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A Suggested Approach to a Proposed Program for Teaching General Science in Booker T. Washington High school, Conroe, Texas

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A SUGGESTED APPROACH TO A PROPOSED PROGRAM FOR TEACHING GENERAL SCIENCE IN BOOKER T. WASHINGTON HIGH SCHOOL, CONROE, TEXAS

COLLIER

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A SUGGESTED APPROACH TO A PROPOSED PROGRAM FOR TEACHING GENERAL SCIENCE IN BOOKER T. WASHINGTON HIGH SCHOOL, CONROE, TEXAS

By

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PREFACE

Since teaching may be considered a stimulus and learning the response, the function of the science teacher therefore is to provide the best stimuli in an effort to encourage the best learning. Other things being equal the more a teacher knows about the teaching process the more effective his teaching should be. However knowing the facts and principles of teaching does not in itself guarantee that good teaching will be done. Knowing the facts and principles, and applying them correctly are not identical.

In many places there is still the shadow of the mistaken idea that one who has been taught science can teach. Teaching methods derived from belief in this point of view may be direct causes of poor science teaching. To teach science one must know, and knowing suggests other implications such as knowing not only science, but something of the nature of child development and environmental relationships.

In science teaching, as in other professions, there is no one point of view, but many schools of thought, each of which is based on ideas that have resulted either or both from experience or constructive thinking. At its best a philosophy of science teaching should be a guide, flexible enough to include the best that has come from the past and the newer developments in the field.

This work does not offer the writer's philosophy as the only panacea for all the ills in science teaching, which would suggest fixation without elements of elasticity and adaptability, but it does suggest a point of approach to a proposed program based on the needs and interests of the students in a particular locale. The writer does not claim priority of new ideas, but adaptation to a designated situation with a hope of performing a more qualitative job.

During the course of preparing this work it was necessary for the author to avail himself of the contributions of many people and agencies which he has acknowledged by footnotes. Here he acknowledges his indebtedness to them and all other persons whose influences figured in the development of this work. Special appreciation goes to Dr. W. T. Melchoir for his suggestion and explanation of the psychological approach to the scientific method of teaching, to Mr. J. E. Ellison for guiding the development of this work, Mr. H. T. Jones for helping to initiate the study, to members of the science staff for whatever influences they may have exercised during the progress of courses, and to my wife whose challenging inspiration motivated my endurance, and to whom this work is dedicated.

E. D. C.

TABLE OF CONTENTS

CHAPTER I

INTRODUCTION

According to Heiss,[1] the youth of today must adjust themselves to a much more complex and chaotic world than existed a generation or even ten decades ago. This is a fast moving age in which strong forces are tending to produce rapid changes. Young people everywhere have become so accustomed to the phrase "an age of science" that they take it for granted and rarely stop to reflect on the premises lying back of the generalization. Sampling of the factors at work in present day life is convincing evidence of the rapid world change which science precipitates. Technological advances were unparalleled in World War II. Television has become commonplace and may be slowly changing the entertainment habits of large segments of the population. Travel by air has linked the remotest corners of the earth. Depletion of the soil by such natural phenomena as floods, dust storms and erosion, and the rapid increase in population make adequate food supply doubtful in the future. Atomic discoveries promise a new emancipation.

It seems reasonable to predict that the forces of science will play an increasingly important role in the lives of individuals, and that more and more they will be confronted with problems which have causes and solving potentials deeply rooted

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[1] Elwood D. Heiss, Modern Science Teaching, p. 12.

in the area of science. The casual role of science as a basic factor in many of our present-day social and economic problems according to Heiss[1] makes it mandatory for the science teacher to look for ultimate goals of his instruction beyond the narrow confines of pure science to the social implications that result from technological advances. It is no longer sufficient to regard the end of educational procedures as preparation for some dimly visioned future. Young people are experiencing life on every hand and must be conditioned to adjust to its forces, and to solve the problems which are at their maturity levels. It is difficult to find a single element of social change which does not affect the immediate lives of girls and boys, creating real problems for them which they must solve. "Thus, science teachers are faced with the necessity of becoming sensitive to these problems of young people, and so setting the stage for learning, that science materials will make a contribution to the solution of their problems."[2]

"The greatest need in the field of high school science teaching today is a reorganization of content to meet the needs and interests of present day life".[3] According to Hurd, science

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[1] Heiss, op. cit., p. 14.

[2] Ibid.

[3] Victor H. Noll, The Teaching of Science in Elementary and Secondary Schools, p. 125.

teachers are overwhelmingly opinionated that meeting the needs and interests of present day life in teaching high school science is the most pressing and important problem they face.[1]

"The science that will be of practical values to housewives, cooks, [launderers, factory workers, janitors, loggers, pulpwood cutters, domestic servants], and truck drivers is not in all probability the kind of science that is usually offered...."[2] One must not assume that instruction in the fundamental principles of science is adequate preparation to meet the needs of all. The real issue is to determine how these fundamental principles are to be used in the practical situations that the housewife or cook meets in her vocation. Most of the young people [in Conroe] do not need chemistry or physics or biology as such so much as they need the science they come in contact with in their daily lives.[3]

The science program at Booker T. Washington High School in Conroe, Texas limits itself to college preparatory organization and presentation of content. The State Department of Education has a remote but automatic control of the science offerings in that the school in question, as do all others of the state must meet the requirements of this department,

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1 Archer W. Hurd, "How Shall Science Instruction be Organized?" Science Education, XVIII, No. 4 (1934) 106-112.

2 Noll, op. cit., p. 146.

3 Ibid., p. 124.

but unlike some others of the state it has neither the teacher personnel, facilities, or building space to allow for electives that would supplement the traditionally not necessarily required, but acceptable courses to accomodate required science units. General Science is a first year high school requirement according to the 8-4 plan on which Booker T. Washington operates and so the respective science department has offered General Science as such to be followed with Biology and Chemistry in grades ten and twelve respectively, because they were adaptable to the organization. The content of these courses all presuppose future matriculation on a college level.

Science courses should fix their objectives as preparation for life, and especially for the life of the majority of the people. This involves less emphasis on the technical and abstract phases of science, and more on the kind of science needed in vocations, in leisure-time activities for appreciation and enjoyment. The interests of the boys and girls in Conroe vary from no scientific knowledge and attitude to a general application of scientific principles existing about them in the box factory, saw mills, carbon and oil industries, homes and domestic service ranging from maid, yard keeper, chauffeur, and baby sitter to general flunky. On the other hand their needs are far more tremendous by virtue of the existing environment.

Since the concensus of opinion is that "General Science is meeting the needs and interests of boys and girls better than specialized courses are doing",[1] and since the organization impels General Science offerings in a composite course, this work has for a purpose to suggest an approach to a proposed program for teaching General Science as a course designated at 9th grade level in keeping with state requirement and the writer's immediate 8-4 school plan of organization, and to suggest a method of instruction that will stimulate active interests in the complete curriculum, thus precipitating the maximum benefit for Conroe's children. This study proposes a subsidiary purpose to show how Conroe's children can be made scientific minded through this special program of teaching.

The method employed in this study is an analyzation of the state adopted course of study, the proposed textbooks by the immediate system, and the use of certain unstandardized classroom techniques and procedures devised by the writer. The data are obtained from certain observative criteria revealed through follow-ups of a five year span of certain vocation and avocation adult activities of former and current graduates from Booker T. Washington.

Forty questionnaires were circulated to the places of Negro employment to ascertain the kind of employment and proficiency of Negro workers. The writer made twenty-five interviews to housewives and to certain other employers who

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[1] Noll, op. cit., p. 24.

did not accept questionnaires favorably. The Public School records were analyzed for pertinent information regarding follow-ups of children who entered college and the health status of Conroe's children. The Office of the State Department of Health, Welfare Office, Red Cross Office and County Clerk's Office furnished data on births and deaths and certain morbidity data on which this study is based. The Utility Companies (natural gas, electricity and water) gave certain information revealing the retarded development of the city in the Negro areas. This study further includes research and study of contemporary proposals and comparative analyses of their findings.

This work limits itself to an approach to a proposed program for teaching General Science in the Booker T. Washington High School where the interests are far from specialization, but are confined to a standard agriculture curriculum which displaces all electives with required courses irrespective of interests. The work further limits itself to a situation where lack of city recreational facilities, and where economic insecurities often make it imperative for many to drop out of school to assume adulthood at the end of freshman high school, the year in which General Science is offered at Booker T. Washington, but when the student is of the age and physical stature to offer help by way of unspecialized jobs such as cafe, laundry, private home, yard and grocery store help. For wholesome and complete living the school feels responsible even though it does not finish the student in its curriculum.

A final delimitation may be seen in the fact that the entire high school science program includes only General Science, Biology, and Chemistry for grades nine, ten, and twelve respectively.

Except for the words general science, propose and program, the terms embodied in this problem have no unusual meaning and may be given a general connotation. For this work propose means to suggest unvalidated but scientific potentialities for teaching General Science in a specific locale. Program suggests a plan or procedure for teaching General Science in the Booker T. Washington High School. General Science in this work refers to a specific course which is taught independently of other courses, but which is a combination of physics, biology, and chemistry not as a series of short and independent courses, but as they contribute to a unified course of instruction in the practical problems of the pupil's life. It is founded on the progressive offering of elementary sciences, and is the development of these experiences toward further development and additional growth of the pupils.

