ORGANIZATION OF A COURSE IN SCIENCE

FOR

THE CHANUTE JUNIOR HIGH SCHOOL

by

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INTRODUCTION

The organization of a program of instruction that will best meet the needs of tomorrow's citizens implies more than a small amount of knowledge concerning trends, philosophies, objectives, and methods of teaching. Modern educational practice points toward the improvement of all phases of the school curriculum. There are, however, a great many fields in which there is much confusion regarding just what the best practice might be. This situation exists in the junior high school science field. The author in keeping with the desire to make any improvements that need be made in the program of Chanute Junior High School faces the need of organizing a better course in science for that school. There are many examples to follow in such a task, but, if one surveys the past practices of science course organization, he will not find a well defined plan for such organization.

We must recognize, too, that the science teaching of the past has not functioned well except in a limited way. The depletion of our natural resources seems imminent; there is little regard for truth in advertising; many fads and fallacies guide great numbers of Americans; human science is overshadowed by the science of controlling environment for the few; and this all points out the need for better science teaching.

Until recently the junior high school science course was little more than an immature senior high school course. This resulted in a course being given that was over the age level for these pupils in many cases, and often the course was weak because an attempt was made to take out the difficult parts. This state of affairs along with the great influx of pupils in secondary schools and their longer residence in these schools has made reorganization of the science course imperative. As might be expected a great variety of types of organization has resulted. The question of what a good junior high school science course should include still is one to be answered. In this thesis we have set out to determine what kind of science program will function best in our own situation. It will not be the purpose of this study to set up a program that will function in any or all school situations. Programs of science instruction cannot be drawn up by some one who does not have some insight into the needs and possibilities of the situation in which the program is to be used.

Some idea of what our science background has been in the Chanute junior high school during the past few years should be of value. For the past three years and up until 1935 the only phase of science that was taught was physiology. This course was given alternately with physical education. In the fall of 1935 a different and more extensive type of science program was begun. Science was given in all three grades as follows:

Seventh grade
Nature study.

Eighth grade
Health.

Ninth grade
General science.

This program was followed that year only and in the fall of 1936 a series of units were developed in each of the grades. Probably this past year the work in science has improved because of the increased interest shown as well as work exhibited. We feel, however, that greater improvement is necessary before our course functions as it should.

The problem of organizing a course in science for the Chanute junior high school has been approached as follows:

1. The literature on the subject has been surveyed.

2. An attempt has been made to establish some bases for setting up the program as to its content, books to use, methods of teaching, trends to follow.

3. Certain needs for science training have been developed.

This procedure led up to the organization of the course and its presentation in the final section of this thesis. It must be kept in mind that the author has not attempted a course that will be a panacea for all of the ills of science course organization but rather a course that will offer increased efficiency in science training in a specific situation. This situation is one in which the whole school program, the teaching personnel available, the community environment, home environment, and many other factors are probably at great variance with other junior high school situations.

DETERMINING A BASIC PHILOSOPHY AND GUIDING PRINCIPLES FOR SCIENCE TEACHING IN THE JUNIOR HIGH SCHOOL

What should be the philosophy underlying science teaching or what should be the guiding principles, aims, or general objectives of a science course in the junior high school? Asking these questions raises many problems, and answering them all involves more study than the intent of this work on a science course reorganization demands.

However, before any progress can be made in the reorganization, certain logical aims, objectives, or principles must be set up. A practical philosophy is necessary before we can think seriously about results. Determining this philosophy will be the purpose of this part of the study, and from it we hope to formulate principles or aims that will serve as guide posts in the organization of a desirable course in general science.

One need but study contemporary science course content to find that there is no general agreement as to a basic philosophy underlying science teaching or aims and objectives of science courses. The present status of the results of science teaching does not indicate that there has been much rhyme or reason for what has been taught. Brown (6, p.210) presents an insight into the results of teaching when he says that, in addition to the loss of lives, $750,000,000 is spent annually on patent medicines. Counts (9, p.217) says that education in the ways of living is important, yet he points out that the American public is in a grand state of ignorance and is unprepared to use its medical resources. Records show that many preventable diseases are causing useless loss of life each year; diphtheria claimed the lives of 5000 babies in 1934, according to the Metropolitan Life

Insurance Company (26, p.4). Counts (9, p.217) has shown that less than five per cent of the population of the United States has been immunized against diphtheria or any other disease. Even though science has found that a large per cent of cancers may be treated successfully or prevented the Metropolitan Life Insurance Company (27, p.4) points out the death rate from cancer is rapidly increasing. Thousands are sick and dying daily because our present knowledge of medicine is not being applied according to Counts (9, p.217). This deplorable condition should be remedied through education.

Kilpatrick (22, p.66) points out, "The essential factor which makes and explains our modern world and gives to it its differentiating characteristic is tested thought and the way men apply it to their lives and affairs". Tested thought has added to our material ledger but has not yet been considered for its social possibilities, and herein lies a fault of education. Science in the new education must play a far more important part to facilitate this balancing of our social with our economic welfare. To quote Kilpatrick (22, p.66), "That tested thought should loom so large in modern life at once carries with it both demand and opportunity. If science can accomplish such results, then surely we must not fail to utilize possibilities of the new organon. The call to teach science is not new, but sober thought must question our present success in answering the call. Superstition still abounds. That modern science should have made possible tall structures which, paradoxically, refuse to have thirteenth floors, carries with it a lesson which education cannot afford to ignore. If any say no, that such a superstition is only harmlessly amusing, let him look further at our patent medicine bill or at such a flourishing cult as chiropractic (and read its own account of itself). Then think of Dayton, Tennessee and the vast numbers who have neither learned to test thoughts for themselves nor even yet to accept the procedure as a dependable one. No, we have not succeeded in teaching science. We must increase the ranks of those who advance thought. We must learn how to apply tested thought in the social sciences to our institutional life to improve it, if mayhap we can, in a measure commensurate with our success in the realms of the "natural" sciences. In addition, the great majority who never thus add to thought must learn to see, understand, and in some measure follow scientific methods. At the least, they must see and understand enough to believe in it and not to scoff, as often now is done. We must succeed in teaching science."

Further evidence is given by Watson and Spence (31, p.103) that the scientific method is not universally used when they say: "The essential fact in all scientific study is the use and the comprehension of the scientific method. Nothing is to be taken for granted and no test, whether quantitative or qualitative, is to be overlooked. Every conclusion as it is reached is held subject to the results of verification, modification, or overthrow by later inquiry or by the discovery of new methods and processes of research.

"One would suppose that after half a century of this experience and this discipline the popular mind would bear some traces of the influence of scientific method, and that it would be guided by that method, at least in part, in reaching results and in formulating policies in social and political life. If there be any evidence of such an effect, it is certainly not easy to find. Passion, prejudice, partisanship, unreason still sway men, whether as individuals or in the mass, precisely as if scientific method had never been heard of. How is it possible that with all of the enormous advances of science and with all its literally stupendous achievements it has produced such negligible results on the mass temperament and the mass mind? This is a question which may well give us a pause, for something must be lacking if intelligent men and women, long brought into contact with scientific method and scientific processes, pay no attention whatever to these, and show no effect of their influence, when making their private or public judgments."

