

> The problem approach stimulates both curiosity and the desire for mastery. If the solution of the problem involves "manipulation," e.g., building a model to demonstrate a point or performing an experiment to test a hypothesis, so much the better.[6]

Guidance by the teacher is necessary if the child is to acquire success in understanding this method of problem solving and the application of this method to the problems in his daily living.

It is possible for the teacher to plan lessons that can help the junior high-school student use this method of problem solving early in the junior high-school program. The teacher must be patient as well as persistent in presenting this method of learning to the children. Of course, when this objective is reached, children of all levels of intelligence would see more meaning in school and would use school as a means to an end instead of just letting each day of school be an end in itself. For the students that learn to comprehend the meaning of the scientific method, there would be more joy in studying and a greater preparation on the part of the student for future planning.

These objectives cannot be reached unless teachers are

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[6]Norma E. Cutts and Nicholas Moseley, Teaching the Bright and Gifted (Prentice-Hall, Englewood Cliffs, N. J., 1957), p. 141.

willing to change from the old idea of textbook teaching to the new idea of applying the scientific method of problem solving to their own teaching.

## The Scientific Vocabulary

Science, like many other fields, has a particular vocabulary that must be learned before an understanding of the content areas can be reached. The building up of a science vocabulary is an important part in the foundation of understandings of the actual meanings of science.

> One of the basic objectives in teaching science is building up a vocabulary of scientific terms. Paradoxically, the vocabulary burden is primarily responsible for the difficulty experienced by the student in reading science. If he can master the vocabulary of a course in biology or physics, the battle is half won.[7]

Whether it is in the following of directions or in the interpreting of the meanings of words, it is necessary that the child understand that in science exactness is paramount.

> The use of language in science and health provides an opportunity to emphasize the positive aspects of usage in the choice of words which describe exactly and accurately what has happened or has been observed.[8]

In the study of science many words, prefixes, and suffixes have similar spellings but entirely different meanings. The teacher should make a special effort to bring words of this type to the attention of the student.

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[7]Delwyn G. Schubert, "Science Teachers," The Clearing House, XXX (1955), 83.

[8]Virgil E. Herrick and Leland B. Jacobs, Children and the Language Arts (Prentice-Hall, Englewood Cliffs, N. J., 1955), p. 306.

For vocabulary development to be effective, there must be direction on the part of the teacher in setting the right atmosphere for the child so that the importance and need of an expanding vocabulary will be realized.

> Teachers must be skillful indeed to introduce necessary technical language slowly enough so that students will learn to use it. With use will come familiarity. If the terms are not to be used, there is no excuse for learning them. Instructors must be sympathetic with the student's conditioning against technical terms since some of the conditioning was done by adults, even by teachers. Explanations of the meanings of words, explanations of the reasons for such terms, accompanied by an honest effort to reduce the difficult terminology to those that will actually be used by the majority of the students, will go far to eliminate the mind set against the introduction of new words in the science class.[9]

Since achievement in science is closely associated with vocabulary development, scientific growth for the child can proceed only as the child's vocabulary grows.

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[9]Bulletin No. 400, Course of Study in Science for Secondary Schools (Department of Public Instruction, Harrisburg, Penn., 1951), p. 40.

# CHAPTER III

## SATISFYING THE NEEDS OF THE JUNIOR HIGH SCHOOL STUDENT

### Introduction

Science at the junior high-school level should be taught in such a manner as to give children an opportunity to learn that their lives can be enriched by the use of the knowledge of science. They need learning experiences in various sciences that will enable them to better understand their natural environment.