For further clarity the writer defines words used in the hypothesis and body of this work. Needs includes everything necessary to insure the optimum development of the potential abilities of a pupil - intellectual, physical, moral, emotional, and social - both in relation to his present interests, abilities and level of achievement, and in relation to the probable future demands of the individual and of society.[1]

Interests connotes a subjective-objective attitude, concern, or condition involving a percept or an idea in attention, and a combination of intellectual and feeling consciousness. It may be temporary or permanent based on native curiosity and conditioned by experience.[2]

Scientific attitude is the mental readiness to search for truth without prejudice, to change opinion on the basis of new evidence, to seek cause-and-effect relationships, and to discriminate between fact and theory.[3] Noll[4] analyzes the scientific attitude to include the following habits: (1) "accuracy in all operations including calculations, observation, and report". The dominating urge of all science is towards truth and that is not to be reconciled with inaccuracy. (2) "Intellectual honesty". This habit goes beyond the little measure of accuracy that it includes to submerging of personal bias and prejudice, and to the acknowledgment of wrong when

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[1] Carter V. Goode, Dictionary of Education, p. 271.

[2] Ibid., p. 223.

[3] Ibid. p. 37.

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proved so. (3) "Open-mindedness" involves a willingness to accept new data and facts and an unwillingness to accept a solution as final and ultimate. (4) "The habit of looking for natural causes." It is a conviction of universal operation of the law of cause and effect, and it does away with unnatural phenomenal causes on which superstitions are founded. (5) "The habit of suspended judgment" involves the habit of qualifying conclusions drawn in accordance with facts available and missing. It discourages jumping to unfounded conclusions. (6) "The habit of criticism" suggests the ability and willingness to examine oneself, and to look at proposed remedies, explanations, and natural occurrences in a questionable sphere.

Chapter IV suggests the scientific method as the nearest approach towards confirming General Science within the experiences of the children. For this work the writer subscribes to Childs'[1] definition of scientific method.

> "The intellectual commandment of scientific method is to learn to think in terms of things to be done - of acts to be performed - as well as what we anticipate will happen as a result of that which we do. Indeed, the heart of scientific method is the hypothesis, and to be acceptable an hypothesis must meet the basic tests: it must define

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1 John L. Childs, "The Morality of Science and the Values of Democracy", Science Education XXXIII No. 4 (1949) 265.

> an act to be performed under definite and specific conditions, and it must also describe a result or situation that will come to pass, when the act described is actually carried out. In order to teach a child scientifically, we have to teach him to think in terms of definite overt acts that will define, refine, test, reconstruct, and validate through public means that which he asserts is the case."

This study then suggests that the science teaching at Booker T. Washington High School at Conroe, Texas is not confirmed within the needs and interests of the high school students, and that it does not motivate scientific queries nor optimum environmental adjustments and developments with a view to changes when the need arises.

Thus, the hypothesis evolves to suggest an approach emboding the scientific method to a proposed General Science program at the ninth grade level based on the immediate needs and interests of the high school pupils in Booker T. Washington High School, in Conroe, Texas. The presumption is that proper methods of instruction can create a scientific attitude that promotes environmental adjustments and developments, and a discriminatory power reflective in other instructional courses in and out of school. Authoritative data show that the composite needs of all students in Conroe divide to show a small and large percentage of college and non-college potentials respectively.

CHAPTER II

REVIEW OF LITERATURE

Except for work done in the field of science toward revolutionizing the approach to a scientific one by individuals and state departments, and showing that the very nature of science reveals potentials subject to dynamic controls influential in the lives of people and therefore requires constant readaptation of subject matter, methods and devices to meet the needs of people, and except for such studies as are referred to in Chapter III, The History of Science Education there exists no related study.

These studies all recognize and acknowledge a dominating influence of science on life, but how the various elements of science shall be included and taught to meet the needs and interests of high school youth have engineered the several studies.

Instruction in Science[1], an outgrowth of a cooperative effort by the membership of the North Central Association of Colleges and Secondary Schools in 1928 is an effort to determine America's standing in secondary education. This study was initiated on the belief, "that the people of the United States are now getting a new conception of education.

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[1] Wilbur L. Beauchamp, Instruction in Science, pp. 1-63.

They are coming to look upon education as a preparation for citizenship and for daily life rather than from the money return from it. They are looking upon the high school as a place for their boys and girls to profit at a period when they are not yet acceptable to industry."[1] With the inadequate fund provided, the committee reduced its study to cover, "those things which pertained strictly to secondary education, that is, its organization; its curriculum, including some of the more fundamental subjects, and particularly those subjects on which a comparison could be made between the present and earlier periods..."[2]

Thus, the evolving Instructions in Science summarizes this survey of instruction in science. Wilbur L. Beauchamp[3] carefully analyzed available courses of study materials, and visited a considerable number of schools to acquaint himself more in detail with the practices and procedures in schools judged to be outstanding in the science work. The investigator found that general science courses had risen. Chemistry instruction had been altered to bring the subject matter to actual life conditions, and the

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[1] Beauchamp, op. cit. p. v.

[2] Ibid. p. vi.

[3] Ibid. pp. 1-63.

important position of science as a subject of study in the schools justified an extended treatment of its aims, content, and teaching procedures. The data presented indicate that, in general, the courses of study are not based upon an adequate and clear-cut theory of education. They raised the question of whether or not it is advisable to proceed in the revision of existing courses of study until more evidence is obtained to serve as a basis for such revision. Observation of classroom teaching and the different suggestions given in the courses of study indicate great confusion as to the methods to be employed in teaching science. A shift has occurred from the organization of courses in terms of topics and subtopics to organization around certain major ideas or concepts. A shift has taken place from the topical method of developing a topic to the problem method of development. A greater emphasis on the interpretation of the environment is observed in the more recent courses. A widespread use of illustrative materials supplied by newspapers, magazines, and government bulletins was also observed in all science classes. The use of the classroom period for oral recitations has been replaced to a considerable extent by the use of the period for study purposes under the supervision of the teacher. The introduction of materials to serve as study guides is apparently widespread. The more recent courses of study include a much greater number and variety of suggestions for teaching than the older courses. The laboratory work in the specialized sciences has, in the past, often been divorced from the work in the textbook. More attention is being given to visual aids than ever before. This list of innovating practices does not necessarily indicate the changes which should be brought about in the teaching of science. The trends do, however, "disclose the variations from the dominant practice which may well result in progress and which, as already stated, should be given careful consideration by those who are undertaking the improvement of instruction in science at the secondary school level."[1]

Science in General Education[2] appeared in 1948 as the result of a conviction that college teachers everywhere were interested in curricular changes occurring in sister institutions. This study brings together a set of statements from representative institutions describing science courses for the student who does not intend to devote his life to science or to a related occupation.

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[1] Beauchamp, op. cit., p. 61.

[2] Earl J. McGrath, Science in General Education

It presents detailed information about a wide variety of such courses together with discussions of the philosophic principles on which they rest. This study is further designed to report the progress already made in overcoming difficulties in science education in a few institutions for the benefit of those faculties only now beginning to reconsider the aims of higher education for the thousands of students who do not wish to become specialists or scholars in any particular field, but who do wish to gain enough knowledge to make intelligent decisions as citizens. Herein lies the analogy of this study to that of the writer's.

The study further shows that few colleges have realized the necessity of organizing science to meet the demand of general education, and that all courses should be offered on a sequential basis growing out of the student's high school preparatory courses that were sequential on the basis of his interests. (It does recognize the fixation of General Science first, or in the ninth grade depending on the plan of organization, and the fixation of Biology in the tenth grade.) Thus, the revision in colleges makes a parallel revision of high school sciences imperative, and this realization makes <u>Science in General Education</u> analogous to the writer's study.

Another parallel may be seen in <u>Science Teachers</u>

Objectives and Attitudes Toward Using Community Resources.[1] It is a study of fifteen Maryland Negro Secondary Schools designed to investigate science teachers' objectives and attitudes toward using community resources and data in teaching. The study was launched on the belief that science teachers would be directed to self-evaluation and improved teaching practices, and further that the state of Maryland and Morgan State College officials would be aided in charting new directions in science education. The study revealed that high school science teachers needed to concentrate more fully on the importance of the physical environment; that learning situations are increasingly centered in personal and community problems; that biological and physical resources of the community have been used in functional purposes by providing the kinds of learning and experience that converge into such areas of human activity as health, safety, citizenship, democratic living, social adjustment, personality and good taste; that needs for teacher competence developed in functional areas of science, non-science areas, scientific method of problem solving, use of community resources, adult education

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1 Thomas P. Fraser, "Science Teachers Objectives and Attitudes Towards Using Community Resources", Science Education XXXIII No. 5 (1949) 350-60.

extra class activities and intercultural relationships, and that the areas in which science teachers need broad understandings are human growth and development, and secondary education (including the place of science in its program). Finally the study becomes valuable to Morgan State College in redesigning its curriculum to provide unified and broad background for all students because "to meet the needs of today's complex society, science teachers need a wide range of knowledge and a broad background of general education."[1]

The relationship of Victor H. Noll's[2] current study lies in his proposed scientific method to teach all sciences and to procure a scientific mind, his proposed science curriculum that determines what sciences will actually function in the lives of young people, and his proposed measurement for achievement in science by the preferred objective testing method.