Pupils of the eighth grade of Chanute Junior High School were asked recently to list the superstitions that their parents or acquaintances believed had some value. These lists were handed in to the instructor by the one hundred eighty-nine pupils and showed a great number of ridiculous superstitions. Some of the most common were:

For a stye on the eye rub the eye with the tail of a cat that is of the same color as the eye.

To remove warts hide mother's dish rag, tie as many knots in a string as there are warts and then bury the string, or cut as many notches in a stick as you have warts and throw it over the left shoulder.

Wet paper and place on wound to stop bleeding.

If one steps on a pin and saves the pin, the wound will heal in two days.

Use flour for burns.

Use asafetida to prevent disease.

Use soap and salt for boils.

Carry an Irish potato to treat and prevent rheumatism.

Bluing for burns.

Burn Cresoline lamp for whooping cough.

Wear a dirty sock around the neck to cure sore throat.

Nail an onion above the door in the fall to keep colds out.

Crossing of path by black cat brings bad luck.

Counting cars in a funeral procession will bring death in family.

Stir cake away from one to drive trouble away.

Salt thrown over the left shoulder to prevent a quarrel.

Bad luck to return borrowed salt.

Howling dog at window means death in family soon.

If a bird gets in the house some one in the family will die.

To stop nose bleed put key down back.

Drink whiskey to treat snake bite.

Place snake bitten part inside a warm hen to draw out poison.

Fat meat to draw out splinters.

Use kerosene for snake bites.

Goose grease on the soles of the feet for colds.

Hair cut in the wrong time of moon will not grow again.

Dreaming of fish causes bad luck.

Horse hairs soaked in water will grow into snakes.

A black silk thread around the neck will prevent sore throat.

Killing spiders brings bad luck.

Seven years of bad luck to break a mirror.

Wearing a copper ring or a copper wire will cure or prevent rheumatism.

Put sulphur in shoes to keep chiggers away.

Use chewed tobacco on cuts.

Boiled pig foot tea for colds.

These superstitions indicate that if there has been any science training given to those who hold to such beliefs it has missed its mark in many respects. Conversation with those who have had science training reveals the nature of the training and its shortcomings to some extent. There seems to be very little understanding of commonplace science needs among educators or how to meet the needs best. More often the spectacular, the strange, or the traditional aspects of science have been emphasized.

Courses of study, reviews of investigations made, Yearbooks of the Department of Superintendence, and other available sources of information reveal the following fairly well defined trends in junior high school science:

Placement and Sequence of Courses

Foberg (17, p.150) indicates in his study that the general science course should present biological material in the seventh grade, health in the eighth, and physical science in the ninth.

According to Caldwell (8, p.23) science should be taught in the seventh and eighth grade for three periods each week or in one of these grades five periods a week for the full year, and should include general science and hygiene. The ninth grade should be given biological science including hygiene.

Curtis (12, p.65) shows a tendency to place general science in the seventh and eighth grades and make it a required course.

Hunter (20, p.127-138) in a review of courses of study reveals a spread of science training over the three years of junior high school with no definite placement of subject matter.

Loomis (25, p.63) has set up the following program for science:

Seventh grade general science..1 period each week
Eighth grade general science..1 period each week
Ninth grade general science..2 periods each week

Aims and Objectives

Frank (18, p.1) lists the following as aims of science teaching in junior high school:

1. Exploration
2. Guidance
3. Adjustments
4. Stimulation

Briggs (5, p.235) sets up his aims as:

1. Appreciation
2. Avocation
3. Social contact
4. Utility
5. Scientific attitudes
6. Preparation

Bissiri (3, p.363) says that there are three major objectives of science at the junior high school level:

1. To develop the pupils' desirable scientific attitudes.
2. To give an insight into the major fields of science, and
3. To prepare the ground for more advanced science courses.
The third being the least important.

Hunter (20, p.138) is somewhat more definite in stating the aims of junior high school science after he has made a study of courses of study, trends, and aims given by others in the field. His aims are as follows:

1. Health information and a scientific background of health knowledge and habits that will help the students best in their future lives as citizens.
2. Must open eyes to wonders and beauty of science as it affects their lives at home and reveal to them the wonders of nature.
3. Must develop an appreciation of changes taking place about them such as the forces of wind, water, cold, heat, light, and darkness, and point out means of controlling them.

The National Society for the Study of Education (29, p.193) has developed the following aims:

1. Life enrichment through—
   (a) Understanding of major generalizations of science.
   (b) Development of scientific attitudes.

Cureton (11, p.767) in his study of aims of junior high school science found that there is no general agreement concerning basic aims, and that the most important aims correspond roughly to the classification of junior high school science as an appreciation subject, a formal subject, a cultural subject, a content subject, and a try-out subject.

That there is no general agreement as to basic aims of junior high school science may be accepted as a relatively true statement. However, in reviewing the aims as outlined above, one may find many aims that would motivate the development of an excellent science course. It will be found upon examination of new text books of junior high school science that the aims established in the Report of the National Society for the Study of Education, Thirty-first Yearbook, are quite generally adapted. These aims are as follows:

1. "To develop an understanding of, together with an ability and desire to use, those scientific attainments that may function in intellectual experiences most common to everybody.
2. To develop some understanding of, together with an ability and a desire to use, some of the methods by which scientific attainments have been achieved.
3. To engender the scientific attitude of respect for truth and for scientific methods."

There can be no doubt of the value of these aims, yet, in the text books examined, there seems to be a wide difference in methods of attaining these aims. This, of course, is possible, but one wonders whether it is not the rearrangement of subject matter rather than fulfilling these aims that is most outstanding in these books. This statement is not to be considered as disfavoring the new texts. Certainly they have made a great contribution to science teaching.

Adams (1, p.419) says that we must have some aims based on values before we can reform our system intelligently and this will apply equally well to reorganizing the science course. But what are the values upon which one might base his aims? The social-economic goals for America as outlined by a special committee (21, p.6) of the National Education Association represent desirable values for consideration and certainly do contain basis for aims of a junior high school science course. These goals are as follows:

1. Hereditary strength.
2. Physical strength.
3. Participation in an evolving culture.
   (a) Skills, techniques, and knowledges
   (b) Values, standards, and outlooks
4. An active, flexible personality.
   (a) Personal initiative
   (b) Discriminating judgment
   (c) Flexibility of thought and conduct
   (d) Individual differences
   (e) Cooperativeness
5. Suitable occupation.
   (a) Guidance
6. Economic security (possibly through suitable occupation)
7. Mental security.
8. Equality of opportunity.
9. Freedom.
10. Fair play.

The functional division of an enriched secondary school curriculum as outlined by Watson (30, p.154) in his, "A Program for American Youth", might well serve as the basis from which to develop the aims of a course in science. These divisions are as follows:

1. Keeping physically fit.
2. Keeping mental and emotional balance.
3. Increasing ability to find and to use information from books.