> It is reasonable to suppose that a child can "find his place in the world" with greater skill and therefore with greater self-realization if he has been helped in school to develop better understanding of the physical environment.[1]

It is not the purpose of the author to make scientists of all students, but to show how an understanding of science will make the everyday living experiences more meaningful. The scientific developments in our modern civilization have made it necessary that all students have some knowledge of the various sciences. In daily living, students are affected by such sciences as biology, mathematics, physics, chemistry, astronomy, meteorology, and health. Therefore,

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[1]Hollis Caswell and Wellesley Foshay, Education in the Elementary School (American Book Co., 2d ed., New York, N. Y., 1950), p. 164.

it is essential for students to have a basic understanding of science if they are to realize the inter-relationship of science and the society in which they live.

> For the past three centuries, they say, science has played a leading part in shaping our civilization. Today, it is a potent influence in directing the future course of our culture. Science is one of the chief elements in the cultural heritage; and the understanding of scientific methods and the scientific point of view is a part of the cultural birthright of youth.[2]

For a program of junior high-school science to be successful in the orientation of the child to his environment, it must be planned in such a manner as to consider the particular characteristics and needs of the pre-adolescent child.

## Characteristics of Junior High School Pupils

Children entering the junior high-school are in the transitional stage of life. There is a wide variance of both physical and mental development. Thus, it is an age of differences and variability. It is the responsibility of the teacher to recognize these characteristic changes and plan the educational program to help the child better fit in his environment.

1. The pupil is more concerned about his relationship with other people.
2. The pupil shows increased curiosity about himself and his environment.
3. He has to adjust to rapid and profound body changes.
4. The pupil tries to achieve independence and, at the same time, maintain security.

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[2]Educational Policies Commission, Education for All American Youth (National Education Association of the United States, Washington, D. C., 1944), p. 130.

5. The pupil strives for personal values in his personal social setting.
6. The pupil desires many outlets for expressing his ideas and feeling.
7. The pupil needs to acquire knowledge and skills sufficient to permit him to proceed on his own.
8. The pupil wants to participate as a responsible member in larger social groups.[3]

One of the vital tasks of the teacher is to realize the importance of each of these characteristic changes in the child. After the teacher understands these changes, he will be more able to help fulfill the student's needs.

## The Needs of the Junior High School Pupil

In analyzing the previously discussed characteristics, certain needs of these pre-adolescent children are indicated. As modifications of the Ten Imperative Needs of Youth, they are:

1. All junior high-school youth need to explore their own aptitudes and to have experiences basic to occupational proficiency.
2. All junior high-school youth need to develop and maintain abundant physical and mental health.
3. All junior high-school youth need to be participating citizens of their school and community, with increasing orientation to adult citizenship.
4. All junior high-school youth need experiences and understanding appropriate to their age and development, which are the foundation of successful home and family life.
5. All junior high-school youth need to develop a sense of the values of material things and of the rights of ownership.
6. All junior high-school youth need to learn about the natural and physical environment and its effect on life, and to have opportunities for using the scientific approach in the solution of problems.

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[3]Criteria for Evaluating Junior High Schools (The University of Texas, Austin, Texas, 1956), pp. 22-42.

7. All junior high-school youth need the enriched living which comes from appreciation of an expression in the arts, and from experiencing the beauty and wonder of the world around them.
8. All junior high-school youth need to have a variety of socially acceptable and personally satisfying leisure-time experiences which contribute either to their personal growth or to their development in wholesome group relationships, or to both.
9. All junior high-school youth need experiences in group living which contribute to personality and character development; they need to develop respect for other persons and their rights, and to grow in ethical insights.
10. All junior high-school youth need to grow in their ability to observe, listen, read, think, speak, and write with purpose and appreciation.[4]

The purpose of classroom learning is to prepare the child for life's needs; each child must be given the best possible preparation for meeting the problems of later life. Since junior high-school science is rich with learning experiences for the doers as well as the readers, a balanced program of science that contains activities for all students will do much to meet their common needs.

In setting up a plan for satisfying the needs of the junior high-school student, it was decided to make modifications in the plan for satisfying the needs of all students as done in the Course of Study in Science for Secondary Schools in Pennsylvania.[5]

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[4]Helen J. Rogers, "The Emerging Curriculum of the Modern Junior High School," The Bulletin of the National Association of Secondary School Principals, XXXIV (April, 1950), p. 128.