Summary of the Relative Achievements of the Objectives of Secondary School Science in a Representative Sampling of Fifty- Six Minnesota Schools[3] reveals that science

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1 Fraser, op. cit., p. 360.

2 Noll, op. cit.

3 Kenneth E. Anderson, "Summary of the Relative Achievements of the Objectives of Secondary School Science in a Representative Sampling of Fifty-Six Minnesota Schools", Science Education XXXIII No. 5 (1949) 323-328.

instruction in the Minnesota high schools in 1946-47 was in need of improvement. This study resulted in suggestions by teachers that colleges and universities directly entrusted with the preparation of science teachers be seriously concerned.

This study did not include all sciences. It had for its purpose to describe the current practices in the teaching of sciences, the teachers in terms of preparation, experience, teaching load, teaching objectives, and professional activities; to determine the relative contributions of factual information, understanding of principles, scientific attitudes and intelligence to the understanding of the scientific method, to determine which pupil factor or factors in the pupils' background contributed to the achievement of the objectives of science instruction, and to determine which teacher factors, or factors in the teaching situation contribute to the achievement of the objectives in science instruction.

The study results showed a lack of preparation of the teacher in the sciences, the dependence on textbooks and manuals, the lack of understanding as regards the sciintific method in science, the lack of procedures for developing the understanding of principles and acquisition of scientific attitudes, the lack of differentiation in terms of curricular materials, and the lack of professionalism.

San Francisco State College initiated a revision of its curriculum and science department on the high school science experiences of 506 non-science curricula students in a study by Stanley W. Morse.[1] The sciences most frequently included in the survey were Chemistry, Biology, and General Science in the order named. The investigator believes that General Science fell third because many of the 506 students reporting only high school sciences had been exposed to General Science as early as the seventh grade and therefore did not include it in the high school survey. This study indicated that studies in the two broad areas of biological science and physical science had been omitted from approximately one third of the 506 students. Therefore the theory (analagous to the writer's study) evolves that any college program designed to round out the total experience of the students should include both science areas.

The adequacy of the scientific method of instruction as a suggestive approach to making General Science meaningful by motivating scientific thinking is made a more desirable goal by the Blair and Goodson study.[2] In 1938

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[1] Stanley W. Morse, "High School Science Experiences of 506 Non Science Curricula College Students", Science Education , XXXIV No. 2 (1950) 117-26.

[2] Glenn M. Blair and Max R. Goodson, "Development of Scientific Thinking Through General Science", School Review XLVII No. 11 (1939) 695-701.

these two men made a study to see if General Science would automatically teach scientific thinking or if special effort of deliberate attempt toward developing scientific thinking were necessary.

The Noll test was the instrument used in this study. Three groups of ninth grade children were used - one group taking General Science where the teachers made special effort to teach scientific thinking - one group taking General science where the teachers made no special effort to teach scientific thinking - and one group of non-science children.

The test series showed that the specially taught children in General Science where the teacher's aim was scientific thinking showed a gain of 7.3; the children taught with no emphasis on scientific thinking made a 4.0 gain, and the non-science children showed a 4.8 gain.

This study seems to indicate that studying General Science will not in and of itself make a unique contribution to the development of scientific attitude on the part of ninth grade pupils; that marked improvement in scientific thinking is secured however through the General Science course when special attention is directed toward obtaining this outcome, and further that open-minded thinking from cause-to-effect is not always derivable from a course labeled General Science but that such results are secured only when the General Science course provides specific opportunities for training in thinking of this type.

These reviews do not portend all inclusiveness, but they do represent some of the most nearly and currently related.

CHAPTER III

HISTORY OF SCIENCE EDUCATION IN AMERICAN SCHOOLS

Material for this chapter was secured in the main from Modern Science Teaching.[1] This chapter finds significance only in the fact that reviewing the development of science education shows more clearly and definitely the emphasis placed on science in the delineation of the early narrow school curricula to a wide and diversified sphere in the modern school organization, and the advent and importance of science in the writer's respective high school curriculum.

Formal education in America began about 1635 with the founding of the first Latin grammar school. These schools were established as college preparatory schools for boys contemplating professions, but they soon died out because of their failure to meet the needs of the times. Record gives no appearance of any science offerings in the Latin grammar schools.

Public academies began replacing these schools about 1750 and by 1850 were the dominant secondary school type. The academies were designed to meet the needs of the boys and girls who were not going to college. Each offered a much more practical curriculum. Here science education

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1 Heiss, et al., op. cit. pp. 4-12.

began by way of natural philosophy, a forerunner of physics.

The free public high school grew out of the academy and included a curriculum of science influenced by those in the academies. These consisted for the most part, of natural philosophy, natural history, and chemistry. Each of these sciences was in the curriculum of the first American high school founded in Boston in 1821.

Natural philosophy had its beginnings in the European schools and was brought to America and included in the curricula of the earliest academies. It consisted of materials selected from the fields of physics, astronomy, and earth science. The treatment was largely descriptive and there was little or no laboratory work. Many of the textbooks were inductive in their method. A topic was introduced with a problem, which was not explained. The topic usually ended with a statement of a principle. Some of the early textbooks went through as many as forty editions.

Chemistry was offered as an elective subject in the curriculum of the English High School in Boston in 1821. Generally chemistry had a very uncertain place in curricular offerings. Thus, some high schools had it while others did not. Little or no laboratory work was done by students prior to 1860 since many schools had difficulty in getting apparatus and chemicals.

Botany and zoology comprised the natural history course offered in the early academies but there was no integration of these as we have now in the high school biology course. The emphasis was on the learning of facts. Considerable attention was given to the physiology and morphology of plants and animals.

An appraisal of the science education of the first fifty years of the high school movement would seem to indicate that the courses were taught primarily for their practical and informational values. There was little or no laboratory or demonstration work, and great emphasis was placed on the memorization of factual material. The courses were popular and were taken by many students who were not going to college. Although some of the text-books were inductive in development, most of the teaching was by lecture and recitation methods.

Between 1872 and 1900 colleges influenced the sciences offered in high school. Harvard took the lead in 1872 by stipulating acceptance of physics and other high school sciences acceptable for college entrance, and later standardizing a list of forty-six acceptable experiments in physics for college entrance. Thus, offerings in high school science gravitated toward college requirements. The colleges further conditioned and limited the high school science offerings by preparing their courses of study on the basis of college requirements for entrance, and consequently every student took the required courses for college preparation whether he planned going to college or not. Many of the high school textbooks became simplified and more condensed college courses having no value beyond that of college entrance.

The college continued to exert its influence in conditioning the high school science curricula down through the early years of this century.

A Committee of Ten, of the National Education Association in their 1893, 99, and 96 reports on college entrance requirements initiated a movement toward standardization which culminated in the organization of the College Entrance Board. Prior to these reports high schools had been offering short term courses in many sciences such as physics, chemistry, astronomy, geology, botany, zoology and physiology. This Committee on College Entrance Requirements condemned the practice of short courses and recommended full year courses in fewer sciences. Thus, the first attempted standardized science sequence for high schools came about. The courses proposed were: First year - physical geography; Second year - biology; Third year - physics, and Fourth year - chemistry.

Twiss[1] sums up the effects of the period of college domination of high school science as follows:

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1 G. R. Twiss, Principles of Science Teaching, p. 188.

> "As far as science is concerned the results have been both good and bad. Among the good results are the establishment of the principles (1) that high school teachers should have adequate college training for their work, (2) that laboratory work, field excursions, and some reference book work should be carried on in connection with each of the sciences, (3) that schools should be adequately equipped with laboratories, apparatus, and libraries for such work, (4) that double laboratory periods should be provided in the time schedules for the laboratory exercises, (5) that laboratory notes should be systematically entered in suitable books by the students, (6) that pupils should be taught not merely to memorize but to think. Among the bad results have been (1) the tendency to cast all instruction in one mold in the attempts to meet the specifications of syllabi and examinations (2) over-emphasis on the assimilation of subject matter and the consequent undervaluation of the scientific method of study, by means of which the subject matter of science is best acquired, and (3) worst of all discouragement of initiative on the part of school teachers and administrators because of the burdensome amounts of subject matter that were called for by these authoritative syllabi."

Readjustments became evident between 1900-1920. The college dictated high school curricula clearly proved their inadequacies to meet the needs of young people. The high school population was increased and the demand for a different type of curriculum was evident. A junior high school movement was begun.

Most pertinent to the development of this work however is the change in science offerings that was concomitant to the reorganization of the school plans. About this time in an attempt to meet both the needs of the changed high school population is the significant introduction of general science to replace physical geography as the first year subject of the four year science sequence. This change came about in an attempt to meet the need of a terminal course in science for students not going to college and also to provide an exploratory course for the later specialized sciences.

In some of the new junior high schools the science offerings were pushed down into the seventh and eighth grades. This had the effect of increasing the opportunities for science experience over a longer period of schooling. In the course general science largely replaced physical geography.

The trend toward change, to meet more adequately the newer demands on the high school, moved slowly, but was accelerated by the reports of the Commission on the Reorganization of Secondary Education of the National Education Association. A sub-committee of this commission gave the first report dealing exclusively with the teaching of science in the secondary school, and constitutes one of the landmarks in science teaching in American schools.