4. Choosing vocations.
5. Developing an ability to earn a living.
6. Maintaining desirable social relationships.
7. Exploring leisure-time possibilities.
8. Developing skill in some avocation pursuits, hobbies, and recreations.
9. Creating beauty in surroundings, dress, and objects of art.
10. Acquiring understanding of, and at-home-ness in the world of nature.
11. Learning discrimination and taste in novels, plays, stories, poems, movies, radio programs, etc.
12. Purchasing and saving wisely.
13. Establishing a home.
14. Bringing up children.
15. Becoming able to interpret current events as reflected in the news.
16. Serving the community, state, nation, and world society as a good citizen.
17. Working out a satisfactory philosophy of life.

According to Webb (32, p.5), the North Central Association has adopted a pattern for the evaluation and reorganization of curriculum materials that lists four ultimate objectives, and each of these is broken up into four subdivisions or immediate objectives. The ultimate objectives are as follows:

1. Health
2. Leisure time
3. Social adjustment and adaptation
4. Vocational guidance

The immediate objectives under each are as follows:

a. Acquiring fruitful knowledge
b. Developing interests, motives, ideals, attitudes, and appreciations
c. Development of mental techniques in memory, imagination, judgment, and reasoning
d. Acquiring right habits of conduct and useful skills

These ultimate objectives, of course, represent the core of the Cardinal Principles of secondary education issued in 1918 and with their immediate objectives might serve well as aims and objectives upon which to build the junior high school science course. Myer (28, p.134) in a recent article presented a list of ten qualities that one would expect to find in the good citizen. These qualities are as follows:

1. Sympathy
2. Public spirit
3. Constructiveness
4. Power of self criticism
5. Tolerance
6. Freedom from dependency upon symbols and labels
7. Freedom from meaningless devices
8. An inquiring mind
9. A technique suitable for acquiring new knowledge
10. Historical perspective

The purpose of this list is to outline the desirable qualities of an adult citizen, and, as such, it presents also a worthy though distant objective for the junior high school student who hopes to become a well rounded citizen in his community. We are not going to fit our courses in junior high school to the future only, but we feel that the qualities just named will serve well as objectives toward which all of our students might aim. Myer's philosophy holds much of value for the curriculum maker. Constructiveness, freedom from dependency upon symbols and labels, freedom from meaningless devices, an inquiring mind, and the development of a suitable technique for acquiring new knowledge, all might be considered as a part at least of the aims for a junior high school science course.

It might be well to state at this point what man considers the chief objective of the junior high school, which is, to explore individual capacities and to provide for the development of different aptitudes and interests revealed through exploration. Briggs (5, p.235) says that it is the responsibility of the junior high school, "to assure that all courses be of value regardless of any pupil's educational ambition or expectations as to continuance, and at the same time by exploration of the pupil's interests, aptitudes, capacities, and needs, and also by revealing to him the possibilities in the higher fields of study, they should result in a justifiable sorting of the entire student body according to the curricula in which they are most likely to be successful and to find satisfaction of their needs".

To summarize, we note first the failure of science teaching to keep the pace set by a rapidly expanding world of applied science. To substantiate this statement one may recall the references made to health conditions, superstitions, patent medicines, and failure to recognize the place of science in our social welfare. There are a wide variety of aims and objectives for science teaching, and there is no general agreement as to what the aims and objectives should be. Contemporary educators are pointing out the need for giving a school environment which will aid in preparing the individual to live a fuller life as a participating member of society. The new text books adopt the aims set up by the National Society for the Study of Education but all differ in the methods and materials for attaining these aims. Even though there is no general agreement on aims there seems to run through the aims and philosophies reviewed the following important trends:

1. That the individual should receive training in science that is adaptable to his immediate as well as future needs.
2. That the course be exploratory in order to reveal to the individual a wide range of possible interests.
3. That society must be better oriented through science teaching.
4. That science must play an important part in meeting the challenge of the new leisure.

5. That scientific attitudes and values must be established.
6. That the science course must be of value regardless of its future implications.
7. That science should make understandable the world around us.
8. That the science should be organized around the interests, capacities, and desirable activities of the individual.
9. That the course in science should extend through the three years of junior high school.

We may say, in conclusion, that our philosophy for science teaching in the junior high school must be based upon the trends noted above. That is, science teaching must provide an environment in which the individual, either consciously or unconsciously, develops a way of thinking and acting that will prepare him to meet the problems of life in a more satisfactory manner for himself and for society. We do not assume the responsibility for preparing the student for senior high school science nor do we see the need for preparing every one for a scientific career. Keeping in mind the objectives of the junior high school, the aims established by recognized authorities in the field of science curriculum revision, the aims and objectives adopted in various courses of study, and probably more important than the others our own community needs, we set up the following guiding principles for science teaching in the Chanute Junior High School:

1. The junior high school course should provide for ample exploration in many fields of science.
2. The junior high school course should develop an inquiring mind.
3. Junior high school boys and girls need to know the value of the scientific method and its application to their own problems.
4. All should have an appreciation of the world about them.
5. Tested thought and its value must be appreciated and used.
6. Health information must be a part of the science program.
7. The course should cover the whole junior high school period and be made a vital part in shaping attitudes and interests.
8. At the present time the course probably need not be based upon any one text book because of the shortage of texts in the field.

9. The course should develop an understanding of the practical application of scientific principles to life situations.

10. By all means the course in junior high school science should be a part of living situations and not a formalized classroom course.

SCIENCE COURSE CONTENT, TEXT BOOKS, AND METHODS OF TEACHING SCIENCE AT THE JUNIOR HIGH SCHOOL LEVEL

No attempt will be made in this study to give an extensive review of the many science courses of study that may be found. We are attempting to determine major trends in science course development and to that end only will this study be directed. Many intensive studies have been made on this subject as well as upon text books and methods of teaching science, and their results have been quite generally accepted by workers in the field of curriculum revision. We, therefore, will rely upon this tested thought for our source of information in this study.

One has but to examine courses of study and recent studies in the field of curriculum revision to note the lack of agreement in what should be included in the junior high school science course. Harap (19, p.477), Downing (15, p.509), and Douglass (14, p.239) point out the lack of agreement in science course content and in text book content. They show that the content of science courses is not well established and that a need for revision exists. This lack of agreement coincides with the findings made in the first part of this study in regard to aims and objectives of science teaching. One would expect to find just such a lack of agreement in science course content since there has been no general agreement as to the aims of science teaching.

The content of the science course must follow the establishment of guiding principles of science teaching. These guiding principles must be based upon experiences that will result in the development of desirable skills, attitudes, and habits. We have established such guiding principles for our own local situation. The development of our course content will have to be contingent upon those principles, but, if our guiding principles are justifiable, our course should contain the elements necessary to provide for more than a local situation.

When we think of content we think of subject matter and text books. What subject matter need be included? Here again we are at a loss to state definitely the answer.