[5]Bulletin 400, pp. 27-35.

| NEEDS | HOW MET THROUGH SCIENCE EDUCATION |
|---|---|
| 1. All youth need to explore their own aptitudes and to have experiences basic to occupational proficiency. | |
| a. Scientific understanding helps in choosing a vocation. | a. The exploration of the various subject areas in science provides an insight into occupations and interests. Field trips to industrial plants and laboratories will let the child see science in action. |
| b. Carefulness, neatness and precision. | b. Laboratory experience, proper form in making reports, etc. |
| c. Recognition of the importance of an honest achievement on the pupil's level and the limit of his ability. | c. The report of a laboratory experiment performed by the pupil and written up as a report of his own efforts with correct deductions and conclusions is an excellent motivating device to accomplish attainment of this understanding. |
| 2. All youth need to develop and maintain good health and physical fitness. | |
| a. Knowledge that certain discomforts, and physical ills are not necessary in a scientific society. | a. The study of foods as to nutritive value and vitamin content; how each contributes to the growth, development, and maintenance of certain parts of the body and nervous system. Discovery and research in the field of medicine bring newer methods and materials to produce a desired effect. |
| b. Functional knowledge of community health and safety; higher living standards. | b. Study of the subject areas of sanitation, food inspection and grading, pure food laws, and industrial processes used in the community. |

| NEEDS | HOW MET THROUGH SCIENCE EDUCATION |
|---|---|
| 3. All youth need to be participating citizens of their school and community, with increasing orientation to adult citizenship. | |
| a. To develop standards which will make for desirable civic and social outlook. | a. Opportunity to practice such standards through group participation in the science laboratory and classroom. The consequences of poor standards. |
| b. Knowledge and practice of democratic processes, the acceptance of authority and responsibility. | b. Laboratory work by pupils working in groups and a consideration of the history and development of modern science lend themselves admirably to development of democratic processes. |
| c. An understanding that property rights, human rights and privileges must be respected in harmonious social living. | c. The practice of students working in groups, classes working together on a single problem, groups working together in the laboratory, for all of which supplies are issued, can be made a tool for practicing this understanding. |
| 4. All youth need experiences and understanding appropriate to their age and development, which are the foundation of successful home and family life. | |
| a. Application of biological facts and laws of physical science to present-day situations. | a. The study of these subject areas should provide opportunity for relating them to present-day situations. |
| b. Understanding the individual, the family, and the society in which they live. | b. The study of health and hygiene, family relationships, and laws of heredity help develop an understanding of all. |

| NEED | HOW MET THROUGH SCIENCE EDUCATION |
|---|---|
| c. Ability to participate in group processes, cooperative activities, and discuss controversial issues. | c. No subject offers greater or wider possibilities. Development of cooperative planning and execution of science units involving laboratory solutions of problems is ideal for group learning experiences. Discussion of uses and controls of atomic energy promote ability to discuss. |
| d. A sense of right and wrong--i.e., moral and spiritual values. | d. Laboratory work in science can help determine the right solution. Examples of how the Bible and science are alike will help the student realize the spiritual need in science. |
| 5. All youth need to develop a sense of the values of material things and of the rights of ownership. | |
| a. Ability to make wise choices or decisions. | a. Practice in use of the scientific method of problem solving. |
| b. Consumer education. | b. Can be interwoven through all science subjects by emphasis on such subjects as grading of materials, cost of production, natural resources and supply of raw materials, synthetic products, and substitutes, analysis, and reports on consumer research. |
| c. The practice of economy in use of materials and time. | c. Laboratory processes show that desired results can be obtained only with exact amounts of materials and supplies as recommended and that variations in these amounts obscure the desired result and produce misleading observations. |
| d. Care in handling precision tools and instruments. | d. Instruction and practice in the use of balances, meters, and measuring instruments. |