This report gave impetus to an emerging science sequence in the high school and pointed science instruction toward larger social goals than had been true previously. The report showed further how science instruction could contribute to the cardinal principles of secondary education.

The Thirty-First Yearbook of the National Society for the Study of Education advocated for the first time a twelve year sequence beginning in the elementary school and extending through the high school. It also advocated that science instruction on all school levels be organized around certain broad concepts or generalizations.

In 1938 the Commission on Secondary School Curriculum of the Progressive Education Association issued a report, "Science in General Education" which advocated that high school science be taught around broad areas of living such as (1) personal living, (2) immediate personal-social relationships, (3) social-civic relationships, (4) economic relationships, (5) the disposition and ability to use reflective thinking in the solution of problems.

The National Committee on Science Teaching of the Department of Science of the National Education Association, after a three year study issued a series of reports in 1942. Two of these reports had to do with the changed emphasis on the teaching of Science in America. These reports were Science Teaching for Better Living and Redirecting Science Teaching in the Light of Personal-Social Needs. These reports bore tremendous significance because they were prepared by science teachers. They advocated somewhat the same point of view as of the Progressive Education Association mentioned already but perhaps they might have gone further in suggesting that pupils have science needs in such areas of living as safety, conservation, health, and vocation.

The National Society for the Study of Education published its Forty-Sixth Yearbook entitled "Science Education in American Schools" in 1947 and stressed the importance of science taught for its functional value in aiding the adjustment of individuals. It urged support of the inclination or tendency to offer physical science in the high school for those pupils not going further in the study of science.

CHAPTER IV

SUGGESTED METHODS ADAPTABLE TO THE SCIENTIFIC APPROACH

This chapter is designed to suggest methods and techniques of teaching that are specifically adaptable to the following proposed, or any science program, and susceptable to approach by way of the scientific method.

"Science is quite as much a method as it is subject matter",[1] and the feeling has been growing that the important outcomes of science study are training values rather than factual information.

There is no one best method apart from the person doing it, the material with which it is done, the person to whom it is done, and the conditions under which it is done.[2] Thus, all experimental evaluation of method involving the human element is necessarily inconclusive and should be in general terms as is true in this given situation. Yet the scientific attitude and the scientific method are considered more important to the individual in meeting his life problems than the memory of facts.[3]

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[1] Elliot R. Downing, "The Elements and Safeguards of Scientific Thinking", Scientific Monthly XXXVI No. 3 (1928) 231-43.

[2] Noll, op. cit., p. 43.

[3] Victor H. Noll, "About Integration in Science?" School Science and Mathematics XLI No. 3 (1941) 242.

The teacher must formulate a philosophy of teaching and create methods to suit his own conditions and needs,[1] but he must guard against the fixation and rigidity of his philosophy and method else it becomes unscientific. They should be flexible, adaptable, and developing in nature to the conditions and factors of social change. The problems confronting boys and girls everywhere are complex and certainly in this locale of study where they are torn between standards of idealistic virtues and the immorality often contingent with saw mill living; where a sense of the beautiful and yearning for the cultures of civilization are thwarted with the cheap, gaudy, and selfish; where parental guidance in the interpretation of the physical phenomena of life and earth is the public school teacher's task, and where certain laws of nature are taboo for parental and public discussion with the child. Yet this same child experiences and satisfies his queries unscientifically and often unreliably - just to mention a few of his problems.

Heiss[2] says this complexity is true not only because the forces bringing about social and economic changes are complex but also because individuals differ in hereditary

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[1] Heiss, op. cit., p. 14.

[2] Heiss, op. cit., p. 15.

background - emotional patterns, needs and sensory equipment. This means that many different types of behavior will result from a group of boys and girls demanding adjustment from the same situation.

The writer suggests the scientific approach as the nearest toward helping students adjust to the situations confronting them. This ofcourse further suggests studying the broad picture of their present day life and seeing the larger aspects from which their problems arise.

According to the Forty-Sixth Yearbook[1] an individual cannot appreciate the importance and the many contributions of science unless he has some understanding of his environment and the way science affects both the environment and his own life situations.

Dr. Smith[2] predicts that unless the science curriculum is made more appealing to the normal pupil and more functional in daily living, not only will the school science program suffer but eventually technological civilization itself will pay the penalty for the inability of educators to meet the challenge of scientific progress.

The real instructional problem Smith[3] says then is to

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1 Nelson B. Henry, The Forty-Sixth Yearbook, p. 178.

2 Victor C. Smith, "Making the Secondary Science Program Function", Secondary Education, XII No. 2 (1945) 6.

3 Ibid.

select the crucial, functional material needed in a given situation, and to teach it intensively and scientifically well.

The scientific method in this case then suggests the use of laboratory instruction and equipment. It further implies not necessarily a science laboratory only, but a working situation of whatever guise. Most of the methods peculiar to science teaching arise out of its extensive reliance upon the laboratory.[1]

Suitable and well prepared demonstrations are effective methods of increasing the reality of scientific law and generalization. The writer offers this ability certainly not as an indispensable one, but as an asset to the science teacher's accumulated techniques.

Though contrary to the writer's point of view Noll[2] suggests that unless there are more justifiable reasons for pupil performance, the teacher may just as well perform the experiment as a demonstration if it is a rather expensive one, and thereby effect saving of equipment. Yet the writer contends that no sacrifice should be made at the expense of learning. A further justification for demonstration may be seen in the performance of a difficult

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[1] Noll, op. cit., p. 44.

[2] Noll, op. cit., p. 44.

or dangerous experiment and expecially with inexperienced pupils.[1] Whenever there is an experiment that cannot be performed individually within one class period, the teacher may resort to demonstration.

A reverse sense of what has been stated may seem to suggest that individual laboratory experimentation may be deferred to simple, short and less expensive experiments. However this does not mean throughout the course, but that experiments for individual performance should be selected that can be successfully performed by all the pupils.

To facilitate the laboratory method pupils should be required to submit brief but carefully and accurately written reports of experiments. Although no study can claim to settle the best method for reporting laboratory experiments, they all agree that, "the important element is not by what method the experiment is recorded but how well it is recorded by whatever method is used."[2]

Pupils should further be required to make simple, analytic drawings rather than representative ones. Probably the chief, if not only justification for laboratory drawings is to clarify and fix in the minds of pupils the things learned or to be learned. The analytic drawings

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[1] Noll, op. cit. p. 47.

[2] Ibid., p. 50

aim primarily to show structure and function without reference to artistic effect or pictorial detail, while the representative drawing emphasizes the artistic effect perhaps at the expense of scientific accuracy.

In an experiment conducted in General Science, Ayer[1] found that representative drawing not only fails to aid memory but may sometimes interfere with it. It causes bad habits of analytic study; it produces copyists instead of scientists, and it diminishes interests. The analytic drawing on the other hand aids retention and directs attention to the essential features of the experiment.

Other available experimental evidence on analytic and representative drawings rather consistently indicate that the latter seldom, if ever justifies the large amount of time involved. However with the few artistic, certain concomitant satisfactions may be achieved in the construction but with the average pupil the time could be spent much more wisely.

The scientific method suggests the use of laboratory manuals only in a problematic situation. This does not necessarily mean turning the pupil loose in the laboratory with no instructions or with oral instructions only.

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[1] F. C. Ayer, The Psychology of Drawing with Special Reference to Laboratory Teaching, pp. 107-68.

It means that the teacher presents a variety of problems to the class, from which the individual pupils select challenging ones and the teacher and pupil together formulate the problem and the method of solution without printed or written directions, making the initiative rest with the pupil instead of the teacher. According to Noll[1] the problem method, if properly administered, provides stimulation and motivation to the pupil, causing him to think harder and to achieve more than if he were taught by the usual laboratory manual style. This traditional use of the manual, Noll[2] thinks results in a cook-book type of work characterized by slavish following of printed directions.

Hunter[3] and Walter[4] among others made separate investigations of methods conducting laboratory work with manuals. Both used manuals with certain groups and some

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[1] Noll, op. cit., p. 53.

[2] Ibid. p. 53.

[3] G. W. Hunter, "The Oral Method Versus the Laboratory Manual in the Laboratory", School Science and Mathematics XXX No. 4 (1930) 429-432.

[4] C. H. Walter, "The Individual Laboratory Method of Teaching Physics When No Printed Directions are Used", School Science and Mathematics XXII No. 1 (1922) 29-32.

variety of the problem method in which the pupil formulated his own laboratory problem and procedure. The results indicated superiority of the problem method to others.

Another suggestive technique that may aid the scientific instructional method lies in the use of workbooks. Yet, there has been much difference of opinion as to their actual influence upon achievement. Some teachers are very enthusiastic over workbooks, while others consider them merely a novel or craze. Thus, a number of studies have been made in an attempt to evaluate their use as a teaching aid. Among them are studies by Browning[1], Hurd[2], and Peterson and Douglass[3] which indicate unanimously that workbooks, although they seldom seem to, may result in greater learning (if properly used) as measured by objective tests of achievement in science. These studies further indicate that there is little measurable difference

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[1] Charles A. Browning, "The Work-Sheet for High School Physics", Science Education XVIII No. 2 (1934) 37-41.

[2] A. W. Hurd, "The Workbook As An Instructional Aid", School Review XLIII No. 10(1935) 608-613.