Peipor (29, p.194) believes that subject matter should deal with the activities and problems interesting to the child with special emphasis on his environment. Hunter (20, p.113) says that the selection of subject matter must be determined by:

1. The mental age or capacities of the child
2. His point of view or interests, and
3. His science background

Dvorak (13, p.603) finds that many of the pupils are already familiar with much of the material of the course. Subject matter selection or content of the junior high school course should be determined in a measure by the science background of the individual. In the spring of 1936 the sixth grade pupils of Chanute were given the Unit Scales of Attainment tests Form A, and, although no science is taught in the elementary schools, the general level of attainment in the science section was above the average level of the other sections. This is a significant fact for consideration in developing our own program. Elementary science should have some influence upon the junior high school course if the two courses are well coordinated and if the progress of the pupil is kept in mind. However, the subject matter of the elementary and the junior high schools courses should be organized with the same aims in mind, differing most in intensity of application and in the maturity level of the child.

Leker (24, p.724) has shown that text books in general science overlap the subject matter of the special sciences. This would lead us to assume that general science subject-matter is drawn principally from the special science field. Klopp (23, p.236) assures us that the ardor of children will be sacrificed by the limited material offered in many modern texts.

Harap (19, p.477) finds in a recent study that general science texts:

a. Do not attach as much importance to environment as necessary.

b. Do not give as much attention to earth and other heavenly bodies as necessary. (The newer texts have made up for this to some extent.)

c. Are deficient in household equipment when compared with courses of study.

d. Place too much emphasis on communication, industry, and machinery.

Science course content for junior high schools evidently has not been definitely determined. This lack of definiteness is due in part to the fact that junior high school science is a comparatively new field and there has not been a clear definement of aims and objectives. Leading book companies are reluctant to place on the market books for a three year course in science. We have at this time reviewed only two series of science texts for the seventh, eighth, and ninth grades, and both are commendable. Yet, as one reviews each copy, he wonders if these texts are much further along the way toward giving desirable science training to junior high school pupils.

There is a tendency in the new texts to set up and work toward the aims outlined in the thirty-first Yearbook of the National Society for the Study of Education (29, p.194). It will be noted, too, that each of the text book writers develops the material of his text along lines different from others in the field. Each of the new texts is a contribution to science study and teaching, but all differ greatly in the approach and development of content.

It will be found upon examination of texts that there is woven into the subject matter much of the individual author's concept of teaching the subject. Unless the teacher's background and philosophy happens to coincide with that of the author much of the value of the text will be lost. It would seem that, in as much as there is no general agreement in what should be taught and no agreement as yet in aims of the course, that a handbook of fundamental science information, an encyclopedia, a well balanced classroom library, or all of these plus the leadership of a teacher instilled with the philosophy of making science a vital part of each child's life would be the best program possible now.

Another common approach to providing science training for the junior high school has been to offer nature study in the seventh grade, health teaching in the eighth, and general science in the ninth. This science set-up is still used in many schools, but there seems to be no valid reason for assuming that seventh grade children have any more need for nature study than do those in the eighth or ninth grades. It would seem that health training, as such, would be as necessary for seventh and ninth grade children as for eighth grade. It is true that the subject matter of most general science texts is above the age level of children in either the seventh or eighth grades, but, as many believe, much of the field covered in general science seems to fall more naturally within the interest range of younger children.

All agree that nature study and health study must hold a large place in any science course and all agree that much of the old general science course is of value. Williams and Shaw (33, p.214) believe that health training very definitely has an important place in the junior high school grades, and, in addition to including it in the conventional general science course, it should be stressed in civics, history, and home economics.

Beauchamp (2, p.61) points out the fact that very little experimentation has been made to determine the grade placement of science course content for junior high schools.

We note in the various studies made by workers in the field that the content of the junior high school texts in science shows a close agreement on topics covered, but a wide disagreement on space given to each topic. Downing (15, p.509) in a review of a study of topical word space in 25 texts in general science found the following order of arrangement:

Mechanics
Weather and climate
Plants
Electricity and magnetism
Bacteria and sanitation
Water, uses, and supply
Heat
Food, nutrition
Light
Human body
Earth as a planet

Combustion, fuels
Elements, compounds, and mixtures
Life in general
Lower animals
Rocks, minerals
Erosion, soil formation
Sound
Household chemistry

Beauchamp goes further to state that there is no consensus of opinion as to what should be treated in a general science text.

The Kansas State Department of Education has taken a forward step in untangling the muddle of uncertainty in science course content by setting up a series of unit topics to be developed in the elementary schools. These unit topics are based upon the thirty-eight basic concepts of science training developed by the Committee on Teaching of Science of the National Society for the Study of Education, as presented in their thirty-first yearbook (29, p.194). In this Kansas program it will be noted that the content of the course has not been stated definitely except for certain large fields of study but that it does follow the recommendations of the committee named above, which are as follows:

1. That subject matter should deal with activities and problems interesting to the child and which form a part of his experiences.
2. That emphasis be placed upon practical adjustment

to environment by means of activities based on concrete experience.

3. That the organization of subject matter consist of relatively large units organized into problems which lead to a familiarity with scientific method.

The unit topics being developed by the Kansas Department of Education are:

Grade 7.

Unit I. Movement of the heavenly bodies and how they affect us.

Unit II. How we control plant and animal enemies.

Unit III. How geological time is determined.

Unit IV. How the control of energy has changed our manner of living.

Unit V. The development of scientific method and its results.

Unit VI. The utilization of waste products.

Grade 8.

Unit I. How man has changed plants and animals.

Unit II. Popular fallacies and superstitions that science disproves.

Unit III. Problems that alloys have solved.

Unit IV. Long time climatic changes.

Unit V. Balance in nature and examples of its disturbance.

Unit VI. How chemistry has changed living conditions.

It should be pointed out that these units are for grades one to eight and for use in the elementary and rural school organizations rather than for junior high school.

The methods of teaching science are almost as varied as are the teaching abilities of science teachers. During the past decade the great importance of teaching methods has been more clearly realized than ever before. We have noted the publicity given to some of the most common methods such as the question and answer, the topical, the laboratory, the lecture demonstration, the project, the work shop, the unit, and others. The findings of Beauchamp (2, p.61) in the field of science instruction are so significant that they should be repeated here. They meet fully the purposes of this study and will be quoted as found.

> "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. Since the majority of school systems leave the choice of method to the teacher, it is evident that, beyond the prescription of topics to be taught, the course of study has little effect upon the day-by-day teaching. Only a certain limited quantity of a teacher's time is available for additional work. The question is

therefore raised, 'Will the teacher's time be more effectively utilized if the time is spent in investigating methods of instructional technique or in working on courses of study? That is, which use of the teacher's time will result in the greater improvement of teaching!"