| NEEDS | HOW MET THROUGH SCIENCE EDUCATION |
|---|---|
| e. Knowledge leading to wise selection, use, and conservation of family resources, such as food, clothing, housing, home furnishings, and home equipment. | e. Study of foods in biology and chemistry; textiles in general science; building materials and their properties and machines studied in general science. |
| f. Conservation of human and natural resources. | f. Laws of health; knowledge of uses and sources of natural raw materials with consideration to probable supply, and methods of conservation. |
| g. Functional knowledge of merchandise. | g. Knowledge of sources of various articles of merchandise; tests for various fabrics and textiles and for authenticity of goods. |
| h. Realization that one never gets something for nothing in the physical universe. | h. Studies of conservation of energy thoroughly meet the concept that everything must be paid for. |
| 6. All youth need to learn about the natural and physical environment and its effect on life, and to have opportunities for using the scientific method of study. | |
| a. Understanding scientific problems. | a. Scientific applications within the community, such as water supply, industrial processes based on new inventions, agricultural problems, power supply, and sewage disposal. |
| b. Understanding life today with recognition of events in the past and their bearing on present-day living. | b. Discoveries and inventions in science have had and are having a profound influence on present day living. A study of the history of science will show the magnitude of these changes. |

| NEEDS | HOW MET THROUGH SCIENCE EDUCATION |
|---|---|
| c. Substitution of scientific fact for superstition and traditional beliefs. | c. Through the acquisition of knowledge of natural laws and scientific principles, an understanding of the true explanation can take place. |
| d. Use of scientific methods in place of the uncontrolled, biased, and fragmentary methods. | d. Constant training in the application of the scientific method in laboratory exercise, and reports. Actual testing instead of just forming an opinion. |
| e. Knowledge of natural environment and phenomena and their effect on life and culture of the community the nation and the people of the world. | e. This primary objective of science education can be accomplished through a study and knowledge of: natural laws and their application; natural growth and development in the animal, vegetable, and mineral kingdoms; soil erosion and conservation; laws of heredity; climate, etc. |
| f. Appreciation of the close relationships between scientific knowledge and achievement and human welfare, industrial progress, and economic trends. | f. A consideration of the work necessary to build a new industrial plant; emphasis on sociological implication of discoveries and inventions in science, medicine; safety factors, transportation, communication, etc. |
| g. Elementary knowledge of the construction and use of machines used in the home. | g. General science furnishes an adequate study of simple machines and their combination to form complex machines. |
| h. Knowledge of the sources of electric power and the uses of electricity. | h. A basic study of magnetism and electricity constitute several units in most general science texts. |
| 7. All youth need the enriched living which comes from appreciation of an expression in the arts, and from experiencing the beauty and wonder of the world around them. | |

| NEEDS | HOW MET THROUGH SCIENCE EDUCATION |
|---|---|
| a. Accuracy and alertness in observation. | a. Individual work where the solution depends upon the child and the accuracy of his work. |
| b. Appreciation of the relation of science to cultural life. | b. The impact of science discoveries and inventions upon our culture. The changes in our standard of living and recreation. Science work as done through history, the methods and achievements of scientists. New materials that were unknown only twenty years ago. |
| c. Application of principles of color, light, and sound. | c. In all levels of junior high-school science, the basic principles of these things are studied. Experiments can be done that will give the child a better understanding of the uses of these principles in their everyday living. |
| d. Appreciation of the biological principles involved in the selection and preservation of the species in nature. | d. The study of animals and plants in their natural habitat can do much to help the child in understanding of protective coloring, changes of coloring, and reproduction of the specie. |
| 8. All youth need to have a variety of socially acceptable and personally satisfying leisure-time experiences which contribute either to their personal growth or to their development in wholesome group relationships, or to both. | |
| a. How to spend leisure time. | a. Various phases of science often provide the individual with an interest and incentive for hobbies, e.g., photography, hydrophonics, or radio. Science clubs form an excellent media for stimulating hobbies. |