A. W. Hurd, "The Textbook Versus Worksheets in Instruction", Educational Supervision and Administration XVII No. 12 (1931) 661-664.

[3] George W. Peterson and Harold R. Douglass, "Published Workbooks Versus Pupil Made Notebooks in Ninth Grade General Science", School Review XLIII No. 10 (1935) 608-613.

between the accomplishment of classes who use workbooks and those who do not. Thus, the writer offers the use of workbooks as an instructional aid on the assumption that if and when the teacher can advantageously stimulate pupils to self activity, and to present a comprehensive set of problems that will result in a feeling of greater accomplishment and satisfaction on the part of the pupil, the technique is worth the while. Certainly the writer does not suggest using workbooks for"busywork".

The use of visual aids as a teaching device has never been doubted for it seems reasonable to assume that the greater the variety of sense impressions utilized in learnin the more effective it will be. Carl E. Wyman[1] among others used all possible visual aids, including mounted pictures, slides, and films in General Science and concluded that groups taught with visual aid devices learned more than groups taught without them. Noll[2] concludes that visual aids make for higher achievement than no visual aids and that employing projection apparatus such as slides and films seem to be the most effective.

Finally the writer suggests organization and presentation of materials of instruction by methods that encourage

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[1] Carl E. Wyman, "Visual Aids - Of What Worth?" Science Education XVI No. 4 (1932) 291-296.

[2] Noll, op. cit., p. 56.

the pupil to a maximum of freedom and self direction and that permit the fullest possible provision for individual differences. Freedom for the pupil rests chiefly on the development of greater interest in the subject, wider and more varied reading, greater originality and initiative, and increased pleasure from the study of the subject.

It would seem to follow now that a choice of method would be the teacher's first concern. Here Noll[1] again suggests that it may probably be assumed that if one plan accomplishes maximum freedom and pupil self-direction, others of repute might be expected to do so too. The distinguishing features of such popularly discussed plans as the Dalton, Morrison, or Winnetka Plans over the more traditional ones may suggest themselves as important in the teacher's selection. The first distinction lies in the unit organization where subject matter is organized into meaningful wholes instead of artificial and arbitrary chapters. The second distinction lies in individualized instruction. This does not mean neglecting group discussions and presentations, but in the main each individual pupil proceeds at his own rate, and he follows his own interests in the study of the unit together with minimum required essentials.

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[1] Noll, op. cit., p. 58.

Bruce,[1] Garber,[2] and Watkins[3] are all in agreement that the unit plan as such has certain advantages over the usual daily assignment plan and this superiority centers largely around the following three points: children taught by the unit plan seem to retain longer what was learned than those taught by traditional methods, the unit plan produces better results with respect to understanding of principles and applications, and finally, the unit plan is best liked by pupils.

It is generally agreed that supporting studies and experiments have indicated direction toward removing such restrictions and requirements from science courses as definite courses of study or textbook, teacher control and direction, tests and examinations, and in some cases marks. In point of verification Noll[4] reports an experiment by Bernard S. Bradbury, "A Pupil Initiated Course in General

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[1] G. V. Bruce, "An Attempt to Vitalize Chemistry Teaching in the High School Through a Modified Form of the Unit Assignment Technique", <u>Science Education</u> XVI Nos.2, 10 (1932) 209-219; 392-403.

[2] Elinor Garber, "The Project Method in Teaching Chemistry", <u>School Science and Mathematics</u> XXII No. 1 (1922) 65-73.

[3] R. K. Watkins, "The Technique and Value of Project Teaching in General Science", <u>General Science Quarterly</u> VI, VII, and VIII Nos. 1, 2 and 4 (1924) 235-256; 311-341; 387-422.

[4] Noll, <u>op. cit.</u>, pp. 60-62.

Science for a Slow Group". Two classes in ninth grade General Science divided in Groups A and B were the subjects. Group A had a mean I. Q. of 116 and Group B 93. On the Dvorak test Group A had a median score of 91.5 and Group B 85. Group A came mostly from superior homes and Group B from inferior homes. Group A included 33 white and 2 Negro children and Group B included 18 white and 11 Negro children.

Group A was taught by a woman of good science training and four years of high school teaching experience, and Group B was taught by the experimenter who has similar training and eleven years teaching experience. The classes met at the same hour and each teacher used his preferred method of teaching.

In Group A the first ten minutes were used for oral and written review, and the following twenty minutes were used for discussion of the day's lesson followed by the assignment and twenty minutes of directed study. Two of the five periods per week were used for laboratory, chiefly demonstrations.

Group B. was taught according to the following principles: (a) use a variety of texts, (b) do as much experimentation as possible, (c) follow pupils' interests (d) pupils select and perform experiments, (e) insist on a list of references for each topic, (f) make pupils feel responsible for the course, and (g) permit expression of pupil's ideas and originality at any time.

During the first two weeks pupils in Group B simply broused, no assignments were made, and pupils did pretty much as they wished. By general consent the topic (air) was selected to work on in the third week. Thereafter the general procedure was (a) selection of topic, (b) preparation of individual reference lists and combining these for class use, (c) discussion by individuals of points of interest, (d) performing experiments and discussion of results, and (e) discussion of related topics.

Pupils were encouraged to bring in supplementary topics and materials, a bulletin board was used often, and the children wrote reports of laboratory experiments in a form which they collectively devised and which they scored themselves. The teacher guided the work in an organized form. The Powers' General Science Test was given to both groups at the end of the first semester and Group B, although inferior at the beginning rated almost equal to Group A with median scores of 47 and 48 respectively. Group B had also made apparatus and scrapbooks, brought in original experiments, had made out some of their own tests, and often conducted the class work.

Teachers exchanged groups for the following six weeks and pupil preferences registered before and after this change indicated that all pupils in Group B preferred their freedom method, and only four in Group A preferred their own method.

Irrespective of the method preferred by any teacher the writer advocates the creation of problematic situations that encourage solvency by inductive reasoning from a psychological approach as propounded by Dr. Melchoir[1] in a personal interview. In such an approach he offers a facts-knowledge-wisdom-understanding cycle. Beginning with facts which the teacher knows, he should set up general, specific, immediate, and remote purposes. The students are encouraged to gather every possible fact about the area of study with application of causes and relationships. From this application the students acquire knowledge. Further relationship of the economic and social problems secured by application of knowledge encourage reasoning to answer the "everlasting why"[2] and produces wisdom. Understanding is finally arrived at through experimentation, and not only is the cycle complete, but the scientific method has been applied.

"It seems unquestionable then that the inductive

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1 W. T. Melchoir, Supervisor of Workshops, University of Texas for Summer, 1951.

2 Dr. Melchoir's phrasing.

method provides better opportunities for teaching the elements of the scientific method than does the deductive".[1] In inductive teaching, the pupil starts with some problem, the answer to which he does not already know. He then assembles by observation or experiment evidence which gives him a tentative answer to the problem, or perhaps one should say he progresses from the specific to the general. In the inductive method the pupil is encouraged to make hypotheses with respect to probable outcomes of his investigations. His interest is stimulated by the need to check his hypotheses against the outcomes. He is easily convinced of the necessity for identifying and isolating experimental factors and of the value of introducing controls and of making check experiments. Since he does not know what the accepted results are he records his findings with scientific honesty.

The deductive method is the former's compliment. It starts with the solution of a problem presented and observations or experiments are made to verify what has already been told as true. The student progresses from the general to the specific.

Thus, it is apparent that the quality of instruction

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1 Francis D. Curtis, "A Plea for Inductive Teaching", <u>The Science Teacher</u> XVII No. 5 (1950) 223.

seems to depend to a great extent on the methods used, while the methods should seem to depend on the subject matter growing out of the needs and interests of specific children. Further apparent is the writer's insistency upon the scientific method applied to problematic situations.

CHAPTER V

THE PROPOSED PROGRAM

"It is only good teaching to lay hold of the current interest of the pupil and convert it into a drive that makes his science experience more meaningful and lasting."[1] The Committee of the National Education Association on the Reorganization of Science in Secondary Schools as early as 1920 recommended that the subject matter of General Science be selected to a large extent from the environment and that the principles of necessary sciences be used for interpretation of the environment.[2] On the basis of this recommendation the writer submits facts about Conroe upon which the proposed program is made.

The 1950 census report reveals a total population of 7,500[3] including 2,100[4] Negroes. From the latter there are 670 scholastics for 1951 representing 265 families, and 15 per cent illigitimacy assenting to no specific paternal heritage.[5] There are only 1,200 sewer connections for the

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1 Henry, op. cit., p. 178.

2 Ibid., p. 28.

3 Report from Moran Utilities Company, June 8, 1951.

4 Ben L. Cavil, School Census Report, April, 1951.

5 Ibid.

city and only 1,964 water meters.[1] There are four Negro residential sections of town and until recently exclusively all Negro. According to the City Welfare Agency no sewage is in two of the exclusive Negro sections. Only during the last three months has another section been given sewage, and the fourth and oldest section that has been almost surrounded by whites with a few penetrations has sewage only in spots. The natural gas service is limited to a total of 2,500 meters with an estimate of 65 per cent Negro consumption of the 2,100 citizens.[2] Electricity is approximated to serve 80 per cent of the Negro homes.[3] Of the 265 families represented by scholastics, 212 or 80 per cent use outdoor privies, 40 per cent take daily paper, 25 per cent buy magazines including the True Story series.[4]

Within the last five years illigitimate pregnancies have been more frequent in grades seven, eight, and nine according to school records.[5] A study of those same records

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[1] Report from City Water Department, June 8, 1951.