Beauchamp further shows the trends in practices of those engaged in curriculum revision which may be stated briefly as follows:

1. A shift from topics to major concepts or ideas.
2. A shift from the topical method of development to the problem method of development.
3. Placing of greater emphasis on environment.
4. Wide use of illustrative materials from newspapers, magazines, bulletins, etc.
5. Provision for supervised study to replace oral recitations to a large extent. (Douglass (14, p.239) makes the statement that the recitation-study sequence is more effective in general science teaching in junior high school.)
6. Use of study guides, directions, and exercises in mimeographed form, work books, work sheets, etc.
7. Replacement of individual experimentation by either teacher or pupil demonstration. Cureton (11, p.767) says that,

   "The most important methods of teaching and those to which the teacher should give

> the most time are the demonstration, either by teacher or by a pupil or group of pupils, and the general class discussion."

8. Greater attention to visual aids.

We may conclude this particular part of our study by making these general statements to which the study has given reasonable proof as being acceptable to workers in the field of curriculum revision:

1. Scientific research and study has not established the content for the junior high school science course except within broad and general limits.
2. Research has not found agreement in text books as to fields of emphasis in science teaching.
3. Science teaching shows a great confusion of methods employed.
4. There is a tendency to organize subject matter in teaching units based on major concepts or ideas.
5. Better organized teaching units show a tendency to emphasize environment in relation to the individual.
6. There is a tendency to make use of a wider variety of materials in instruction.

SCIENCE NEEDS FOR JUNIOR HIGH SCHOOL
BOYS AND GIRLS IN CHANUTE

One part of this study revealed the general failure of science teaching to provide a practical knowledge of, or a desire to use, scientific principles in life situations. This implies probably the greatest need of all in science teaching, that of presenting a course that will encourage the use of scientific principles explored in the class room in meeting real life situations.

What are the life situations common to junior high school boys and girls of Chanute which demand some science training or knowledge? This study will be confined to those situations which pertain to the child's health, to his home, and to his interests in the field of science.

Any situation affecting the health of individuals or groups demands the broadest understanding of those most concerned. The health concepts of junior high school boys and girls show the necessity for a better knowledge of this important phase of science. The statement was made earlier in this study that the annual patent medicine bill for the United States is $750,000,000. The truth of this statement will become more apparent if one interviews classes of junior high school students. Recently classes in eighth grade science were asked to bring to school from their homes empty patent medicine containers. The response was generous and the result was a collection of cartons, cans, bottles, and wrappers that showed graphically how much dependence is placed in patent medicine. Table I shows the order of importance of the different patent medicines if the number of containers brought to class can be used as a criteria. The results of a questionnaire to the students inquiring about the use of patent medicines at home are shown in column two of Table 1.

Table 1. Patent medicines used by parents of eighth grade students in Chanute, Kansas, as shown by containers brought to class and by a questionnaire to students.

Type of Medicine	Containers (School Exhibit)	Used at Home (Questionnaire)
1. Pain Relief	100	196
2. Laxatives	86	189
3. Stomach--Digestive--or Anti-acid Relief	72	115
4. Tonics--Vitamin--Iron--or Build-up Products	47	67
5. Cough Remedies	44	161
6. Kidney Remedies	31	45
7. Nose Drops and Sprays	30	156
8. Hair Tonics--Dandruff Relief	22	43
9. Rubbing Lotions	18	40
10. Antiseptic Washes	17	87

A close correlation will be noted in the two columns.

Another survey was made to determine the extent to which home remedies of somewhat questionable value were used. This survey was made in eighth grade classes in the Royster Junior High School of Chanute and the results are shown in Table 2.

Table 2. Common home remedies or treatments as shown by eighth grade classes in the Chanute Junior High School.

Rank in Usage	Remedy or Treatment
First	Onions, skunk grease, and goose grease for colds.
Second	Whiskey for snake bite.
Third	Charms for rheumatism.
Fourth	Teas to thin blood in Spring.
Fifth	Turpentine or water to cleanse wounds.
Sixth	Vigorous exercise to whip colds or flu.
Seventh	Castor oil for all stomach aches.
Eighth	Asafetida to ward off diseases.
Ninth	Excessive alcohol for colds.
Tenth	Refrain from bathing or changing clothes if one has a cold.

Each student could tell of some fantastic cure or remedy firmly depended upon by aunts, uncles, cousins, or others. Many recited instances of positive cancer cures by self termed "cancer specialists". Colored pupils offered such remedies as boiled pig hoof tea for anything that "ails". Some recalled the treatment of snakebite by splitting a hen open and placing the warm flesh over the bite. Instances of absurd cures by charms, hokum, and rubbing were given.

Many of the common superstitions were firmly believed in. Black cats, umbrellas, ladders, 13 in any combination, and many death omens had such a strong hold on students that to offer adverse criticism caused some agitation. And, yet, with all of this seeming lack of appreciation or understanding of the use of science knowledge in life situations, we have definite indications that there are some fundamental science truths pretty generally accepted by junior high school pupils. This is best shown in the results of a survey made in the eighth and ninth grades of Chanute Junior High School. The pupils were asked to choose the correct statement in each of the following series:

1. The Chanute water supply is made safe by:
   a. boiling all the water
   b. use of chemicals
   c. sunlight

2. The greatest danger in drinking water that has not been purified lies in:
   a. bacteria
   b. silt and sand
   c. oil in the water

3. Flies are most apt to carry germs that cause:
   a. diphtheria
   b. small-pox
   c. typhoid fever

4. Bleeding from an artery is stopped most efficiently by applying pressure:
   a. between wound and the heart
   b. away from heart with wound between

5. Unconscious persons should be treated by:
   a. having them sit or stand up
   b. slapping their feet
   c. placing them in a comfortable position

6. Drowning persons:
   a. always go down three times before they drown
   b. sink immediately
   c. may sink immediately or bobble up and down a number of times--varies with individual

7. Persons in contact with a live wire should be removed by:
   a. grasping their hands and pulling with great force
   b. grasping the victim's hair and pulling
   c. using dry cloth, wood, paper, or other insulated material

8. Patients who have a contagious disease should be permitted to return to school:
   a. as soon as able to be out
   b. when all of the signs of the disease have disappeared
   c. when the physician releases from quarantine

Table 3 shows the answers made by both the eighth and ninth grade pupils.

Table 3. Knowledge of health and science facts as indicated by a questionnaire survey of the eighth and ninth grades of Chanute Junior High School, Chanute, Kansas.

Number of Question	Grade 8		Grade 9	
	Correct	Incorrect	Correct	Incorrect
1	92	12	191	5
2	91	13	187	7
3	76	32	140	59
4	89	13	163	35
5	95	6	182	14
6	68	36	130	71
7	89	15	182	9
8	90	13	188	13

Another survey was made to determine the extent of immunization against some of the common infectious diseases and the results are shown in Table 4 below.

Table 4. Chanute Junior High pupils (eighth and ninth grade) immunized against small-pox, diphtheria, and typhoid fever.

Grade	Small-pox		Diphtheria		Typhoid Fever	
	Yes	No	Yes	No	Yes	No
8	130	33	86	68	14	134
9	137	45	118	66	34	136

Further evidence of eighth and ninth grade pupils' health concepts was found in a survey which sought answers to the two following questions:

A. If your father or mother has had a serious illness within the past 5 years, how was it taken care of?

B. If you should have the same illness, how would you care for it?

The results are shown in Table 5.