| NEEDS | HOW MET THROUGH SCIENCE EDUCATION |
|---|---|
| 9. All youth need experiences in group living which contribute to personality and character development; they need to develop respect for other persons and their rights and to grow in ethical insights. | |
| a. Respect for the dignity of common labor. | a. Consideration of the work phases necessary to complete various industrial processes. The types of labor, each making valuable contribution to the whole, without which the process could not be brought to fruition. |
| b. Tolerance for opposing viewpoints and opinions, and for others with lesser abilities in certain areas of living. | b. Study of the history of science, and biographies of noted scientists; group participation in solving problems. Understanding different living conditions in different parts of the world. |
| c. Respect for integrity and a desire for the truth. | c. Study of the history of solutions of various specific scientific problems, e.g., the conquest of yellow fever in the Canal Zone; specifics in medicine and drugs. Individual work in solving assigned problems. Biographies of noted men and their search after the truth in scientific problems. |
| 10. All youth need to grow in their ability to observe, listen, read, think, speak, and write with purpose and appreciation. | |
| a. Ability to read and interpret the printed page accurately. | a. The study of science provides a new vocabulary and a new field for reading. Accuracy of interpretation is necessary. |

| NEEDS | HOW MET THROUGH SCIENCE EDUCATION |
|---|---|
| b. Carefulness and correctness in the use of words--accuracy of statement. | b. The study of science provides an active speaking vocabulary and teaches that a careful choice of words must be made in expressing scientific laws and principles. Children must learn also how to pronounce words correctly. |
| c. Exactness in oral and written expression. | c. Written and oral reports on research and laboratory observations. Exactness and accuracy in testing programs, laboratory exercises, and interviews; reports on field trips. |
| d. Ability to listen effectively. | d. Listening to reports of student groups on phases of cooperative work and reporting on these to the entire class. Listening to instructions which are given but once. |
| e. How to tell fact from fiction in advertising claims; propaganda analysis. | e. Knowledge of various tests which can be made and of the actual materials and their properties used in the manufacture of the advertised merchandise. |
| f. Ability to transfer learning. | f. The scientific attitude of forming logical conclusions from established facts and principles. The applying of this method to other phases of living. |
| g. Effective habits of thought. | g. Development of a logical conclusion from observed facts in laboratory and research work. |
| h. Knowledge of a diversity of scientific terms and their meanings adequate for reading magazines and newspaper articles with understanding and appreciation. | h. In general science, one of the main objectives is to have the child learn the meaning and the spelling of the important scientific words as they are used. All of these are important principles of good vocabulary development. |

# CHAPTER IV

## PROVIDING FOR INDIVIDUAL DIFFERENCES

Each student in the junior high-school should have the opportunity to progress according to his abilities. The hetrogeneous grouping of students accents the need for the assessment of the skills of each individual. Unfortunately, many teachers do not allow for individual differences in the achievement levels of the students.

> With all these children--those with the highest I. Q.'s, those with the lowest, and those in between--your responsibility as a teacher is basically the same; to fit your instruction to the abilities of each child.
>
> Just as the chairs and desks in the classroom must be fitted to the physical size of children, so must your instruction and classroom materials be fitted to their intellectual "size." And this is a demanding task, since individual differences in intelligence are far more subtle, far more difficult to identify and to accommodate, than are differences in physical size.[1]

The science program in the junior high-school should be of such nature that all children have the opportunity to participate in science activities.

> Science at Evanston Township High School is for everyone--the strongly academic student and the pupil of low ability. To provide for students planning a career in science or engineering, ETHS offers strong mathematics and science curricula.

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[1]Henry P. Smith, Psychology in Teaching (Prentice-Hall, Englewood Cliffs, N. J., 1954), p. 180.