[2] Moran Utilities Company, _op_. _cit_., June 8, 1951.

[3] Report from Gulf States Utilities Company, June, 1951.

[4] Ben L. Cavil, _Survey of Scholastics_, May, 1951.

[5] Ben L. Cavil, _Study of School Records_, June, 1951.

revealed that 50 per cent of expectant mothers marry before baby comes, 25 per cent afterwards, and 25 per cent do not marry at all.

Questionnaires sent to business places, and interviews with housewives employing Negro help indicated a lack of ethical, social, and physical development and training of Negro people. They indicated further a desire on the part of the employer to have a study of human life, and its various associations including the ethical, social, and physical training for manipulating jobs, as well as limited specializations incorporated in the science curriculum of the school.

Specifically twenty-five (62.5 per cent) of the questionnaires requested that children be taught personal hygiene. A total of thirty-five (87.5 per cent) wanted the science program to offer advantages and techniques of proper employer-employee and employer-customer or patron ethics. The proper attitude toward earning a livlihood irrespective of the calibre of the job was requested by thirty-eight (95 per cent). Significant to the writer's program was the request of forty (100 per cent) that the General Science course teach the advantages of preparation for job selection at least to the limits of high school offerings. All of the questionnaires (forty) indicated that General Science should teach fundamentals of social living and the interdependence of human beings. More enthusiastic workers were requested as assets to the success of jobs by thirty-five (87.5 per cent) of the questionnaires and a suggestion that a teaching procedure or technique designed to accomplish this be incorporated.

Terminology common to such jobs as auto mechanics, washing and greasing cars, cutting pulp wood and logs, laundry, and domestic service should be specifically emphasized in the science program according to thirty (75 per cent) of the responses. These same employers requested as much technical terminology and knowledge as the elasticity of the program would permit. Admitting that the types of jobs offered little or no room for increased complexity thirty-five (87.5 per cent) feared that the Negro employee could not qualify in technical knowledge or attitude. The remaining five (12.5 per cent) declined to comment; yet, two indicated a doubt of his integrity and aptitude.

The interviews were less formal and indicated unanimously that the science program should contribute thorough training in the sciences of domestic living. Special concern was expressed over the Negro worker's indifference to thoroughness and enthusiasm for the job except as they influenced and dictated the compensation. All requested that the principles of sterilization and personal hygiene be taught in the General Science course. Only three (12 per cent) of the housewives interviewed expressed satisfaction with their domestic helpers from the beginning, and they hastened to charge this competence to training by previous employers.

Since 1946 Booker T. Washington High School at Conroe has graduated seventy pupils. Of that number twenty-six (37 per cent) have entered college at irregular intervals, forty-four (63 per cent) have not enrolled in college, seven (10 per cent) have withdrawn (two for volunteer army service), and one (1.4 per cent) has graduated from college. (None of those entering college pursued a science curriculum.) This would seem to indicate that the greater per cent of high school graduates are not college inclined.

Reported data on the morbidity and mortality rates procured from the State Health Department would indicate that a dire need for training in the care of the human body for personal and communicable welfare is becoming increasingly necessary over the state.[1] (See Appendix).

If the types of science courses needed by those students who are not going to college are to be provided, the community must be surveyed for materials to put in these courses rather than accept those remotely proposed by the

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[1] State Department of Health, Department of Vital Statistics, 1950.

college.[1] "Evidence is accumulating that General Science is filling a real need especially for the non-college preparatory pupil".[2]

Because the traditionally standardized and technical body of subject matter in science fails to function in daily life, it is imperative that all science teachers examine the failure of the traditional science program, and consider how the needs of the adolescent may better be met, by improving instruction.[3] Unlimited human wants and needs keep the industrial progress going that was inspired by diversified interests and abilities.[4] Needs of students expressed by electives which they select personally from a wide list of possible courses would seem the best guide for designating courses to be offered.[5]

Upon these facts and data pertinent to Conroe is this

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[1] Paul V. Beck, "Science Serving the Student", *School Science and Mathematics* XL No. 353 (1940) p. 827.

[2] Noll, *op. cit.*, p. 5.

[3] Smith, *loc. cit.*, p. 5.

[4] Beck, *loc. cit.*, p. 827.

[5] *Ibid.*

suggested program predicated. Adapted from a list by Smith,[1] this program suggests areas of interests and needs basically important to Conroe, and proposes with one illustration that the General Science course include at least eighteen pupil selected areas from this list to be developed in a maximum of ten days each.

The proposed list includes (1) chemical changes, (2) foods and nutrition, (3) first aid and home nursing, (4) child psychology, (5) psychology of personal adjustment, (6) air conditioning and insulation, (7) home illumination and decoration, (8) electrical repairs, (9) the earth's surface, (10) meteorology, (11) astronomy for fun (12) minerals, rocks, and gems, (13) common chemicals, (14) principles of electricity, (15) radio and electrical communication, (16) <u>the human body</u>, (17) <u>the human stages and their social and economic influences</u>, (18) reproduction and sex behavior, (19) heredity, (20) simple machines, energy, and work, (21) the automobile, (22) the airplane, (23) industrial machines, (24) elementary photography, (25) local wild life, (26) gardening and soils, (27) green house operations, (28) house design and construction, (29) pest control, (30) sanitation, and (31) family relationship.

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[1] Smith, *loc. cit.*, pp. 5-6.

The underscored should be required.

Thus, the writer means to suggest that General Science courses should be, and are rapidly taking such a trend[1] toward generalized courses planned to meet the immediate needs of the pupils.

In any area of the curriculum objectives should be regarded as directions of growth, and not as ultimate ends to be completely reached.[2]

The objectives for secondary school science teaching (where General Science as a course falls in the writer's organization) are the same as those for other levels, but with varying degrees of emphasis contingent with student maturity. These objectives must be sought in the broad areas of human experience where young people meet their problems of adjustment[3], and for this program they should be in terms of the pupil.[4]

1. They are going through a period of rapid growth,
2. Their interests are centered in sports, team work, collecting animals, adventure, romance, and mystery,

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[1] Henry, <u>op</u>. <u>cit</u>., p. 139.

[2] Heiss, <u>op</u>. <u>cit</u>., p. 24.

[3] Henry, <u>op</u>. <u>cit</u>., p. 150.

[4] Heiss, <u>op</u>. <u>cit</u>., p. 67.

3. They have a strong desire to excel,
4. They like to explore and make discoveries for themselves,
5. They seek group approval and often go to extremes of human behavior to secure it,
6. They have a strong desire and a new interest to understand themselves,
7. There is a desire for freedom balanced by the sense of a need for security and belonging,
8. Their play is self-directed to a large degree and is generally well organized,
9. There are the beginnings of wide interest in the group and in community concern,
10. There is a desire to achieve their full capacities,
11. There is an accellerated development in motor skill and ability,
12. There is a wider interest in reading,
13. There is an awakening to, and interest in ideals,
14. There is a beginning interest in the vocational pursuits of adults.

The following objectives for this program and the illustrated unit were drawn up not only according to the previously mentioned characteristics of the prospective students but, upon the following principles set by the Educational Policies Commission:[1] (a) Contemporary society demands, (b) Objectives of education as propounded by specialists, and (c) Needs of the community.

Objectives:

To facilitate understanding of scientific forces in the environment.

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[1] Educational Policies Commission, <u>Purposes of Education in American Democracy</u>, p. 47.

To stimulate unswearing loyality to democratic ideals.

To develop in the child those general attitudes and habits of broadmindedness, fidelity to truth, careful inquiry and evaluation of evidence in connection with problems and logical analysis of data, which will tend to mold his character and temperament in the best manner.

To develop in the child an interest in the value, worth, and beauty of science to the end that he may have opened before him a great number of interesting avocations, and that he may be stimulated to go further into one or more of the many fields of scientific endeavor.

To understand generalizations of science that a citizen of a modern democracy needs in order to solve everyday personal, social, and civic problems.

To grow in the ability to do critical thinking.

To develop wholesome intellectual interests and appreciations which lead to a desirable use of leisure time and which give a basis for educational and vocational guidance.

SAMPLE UNIT: THE HUMAN STAGES AND THEIR SOCIAL AND ECONOMIC INFLUENCES (Periods in the Life of Man)[1]

Objectives:

A. General:

To develop a greater appreciation for the environment and to intensify the joy of living.

To gain an understanding of the best ways in which to safeguard personal and public health.

To cultivate a scientific way of looking at things and to acquire a method of procedure for solving problems.

B. Specific:

To open new avenues of interests and satisfactions.

To assist in the development of desirable social behavior.

To understand and appreciate the importance to oneself and to society the application of scientific generalizations and discoveries.

C. Immediate:

To acquire a scientific concept of the stages of human development.

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1 Thomas H. Knepp, <u>The Human Reproductive System</u>, p. 46.

To understand human reactions from a developmental basis.

To promote emotional stabilization.

To acquire sexual knowledge contingent with adolescent development.

D. Remote:

To exercise responsible direction of one's own life.

To develop worthy use of leisure time.

To develop an understanding of the requirements and opportunities of various jobs.