Table 5. Type of medical treatment chosen by parents (question A) in serious illness and that desired by pupils if confronted with same illness (question B).

Method of Treatment	Question A			Question B		
	9th	8th	Total	9th	8th	Total
Physician	115	75	190	114	93	207
Chiropractor	17	7	24	8	9	17

Table 5 Continued.

Method of Treatment	Question A			Question B		
	9th	8th	Total	9th	8th	Total
Osteopath	8	9	17	2	10	12
Sent off for remedy	6	6	12	5	1	6
Used advertised remedy from Drug Store	12	5	17	1	2	3
Family remedy	20	11	31	6	5	11
Healed by faith	6	2	8	3	7	10

In 1936 students in health classes of the eighth grade in Chanute attempted to keep a record of pupils who were in school with slight colds but found the task too great because of the fact that many seemed to have continuous colds or at least the symptoms. The prevalence of colds and the lack of due regard for their care are reflected in the absence records for the year. Nearly 65 per cent of the absences were traceable to colds.

The fact that cleanliness is necessary to safeguard health has been stressed throughout the school life of all pupils. The methods of infection by bacteria are pretty well understood by junior high school pupils. It is a well known fact that many diseases are spread by nose and mouth spray, that wounds may become infected if not kept clean, that dirty hands may carry infectious germs; yet, the following practices are common among junior high school boys and girls as well as among adults:

1. Coughing or sneezing without the use of a handkerchief.
2. Licking postage stamps and envelop flaps.
3. Putting fingers in mouth.
4. Scratching sores with the finger nails.
5. Placing adhesive tape next to open wounds.
6. Putting borrowed pencils in mouth.
7. Failing to keep teeth clean.

Health knowledge, it would seem, has little of practical value unless it has some carry over into actual life situations, and the schools must do more to make this carry over possible.

Home Situations That Imply a Practical Knowledge of Science Principles

Recently a questionnaire was sent to representative homes in Chanute in an attempt to determine what science knowledge seemed most practical to mothers or housewives. Out of the 300 replies to the questionnaire the tabulation of results shown in Table 6 gives some idea of the wide range of science interests in the home.

Table 6. Types of science information desired by 300 home-makers in Chanute.

Type of Information Desired	Desired by
Use of chemical in the home such as: lye, acids, soda, washing agents--soaps, etc.	260
Use of cleansing materials for clothing	250
First Aid	250
Heating equipment and fuels	230
Cooking utensils	210
Floor cleaners	210
Diet	209
Radio	208
Lighting the home--eyesight	205
Sanitation, garbage disposal, etc.	196
Electrical refrigerators, oven regulators, repairing electrical fixtures	187
Water supply	177
Ventilation, gas poisoning, gas leaks	164
Fever and disease	159
Flowers	158
Insects	136
Short circuits	131
Meters	127
Temperature and weather	125
Bacteria	121
Pasteurization	120
Plumbing	120
Gardening	116
Noise and hearing	113
Carbon monoxide	101
Birds	61
Pets	29

The results of this study have some implications for a junior high school course in science inasmuch as the child of this age is beginning to play an increasingly important role in the home.

To go still further with the home and its need for a working knowledge of scientific principles, it has been determined by a survey made in the 1937 ninth grade class of the Chanute Junior High School that the home appliances and conveniences are to be found as indicated in Table 7.

Table 7. Appliances and conveniences in Chanute homes as shown by a survey of ninety-five homes.

Appliance or Convenience	Number of Homes
Electric lights	78
Running water	77
Bath tub	75
Telephone	60
Electric sweeper	50
Electric toaster	40
Radio	78
Electric mixer	18
Washing machine	60
Electric iron	70
Garden	75
Flowers	82
Pets	85

We find other implications for science training when we review the facts shown in Tables 8, 9, and 10.

Table 8. Materials from which the 2940 houses (residences) in Chanute are built:

Material	Number
Wood	2727
Brick	114
Stone and Others	99

Table 9. Year the 2940 residences in Chanute were built.

Year	Number
1935	5
1930-1934	28
1925-1929	81
1920-1924	161
1915-1919	180
1905-1914	936
1895-1904	1120
1885-1894	314
1860-1884	113
1850-Before	
Per Cent Built 1919 or Before	90.7

Table 10. Condition of Chanute residences.

Condition	Number
Good	971
Minor repairs needed	1451
Major repairs needed	472
Unfit for use	44
Per Cent Major Repairs or Unfit for Use	17.4

From the above tables we note that 92 per cent of all the residences in Chanute are built of wood in spite of the fact that all lumber used in these houses had to be brought from other states and in spite of the fact that this community has one brick company and one of the largest cement plants in Kansas. We note also that 90.7 per cent of these houses were built in 1919 or before and that 49 per cent of them are in need of repair, either major or minor. These facts, coupled with the offerings of science in the field of home building materials, home fixtures, air conditioning, heating, etc., should provide direct interest in a course in science instruction that would place some emphasis on home building.

The Interests of Junior High School Pupils in the Materials of Science

Many theses have been written regarding the interests of children in the materials of science and the subject needs further development to clear up conflicting results. Some results are of great value, however. Dunlop (16, p. 629-630) found that children learn more readily and with greater facility those things they are most interested in. Interests then are of primary importance in consideration of what should be included in a junior high school science course. The study of Burlingame (7, p.69) ranks the interests of eighth grade children in the materials of science in the general divisions of science as follows:

1st Astronomy	6th Zoology
2nd Physiography	7th Physics
3rd Anthropology	8th Electricity
4th Geology	9th Botany
5th Chemistry	10th Hygiene

She interprets the findings of her study in part as follows:

> 2. "Interest or lack of interest, in any science field will be fairly constant among children of the same age and in the same social-economic background, regardless of intelligence.
>
> 3. "No sex difference in interest in General Science as a whole will be found significant enough to warrant making adjustments in the curriculum for boys and girls....
>
> 4. "It can be expected that children will show a spontaneous interest in any material of science that escapes the commonplace and the familiar, that challenges the imagination, that deals with cataclysmic changes and that possesses the qualities of mystery or of grandeur."

We have surveyed the science interests of the pupils in Chanute Junior High School. The survey was made during the last month of school, Spring 1937, and the results are probably colored somewhat by the course in science in which the children have had a part. However, the results seem to indicate trends in the thinking of these pupils and we believe them to be of great value in this study. The order of placement of each subject shown in the columns in Table 12 represents the rank of placement according to interest.

Table 12. Rank placement of subjects in the field of science according to interest. Pupils of Chanute, Kansas, Junior High School.

Seventh Grade	Eighth Grade	Ninth Grade
Flowers, Trees, Birds, Insects	Astronomy	Chemistry
Animals	Flowers	Electricity
Astronomy	Birds, Nature	Machines
	Hygiene	Flowers, Archeology
Minerals	Diseases	Birds
Weather	Airplanes	The Body
The Earth	Geology	Cosmetics
Radio and Television	Weather	Weather
Electricity	The Earth	Geology
The Body		
Machines		

In summarizing we recall the lack of application of science principles to many health problems. This failure has not all been traceable to a lack of training in health problems but rather to the failure to make health training applicable and a part of real life situations. The science course must more effectively make possible the use of information assimilated in the course by pupils but the science course cannot be the only source for imparting this health training. Health training should be a part of every course that has implications for knowing more about health.