> To provide for the non-college bound and low ability pupil, whose only formal study of science will be that in high school, ETHS offers non-laboratory courses which emphasize practical aspects of science, aim to acquaint pupils with the "method of science," develop skills that may prove useful, and provide general cultural educational values.[2]

It is a challenge to the teacher, in planning his work, to realize that for some of the children any year of school may be a terminal point in the student's learning processes, but for others it is a year in sequence based on previous learning and preparation for future study.

For those children who do not have the ability to proceed as rapidly as the entire group, the teacher must plan experiences in such a way as to make it possible for them to achieve some measure of success.

> However, there are ways in which the skillful teacher can adjust for individual differences in ability and at the same time keep the class together within the broad limits of the course. For example, as soon as you have become acquainted with the ability of each member of the class (through personal conferences, test data, and a study of the child's past record), you can adjust your assignments to fit the child's needs.
>
> When you use differential assignments of this sort, you will get the best results by encouraging each child to volunteer for the projects that are of special interest to him. Be careful to call upon each child to present his own findings and be sure that each child is rewarded in examinations for achieving at the level of which he is capable. By rewarding each child and by holding him responsible for his learning, you encourage him to form desirable work habits. But if you hold him responsible for concepts and materials that are beyond his ability to master, you will force him into confusion and discouragement.[3]

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[2]Board of Education, Annual Report - Evanston Township High School, Featuring Science (Evanston, Ill., 1956), p. 4.

[3]Smith, p. 248.

Learning activities beyond the ability of a child tends to discourage him. In science there are learning experiences that will make it possible for all children to contribute to the learning of the entire group.

> The pre-adolescent, as well as the young child, needs to have tasks he is capable of meeting with success. The teacher plays a vital role in making all school experiences as successful and constructive as possible. All school experiences here refers to both learning and interpersonal ones. The pre-adolescent who is drawn into the on-going life of an interesting classroom and guided and supported by an affectionate, firm, and good-humored teacher is having one of the most beneficial of mental health experiences.[4]

The goal of good planning is to arrange the program so that each child has the opportunity to contribute and share according to his ability.

Richardson[5] states that the science class is one of the best places in the school to accommodate individual differences in children. There are many science books that are written for various levels of reading achievement; there are laboratory experiments of increasing difficulty; and there are many problems that can be solved with increasing standards of achievement.

For those especially gifted students the program needs to be enriched so that these students are challenged to accomplish more. These students do not need extra home work,

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[4]Katherine D'Evelyn, Meeting Children's Emotional Needs (Prentice-Hall, Englewood Cliffs, N. J., 1957), p. 24.

[5]John S. Richardson, Science Teaching in Secondary Schools (Prentice-Hall, Englewood Cliffs, N. J., 1957), p. 69.

extra chores, or useless classroom busy work, but need to be encouraged to reach a level of knowledge and understanding not attainable by those of lower levels of achievement.

The teacher must realize that the gifted student needs to be guided the same as the other students. Without the proper guidance from the teacher, the bright student will not accomplish all the work that he is capable of doing.

There have been several studies made concerning the lack of scientists today. Brandwein[6] in his study of gifted students noted that there was not a lack of future scientists, but a lack of the opportunity to develop them in our public schools. If the children of high ability are given the opportunity to study science in junior high-school, it may help them to decide on further science study.

> It seems (and there is agreement among the teachers) that an interesting and vital course in General Science would stimulate youngsters to take more science, more Chemistry and Physics. Without General Science, there is little "seeding" of interest. This seems to be true of other situations where Physics and Chemistry registration is low.[7]

It is the responsibility of the teacher to set the stage for good learning experiences and furnish the inspiration and guidance for each child to achieve according to his ability.

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[6]Paul F. Brandwein, The Gifted Student as Future Scientist (Harcourt, Brace and Co., New York, N. Y., 1955), p. 34.