To create a desire to correct unsatisfactory conditions.

To understand the effects of physiological development upon behavior and personality.

Method of Procedure (Preliminary Problem)

I. Introduce scientific method (Use a common problem)

Example: Bring to class a toad frog. (Note to reader. In reality the toad and frog belong to different classes of the same phylum and are not one and the same.)

A. Knowledge

1. Gather facts - Life cycle of toad frog

a. habitat

b. reproduction

c. characteristics

2. Supplementary readings

B. Wisdom - Relationship

1. What relationship do toad frogs have to man?

2. What are the intra-relationships of toad frogs?

C. Understanding - Experimentation

1. Secure toad frog

2. Keep accurate record

a. Where found

b. Places of inquiry

3. Compare characteristics

a. External appearance

b. Activities

c. Responses to external stimulations

4. Conclude identity

D. Evaluation

1. Pupil

2. Teacher

II. Introduction of Unit - The Human Stages and Their Social and Economic Influences

A. Knowledge - Secure facts about human stages

1. How life is brought forth

2. Prenatal care

3. Economic preparation for human entry
4. Legalized parental relationship
5. Characteristics of first two weeks of offspring
    a. Care
    b. Behavior
6. Characteristics of offspring from third week to walking
    a. Habits
    b. Development
        1. emotional stability
        2. muscular control
        3. appearance of teeth
    c. Care
7. From first year to menstruation in girls to nocturnal emissions in boys
    a. Characteristics
    b. Care
8. From menstruation to late teens in girls
    a. Physical characteristics
    b. Care
    c. Behavior
    d. Physiological effects

9. From nocturnal emissions to early twenties in boys
   a. Physical characteristics
   b. Care
   c. Behavior
   d. Physiological effects
10. From late teens in girls to death
    a. Physical characteristics
    b. Behavior
11. From early twenties in boys to death
    a. Physical characteristics
    b. Behavior

B. Wisdom - Social and Economic Relationships
1. When is the offspring considered a social being?
2. What is the intra-relationship of man?
3. What is the relationship of human stages and society?
4. How do economic influences affect human stages?

C. Understanding - Experimentation (Confined to observation)
1. Experimentation through observation
   a. At school ranging in age from 6 to 60

b. In community ranging in age from 60 to 90

c. In respective families of members of class of identifiable pregnancies.

2. Keep accurate records of experimentation

3. Conclude stages and arrange in sequential order

D. Evaluation

1. Pupil

2. Teacher

a. Oral and written reports

b. Pupil contribution and cooperation to study groups

c. Objective tests.

REFERENCES:

1. Bolles, M. Marjorie, Sex Education for the 10 Year Old.
2. Corner, George W., Attaining Manhood.
3. Corner, George W., Attaining Womanhood.
4. Corner, George W., Sex Education for the Adolescent.
5. Dennett, M. W., The Sex Side of Life.
6. Edson, N. W., From Boy to Man.
7. Knepp, Thomas H., The Human Reproductive System.
8. Rice, Thurman B., How Life Goes On and On.
9. Williams, Jesse F., Personal Hygiene Applied.

CHAPTER VI

SUMMARY AND CONCLUSION

A study of the aspects of present day living which seem to have science antecedents and potentials, and a study of the needs of boys and girls in Conroe as evidenced by various indexes including their behavior patterns, would seem to reveal that there are many focal points where science can aid in helping them make more effective adjustments.

The influences that have directed the selection of materials for General Science at Booker T. Washington in the past have been largely content-centered remotely controlled by the colleges. This study has suggested that the pupil to be taught (his interests, and needs) is more important than subject matter, and that content be regarded as one of the factors in the educational experiences of young people rather than as the ultimate end of all instruction. It emphasizes that science scientifically taught contributes toward improved thinking in the form of desirable attitudes and skills in problem solving, and promotes social values inherent in making adjustments and earning livlihoods for the young people in Conroe.

The study is a composite in one respect of what many educators think about the latent values potential in a General Science program. The writer indicates that scientific investigation in the science classroom encourages scientific investigation not only in other classrooms but in life situations which the student meets. Successfully meeting the challenges of problem solving in the science classroom may indicate favorable responses to challenges of other spheres.

The writer has suggested the scientific approach to a program in General Science organized around the interests and needs of the pupils at the ninth grade level where in the 8-4 plan of organization on which the school at issue operates General Science as a course is offered.

In this work the writer advocates problematic organization and psychological presentation of pupil-selected areas of interests and needs to encourage inductive reasoning through a facts-knowledge-wisdom-understanding cycle.[1] The writer further proposes probable areas of interests and needs adapted from Smith[2], and in respective answer to a community survey iniated and engineered by himself.

The survey conducted by questionnaires, interviews, and examinations of school and state board of health statistics and city utilities records indicate not only a

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[1] Melchoir, op. cit.

[2] Smith, op. cit.

vast need, but a desire for the most part to have incorporated in the school science curriculum a study of human life including social, ethical, physical and economic training.

Finally the writer felt impelled by nature of the emphasis on the scientific method from a psychological approach to illustrate the development of a sample unit.

APPENDIXES

CITY OF CONROE - 1949*

TABLE I

	TOTAL	W. M.	W. F.	N. M.	N. F.
Cirrhosis of the liver	0	0	0	0	0
Hyperplasis of prostate	0	0	0	0	0
Senility without mention of psychosis, illdefined and unknown causes	5	1	1	2	1
All other diseases	23	11	9	2	1
Motor vehicle accidents	10	3	4	2	1
All other accidents	6	3	0	2	1
Suicide and self-inflicted injury	1	0	1	0	0
Homicide and operations of war	0	0	0	0	0

LIVEBIRTHS, MATERNAL DEATHS AND STILLBIRTHS

TABLE II

	TOTAL	W. M.	W. F.	N. M.	N. F.
Live Births	281**	113	95	46	27
Maternal Deaths	0	0	0	0	0
Stillbirths	8	5	0	1	2

INFANT MORTALITY

TABLE III

	TOTAL	W. M.	W. F.	N. M.	N. F.
ALL CAUSES	19	10	5	2	2
Dysentery, all forms	0	0	0	0	0
Influenza	0	0	0	0	0
Pneumonia	1	1	0	0	0
Gastritis, duodenitis, enteritis and colitis, except diarrhoea of the newborn	1	1	0	0	0
Congenital malformations	2	0	1	1	0
Birth injuries, postnatal asphyxia and atelectasis	6	3	3	0	0
Infection of the newborn	0	0	0	0	0
Diarrhoea of the newborn	0	0	0	0	0
Other diseases peculiar to early infancy, and immaturity unqualified	7	4	1	1	1
All accidents	1	0	0	0	0
All other causes	1	1	0	0	0

*Reproduced

** 11 illigitimate births (10 Negro - 1 White)

TEXAS MORTALITY FROM SELECTED CAUSES - 1949*
CITY OF CONROE
BY PLACE OF RESIDENCE
TABLE IV

	TOTAL	W. M.	W. F.	N. M.	N. F.
ALL CAUSES	118	52	30	22	14
Tuberculosis, all forms	2	1	0	0	1
Tuberculosis of respiratory system	2	1	0	0	1
Tuberculosis, other forms	0	0	0	0	0
Syphilis and its sequelae	1	0	0	1	0
Typhoid fever	0	0	0	0	0
Dysentery, all forms	0	0	0	0	0
Scarlet fever and streptococcal sore throat	0	0	0	0	0
Diptheria	1	0	1	0	0
Whooping cough	0	0	0	0	0
Meningococcal infections	0	0	0	0	0
Tetanus	0	0	0	0	0
Acute poliomyelitis	0	0	0	0	0
Acute infectious encephalitis	0	0	0	0	0
Measles	0	0	0	0	0
Typhus and other rickettsial diseases	0	0	0	0	0
Malaria	0	0	0	0	0
All other diseases classified as infective and parasitic	0	0	0	0	0
Malignant neoplasms, including neoplasms of lymphatic and haematopoietic tissues	13	3	6	2	2
Benign and unspecified neoplasms	1	1	0	0	0
Diabetes mellitus	0	0	0	0	0
Pellagra	0	0	0	0	0
Anaemias	0	0	0	0	0
Rheumatic fever	0	0	0	0	0
Diseases of the cardiovascular-renal system	49	26	7	9	7
Vascular lesions affecting central nervous system	8	2	3	0	3
Diseases of heart	36	24	4	5	3
Chronic rheumatic heart disease	0	0	0	0	0
Arteriosclerotic and degenerative heart disease	26	21	1	3	1
Hypertension with heart disease	4	1	1	2	0
Other diseases of heart	6	2	2	0	2
Hypertension without mention of heart	2	0	0	1	1
Nephritis and nephrosis	3	0	0	3	0
Influenza	0	0	0	0	0
Pneumonia	4	2	1	1	0
Bronchitis	0	0	0	0	0
Ulcer of stomach and duodenum	0	0	0	0	0
Appendicitis	0	0	0	0	0
Intestinal obstruction and hernia	1	0	0	1	0
Gastritis, duodenitis, enteritis and colitis, except diarrhoea of the newborn	1	1	0	0	0