That the home needs for science training are increasingly numerous has been definitely shown. The implications are almost unlimited for a program that will make science knowledge in home situations more meaningful.

The problem of interests of junior high school children in the materials of science is one that needs further study, but the indications are as have been shown in this study that interests are fairly general among children of the same age and sex. It was shown that certain interests seem to exist in varying proportions among different age groups, but within the same age group the interests are common. Hunter (20, p.141) states that in the selection of subject matter for junior high school courses mental age, interests, and science background must be considered important. He further states that seventh grade pupils are individualistic and that their interests are centered in their environment; eighth graders center their interests in idealism, citizenship, and cooperation and their science course should deal with topics of a community nature; ninth graders begin to apply the earlier gained knowledge and understanding.

Our science course then will have its emphasis in situations that are meaningful to boys and girls.

A COURSE IN SCIENCE

FOR THE CHANUTE JUNIOR HIGH SCHOOL

We have shown in preliminary sections of this thesis the confusion that exists regarding science training in the junior high school. We have pointed out the failure of science teaching to correlate science knowledge with life situations and have shown a need for correcting this condition. We have shown the lack of agreement on science course content for the junior high school and the shortage of text books for a three year course in junior high school science. Along with a lack of understanding of what to teach and when to teach it, there was shown a divergence of methods of teaching science, and no agreement as to the best method.

We have pointed out certain needs for teaching science in our junior high school and have indicated general trends in the field of science teaching. Earlier in this study certain guiding principles were set up as being important in organizing a course in science. Now, having established to our own satisfaction the needs, trends, and guiding principles for our course, we can state the aims we have formulated. These aims, though general in nature, are those around which we shall build our course and are as follows:

1. To help the junior high school pupil make an intelligent and satisfactory adjustment to his environment.
2. To help the pupil acquire knowledge, interests, and ideals which will enable him to develop attitudes and habits conducive to good citizenship.
3. To provide a science background that will eliminate fears and superstition.
4. To provide an environment in which scientific achievements and possibilities are more fully understood and appreciated.
5. To develop understandings and appreciations of natural environment by making possible the study of living things.
6. To survey the field of specialized sciences.

Before proceeding further with setting up the outline of our course, it will be well to state the core ideas about which the formulation of the course has revolved. The preliminary work on this thesis, experience as an instructor in junior high school science classes, and my desire as a junior high school administrator to provide a program of training that will be of greater value to children have all contributed to the philosophy underlying these ideas.

First, although it is trite to say it, a good teacher is essential to this or any course. The best program may become useless in the hands of an incompetent or disinterested teacher. I see no hope of putting over any science program unless the teacher is in harmony with it.

Second, this course is organized to meet the conditions of our own school in so far as class schedule, program of studies, and instructional service are concerned.

Third, there are many situations in our school program that indicate a need for special science instruction, such as: the study of foods, their care, selection, and preparation; the environment of early Kansas; the industries of Chanute, why and how they were developed here; the study of electricity, pottery, woods, clothing, water supply, etc. These situations furnish excellent and natural bases for science teaching. Science teaching should be integrated with every situation that permits it in so far as that is possible.

Fourth, the focal point of endeavor for every individual seems to be getting a maximum of satisfaction from life. Science has aided in making life more satisfying for millions of individuals, and to other millions it has meant poverty, torment, or destruction. Science teaching must present more effectively a program that will enlist the sympathies and efforts of a greater number of people in using science on behalf of humanity.

Fifth, there is no place for science instruction that does not function. There is no practical value in stuffing a full school program with science facts just because some other school has found them worthwhile in meeting its needs. It has been noted in this study previously that much science training has been little more than busy work. It seems to our immediate advantage to withold from our program science information for which we cannot see a place.

Sixth, setting up any course when such confusion as to direction exists must be on a tentative basis.

Continued improvement is to be desired and expected.

So that we may approximate the desired ends as indicated in the foregoing six statements, our program will be divided into three phases. One phase will be covered in each of the three years of the junior high school, and each phase will differ widely from the other in the method of approach, in the field covered, and in the desired outcomes. A description of each of the phases follows.

The Seventh Grade Phase of Science Instruction

Pupils who come to the Chanute Junior High School from Chanute's elementary schools have not been accustomed to departmentalized instruction. The one teacher each child has had in his sixth grade work has given him all his courses in that grade. We recognise the need for making his first year in junior high school one of proper adjustments. Therefore, we believe that wherever it is possible courses should be integrated and the subjecting of the child to so many variable conditions eliminated.

Even more important is our recognition of the child and not subject matter as the focal point in our school program. With this philosophy, subject matter fields and course boundary lines have no part in our program as such unless they contribute to the child's adjustment to life. That is, we can no longer have as our major interest the teaching of subjects. Subject matter and courses have no excuse for being unless they function in the integrating process for the child.

We are, therefore, assuming that science as a subject matter field or as a special course in the seventh grade is not desirable if science attitudes and concepts can be developed in a more efficient manner. Attention was called in another part of this thesis to two significant facts. One was that the sixth grade classes in Chanute in 1936 made a higher average in science than they did in all other subjects combined on a standard battery test. This is significant because science was not a course as was English, grammar, mathematics, etc., but was given only as a part of the other courses. The other significant fact was that the results of a survey made in the eighth grade class of the junior high school of Chanute showed a keen grasp of certain health facts even though no course was offered in that field. The assumption may be made that this health training came through its correlation with other courses both in the junior high school and in the grades.

Science training in the seventh grade will be given as a planned part of other courses where it may function most effectively and naturally. As will be explained later a definite program of procedure in providing this science training will be carried out. Outlines of courses and units will be shown to indicate the nature of the program.

Our seventh grade pupils are required to enroll in the following courses:

Mathematics

Physical education and health instruction

Industrial arts, for boys

Home economics, one semester, and industrial arts, one semester for girls

A correlated course in English, speech, and social science (two hours in length)

They may elect band, orchestra, vocal music, or creative dramatics. Special attention is called at this point to the course in English and social science. No attempt will be made here to point out the advantages of this correlation except to state that in this course, which will be given to seven groups of thirty pupils each, we are setting up situations that make it desirable to carry the correlations even further than the two subjects named. The course is based upon the general theme, "The development of the

Chanute community". The theme is approached by developing such topics as how old is Kansas, Indian villages in this community, early settlers, Chanute's industries, health safeguard in Chanute, etc. As a preliminary part of this course a one week unit on the use of the library is given by the librarian. Later and at an appropriate time, each group will be given a four week unit in speech training by a specialist in that field.