[7]Ibid., p. 74.

# CHAPTER V

## SUMMARY AND CONCLUSIONS

The purpose of this report was to suggest certain objectives for a desirable junior high-school science program, and to show how the attainment of these objectives will help to satisfy the needs of the students for more effective living in the world of today.

The author realizes that many objectives could have been selected that would help the teacher of junior high-school science. However, the sources read revealed the following objectives worthy of consideration in any science program.

The junior high-school science program can aid in the development of the scientific attitude by the use of the scientific method of problem solving and an understanding of a scientific vocabulary. This will give the student an operational approach in solving, not only problems in science, but all problems in his development.

The junior high-school science program can be an important factor in the general education of the pre-adolescent and will aid in meeting his everyday needs if it is based upon the characteristics and needs of that particular child.

The junior high-school science program can be designed

to interest all pupils and to challenge the gifted. Learning experiences should be provided to span the range of achievement levels within each class. Special attention should be given those students that have the ability to do further work in the field of scientific study.

It is suggested that further study be done concerning the college preparation of those individuals who plan to teach in the junior high-school. Special emphasis should be placed on meeting the individual needs of the pupils, and the personal satisfaction that they can gain by solving their own problems through a scientific approach. The challenge remains eternal.

BIBLIOGRAPHY

Board of Education. Annual Report - Evanston Township High School, Featuring Science. Evanston, Ill., 1956, p. 4.

Brandwein, Paul F. The Gifted Student as Future Scientist. New York: Harcourt, Brace and Co., 1955, p. 34.

Bulletin No. 400. Course of Study in Science for Secondary Schools. Harrisburg, Penn.: Department of Public Instruction, 1951, p. 40.

Caswell, Hollis, and Wellesley Foshay. Education in the Elementary School. New York: American Book Co., 2d ed., 1950, p. 164.

Conant, James B. On Understanding Science. New York: The New American Library, 1956, p. 19.

Criteria for Evaluating Junior High Schools. Austin: The University of Texas, 1956, pp. 22-42.

Cutts, Norma E. and Nicholas Moseley. Teaching the Bright and Gifted. Englewood Cliffs, N. J.: Prentice-Hall, 1957, p. 141.

D'Evelyn, Katherine. Meeting Children's Emotional Needs. Englewood Cliffs, N. J.: Prentice-Hall, 1957, p. 69.

Educational Policies Commission. Education for All American Youth. Washington, D. C.: National Education Association of the United States, 1944, p. 130.

Henry, Nelson B., ed. Science Education in American Schools. Chicago: University of Chicago Press, 1947, p. 39.

Herrick, V. E., et al. The Elementary School. Englewood Cliffs, N. J.: Prentice-Hall, 1956, p. 236.

_____, and Deland B. Jacobs. Children and the Language Arts. Englewood Cliffs, N. J.: Prentice-Hall, 1955, p. 306.

Hubler, Clark. Working with Children in Science. Boston: Houghton Mifflin, 1957, p. 96.

Little, Elbert P. "From These Beginnings." The Science Teacher, XXIV (1957), p. 316.

Nelson, O. A. "Curriculum Practices in the Secondary School." The National Association of Secondary School Principals, XXXVIII (December, 1954), p. 65.

Richardson, John S. Science Teaching in Secondary Schools. Englewood Cliffs, N. J.: Prentice-Hall, 1957, p. 69.

Rogers, Helen J. "The Emerging Curriculum of the Modern Junior High School." The Bulletin of the National Association of Secondary School Principals, XXXIV (April, 1950), p. 128.

Schubert, Delwyn G. "Science Teachers." The Clearing House (1955), p. 83.

Smith, Henry P. Psychology in Teaching. Englewood Cliffs, N. J.: Prentice-Hall, 1954, p. 180.

Warner, Ruby H. The Child and His Elementary School. Englewood Cliffs, N. J.: Prentice-Hall, 1957, p. 226.

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