*Reproduced

TABLE V*

BIRTH AND MORTALITY RATES - 1949

COUNTY AND CITY	LIVE BIRTHS	INFANT DEATHS		NEONATAL DEATHS		MATERNAL DEATHS		STILLBIRTHS	
		No.	Rate	No.	Rate	No.	Rate	No.	Ratio
MONT-GOMERY	591	32	54.1	18	30.5	0	-	19	32.1
Rural	310	13	41.9	5	16.1	0	-	11	35.5
Conroe	281	19	67.6	13	46.3	0	-	8	28.5

* Reproduced

TEXAS MORBIDITY FOR 1950 FOR SELECTED COUNTIES

TABLE VI*

TEXAS STATE DEPARTMENT OF HEALTH																				
DISEASE	Chickenpox	Diptheria	Dysentery	Gonorrhea	Influenza	Malaria	Measles	Meningitis	Mumps	Poliomyelitis	Pneumonia	Scarlet Fever	Syphilis	Tuberculosis	Tularemia	Typhoid Fever	Typhus Fever	Undulant Fever	Whooping Cough
REPORTS BY COUNTIES																			
Montgomery	61	5		38	340	1	1	2	120	2	20		31	7	1	1	4	2	2

*Reproduced

Table VII

A Suggestive Approach to A Proposed Program for Teaching General Science in Booker T. Washington High School

1. Name of employer----------------------Location----------------
2. Kind of Business--
3. Number of Negro employees--------------Average age------------
4. Number native of Conroe-----------------
5. Kinds of jobs held by Negro employees
   1.---------------------------------------
   2.---------------------------------------
   3.---------------------------------------
   4.---------------------------------------
   5.---------------------------------------
6. What kind of training other than general information is required for holding this or these jobs---------------------------------

   ----
7. How much training must the employer give to the Negro employee to bring him up to maximum efficiency on the job--------------

   ----
8. What percentage of the Negro empleyees understand both general and technical knowledge of the job to perform when hired-----

   ----
9. Are the Negro employees readily adaptable to the technical knowledge required for performance of the job-----------------

   ----
10. What is the Negro employee's attitude toward changing assignments--

    ----

11. What is the Negro employee's attitude toward suggestive methods for doing the jobs assigned

12. Does the employer ever find it possible to increase the complexity of the job

13. Does the Negro employee ever become so absorbed in the job that he does more than the employer exacts

14. What are your recommendations or suggestions for inclusions in the high school sciences

BIBLIOGRAPHY

PERIODICALS

Primary Sources

1. Anderson, Kenneth E. "Summary of Relative Achievements of the Objectives of Secondary School Science in a Representative Sampling of Fifty-Six Minnesota Schools". Science Education. XXXIII No. 5 (1949), 323-328.
2. Beck, Paul V. "Science Serving the Student". School Science and Mathematics.XL No. 353 (1940), 827.
3. Blair, Glenn M. and Goodson, Max R. "Development of Scientific Thinking Through General Science". School Review.XLVII (1939), 695-701.
4. Browning, Charles A. "The Work Sheet for High School Physics". Science Education. XVIII (1934), 37-41.
5. Bruce, G. V. "An Attempt to Vitalize Chemistry Teaching in the High School Through a Modified Form of the Unit Assignment Technique". Science Education. XVI (1932) 201-219; 392-403.
6. Cavil, Ben L. School Census Report. April, 1951.
7. Cavil, Ben L. Study of School Records. June, 1951.
8. Cavil, Ben L. Survey of Scholastics. May, 1951.
9. Childs, John L. "The Morality of Science and the Values of Democracy". Science Education. XXXIII No. 4 (1949), 265.
10. Curtis, Francis D. "A Plea for Inductive Teaching". The Science Teacher. XVII No. 5 (1950), 223.

11. Downing, Elliot R. "The Elements and Safeguards of Scientific Thinking". Scientific Monthly XXXVI (1928) 231-243.

12. Fraser, Thomas P. "Science Teachers Objectives and Attitudes Towards Using Community Resources". Science Education XXXIII No. 5 (1949) 350-360.

13. Garber, Elinor. "The Project Method in Teaching Chemistry". School Science and Mathematics XXII (1922) 65-73.

14. Hunter, G. W. "The Oral Method Versus the Laboratory Manual in the Manual in the Laboratory". School Science and Mathematics XXII (1922) 29-32.

15. Hurd, Archer W. "How Shall Science Instruction Be Organized". Science Education XVIII (1934) 106-112.

16. Hurd, A. W. "The Textbook Versus Worksheets in Instruction". Educational Supervision and Administration XVII (1931) 661-664.

17. Hurd, A. W. "The Workbook as an Instructional Aid". School Review XLIII (1935) 608-613.

18. Morse, Stanley W. "High School Science Experiences of 506 Non-Science Curricula College Students". Science Education XXXIII No. 2 (1950) 117-126.

19. Noll, Victor H. " About Integration in Science". School Science and Mathematics XLI (1941) 242.

20. Peterson, George W. and Douglass, Harold R. "Published Workbooks Versus Pupil Made Notebooks in Ninth Grade General Science". School Review. XLIII No. 10 (1935), 608-613.

21. Smith, Victor C., "Making the Science Program Function". Secondary Education. XII No. 2 (1945), 6.

22. State Department of Health. Vital Statistics (1950).

23. Walter, C. H. "The Individual Laboratory Method of Teaching Physics When No Printed Directions Are Used". School Science and Mathematics. XXX (1930), 429-432.

24. Watkins, R. K. "The Technique and Value of Project Teaching in General Science". General Science Quarterly VI, VII and VIII (1924) 235-256; 311-341; 387-422.

25. Wyman, Carl E. "Visual Aids - Of What Worth?" Science Education. XVI (1932), 291-296.

BIBLIOGRAPHY

INTERVIEWS

Primary Sources

1. Bell, Louis Mrs., 208 E. Avenue E., May 31, 1951.
2. Boedeker, John E. Mrs., 1305 N. San Jacinto, April 25, 1951.
3. Chamber of Commerce, Enterprise Building, May 31, 1951.
4. Clark, Jack Mrs., 1409 N. Thompson May 7, 1951.
5. Davis, Ralph S. Mrs., 510 Dallas, April 17, 1951.
6. Eaton, Hayden Mrs., 301 Conroe Drive, April 25, 1951.
7. Glover, L. M. Mrs., 919 S. Frazier, June 9, 1951.
8. Gulf States Utilities Company, 112 South Main, June 8, 1951.
9. Guinn, Orville L., Mrs., 517 Dallas, April 30, 1951.
10. Henderson, B. E., Mrs., 805 Crooke, May 29, 1951.
11. Holloman, Marshall, Mrs. 1208 N. San Jacinto, May 31, 1951.
12. Hutchins, M. G., Mrs., 613 N. Thompson, April 23, 1951.
13. Jackson, Mrs. James L., 224 Avenue G., May 31, 1951.
14. King, Jack, Mrs., Houston Hwy. , June 1, 1951.
15. Laurence, Ray, Mrs., 301 N. 3rd Street, April 14, 1951.
16. Martin, J. Ross, Mrs., 318 Sherman, April 26, 1951.
17. McClain, W. C., Mrs., 325½ N. Thompson, May 8, 1951.
18. McDonald, W. D., Four Corner Rd., May 14, 1951.
19. Moran Utilities Company, 323 Collins Street, June 8, 1951.
20. Moore, S. Emory Mrs., 105 Dallas, April 16, 1951.
21. Patterson, E. H. Mrs., 1317 N. San Jacinto, May 7, 1951.

22. Powell, Alma Mrs., 406 E. Davis Street, June 9, 1951.

23. Quinn, Charles Mrs., 302 N. 2nd Street, April 21, 1951.

24. Riggs, R. G. Mrs., 404 E. Phillip Street, May 19, 1951.

25. Russell, Paul Mrs., 218 San Jacinto Street, June 16, 1951.

26. Scott, Ralph M. Mrs., 220 E. Avenue J., June 9, 1951.

27. Schaefer J. H. Mrs., 405 Avenue H., June 1, 1951.

28. Water Department, City Hall, 222 West Davis Street, June 8, 1951.

29. Williams, Elmer Mrs., 308 San Jacinto Street, May 5, 1951.

BIBLIOGRAPHY

BOOKS

Secondary Sources

1. Ayer, F. C., The Psychology of Drawing with Special Reference to Laboratory Teaching. Baltimore: Warwick and York, Inc., 1916.
2. Beauchamp, Wilbur L., Instruction in Scinece. Washington: Government Printing Office, 1933.
3. Educational Policies Commission, Purposes of Education in American Democracy. Washington: National Education Association, 1938.
4. Goode, Carter V., Dictionary of Education. New York: McGraw-Hill Book Company, Inc., 1945.
5. Heiss, Elwood D., Obourn, Ellsworth S., Hoffman, Charles W., Modern Science Teaching. New York: The Macmillan Company, 1950.
6. Henry, Nelson B., The Forty-Sixth Yearbook Chicago: The University of Chicago Press, 1947.
7. Knapp, Thomas H., The Human Reproductive System. Dubuque: Wm. C. Brown Company, 1948.
8. McGrath, Earl J., Science in General Education. Dubuque: Wm. C. Brown Company, 1948.
9. Noll, Victor H., The Teaching of Science in Elementary and Secondary Schools. East Lansing: Michigan State Press, 1950.

10. Twiss, G. R., Principles of Science Teaching. New York: Macmillan Company, 1922.