The industrial arts course for boys in the seventh grade is divided into four nine week units: home mechanics, drawing, crafts, and elementary ceramics. Industrial arts for girls will be divided into two nine week units: home mechanics and crafts. Exploration is probably the outstanding aim in this field. In each unit enough time will be given to backgrounds and future possibilities of that phase of industrial arts to provide for exploration but not in a manner that will detract from the natural interest children have in manipulative work.

Home economics for girls emphasizes foods, their selection, preparation, serving, and use to the body. Here again exploration plays an important role but not the leading one.

Physical education is a required course and health instruction is included in that course. Beginning with the school year 1937-1938 special classes will be conducted for those who cannot take the regular course of instruction. Their training will be on a level with their ability to take part. Corrective work will be emphasized and needed health information will be given. All pupils taking physical education will also be given special health training and information one day each week. In the past, science has been given two days each week alternating with physical education.

The traditional type of instruction is given in mathematics and no immediate change is anticipated; however, this does not mean that improvement is not being made or that the need for some reorganization is not seen.

As was pointed out in the preceding section of this thesis, health and environmental interests should have extensive consideration in the seventh grade course in science. We propose to provide for these interests by correlating them with the situation which must naturally arise in the above named courses.

Physical education has a natural tie-up with the health of the child. Both of our physical education teachers have had special training in health education.

Except as the questions of health naturally arise and are met in other situations in the classroom, we will make no other provision for health training.

The plan for presenting the other phases of science instruction in the seventh grade is to include it where the need and implication for such instruction arises. This might be in the work done in the correlated English-social science course, in the industrial arts course, in the home economics course, or perhaps in the teaching of some phases of mathematics. In most cases the regular teacher would be qualified to emphasize the science implications, and in others a specialist would have to present a more detailed and scientific approach. It is evident that no detailed science units can or need be included in such a program. It is also evident that much of what is to be given in these courses has been an important part of the instruction given by the superior type teacher for some time. This work will not be new to him but it will be organized so that all who teach the courses will make use of it instead of just the superior teacher. Each will be furnished with an outline of the work to be covered.

Four examples of correlating science in the seventh grade are:

Correlation with English-social science.

Although this course is undergoing continuous change and is still in the formative stage, the chief points of attack have been determined and the proposed outline of the course follows. Each large field of study in the outline that has science implications will be underscored. A description of the treatment of one of these fields or points of emphasis will be given following the outline.

The Development of the Chanute Community

I. How old is Kansas
   A. Indications of its age in stone
   B. Why and how it has changed
II. Kansas Indians
   A. Life and customs
      1. Securing food and clothing
      2. Caring for the sick
      3. Superstition and legends
      4. Religious customs
      5. Government
III. Early visitors from civilization
   A. Coronado and the Seven Cities
      1. Why he came
      2. What he found

B. Missionaries

1. Neosho county missions
2. Work accomplished

C. Traders

1. Canville the Frenchman

IV. The settler moves in

A. Pioneer life

1. Homes
2. Transportation
3. Communication
4. Care of sick
5. Food and clothing
6. Social life
7. Making a living

B. The Indian moves on

V. New interests bring villages

A. New Chicago and Tioga

1. Village life
2. Law and order
3. Water supply
4. Health
5. Religious life
6. Social life
7. Industries

B. A railroad is built

VI. Chanute becomes a city

A. Industries

B. Natural resources and our dependence on them

C. Industries of service

VII. Chanute's city government

A. Officers and form of government

B. Community services

1. Utilities

2. Police protection and traffic regulation

3. Streets and parks

4. City ordinances

5. Health safeguards

6. Others

VIII. Transportation and Communication grow up

A. Chanute's railroads

B. Trucking companies

C. Martin Johnson airport and air mail route

D. A long distance call to London

E. We hear the coronation

F. Wirephoto

IX. Education keeps the pace

A. What about our natural resources?

1. How can we conserve them?

B. What about the kind of citizen to expect?

1. What kind is needed

C. What can be done to make Chanute a better place to live in?

D. What will be your contribution to Chanute?

The large number of science implications indicated here might easily be developed into wider fields of study. The purpose here, however, is not to separate but rather to integrate these points of interest with the whole broad picture, showing them in their natural relationships. It will not be necessary to set up the procedure for meeting each situation indicated, but an approach to one important implication for science will be given to demonstrate. It should be understood that a variety of approaches may be made and that the one chosen has been arbitrarily chosen. Some definite procedure is necessary if uniformity is accomplished. The following procedure is a more or less common one and its use is acceptable in this course.

Method of approach to one phase of the English-social science course that has special science implications:

I. How old is Kansas?

A. Indications of its age

Note to the teacher: It seems fitting that the natural curiosity of children for their physical environment should be fully considered in any program such as the one we are to develop. The development of this community was preceded by a series of events that has made its development possible. A partial outline of this long succession of events has its place in our course. The purpose of this introductory picture of Kansas of prehistoric times should be to satisfy some of the curiosity pupils may have regarding those times. This part of the course should also result in acquiring appreciation as well as understanding regarding the value and limits of our natural resources upon which this community depends so much. Added objectives might well be to understand the effect of weather on rocks, to study the fossil remains of plants and animals, to understand the formation of coal, natural gas and oil, and to understand the formation of soil.

The following generalizations may be developed:

1. The earth (Kansas) is countless ages old.
2. Evidences of the earth's age may be found in rocks and the fossil remains of plants and animals.
3. The earth's surface is undergoing continuous changes, some of which rob Kansas and Chanute of valuable natural resources.

4. Deposits of plant and animal remains buried thousands of years ago are now valuable to Chanute.

Suggested approaches to this unit:

1. Show the class a collection of fossils and explain their origin.
2. Ask some one to tell how the oil in the Chanute field was formed.
3. Visit a hill or gulley where layers of rock are exposed and question pupils regarding their formation.
4. Visit the rock crusher and collect fossils.
5. Discuss Kansas inhabitants of the Stone Age.
6. Ask pupils to bring as many kinds of soil as can be found.
7. Display and discuss a topographical map of Neosho County.
8. Have a geologist talk to the class on the subject, "How old is Kansas".

Suggested informational activities:

1. From a reference book find out how rocks and soils are formed.
2. Learn how weather affects the surface of Kansas.
3. Find out who the first inhabitants of what is now Kansas were.

4. Determine how fossil remains indicate geologic time.
5. Discuss the possibility of Kansas becoming a desert.
6. Discuss the era in which Kansas was partially covered with ocean water.
7. Find out how coal, gas, and oil were formed.
8. Discuss the geological age of rocks in Kansas.
9. Read about the activity of the United States government in preventing soil erosion in Kansas.

Expressional activities:

1. Collect as many different kinds of rocks and soils as you can find in the Chanute community.
2. Make a collection of fossils.
3. Make posters showing what took place during the different eras of geologic time in Kansas.
4. Make a collection of Kansas minerals.
5. Estimate the age of different rock formations found in the Chanute community.
6. Write a geologic history of the Chanute community.
7. Draw scenes of life as you think it might have been in prehistoric Kansas.
8. Make a series of drawings showing scenes in the five geologic periods as you think they might have looked.

9. Draw a contour map of a section of your community, then reconstruct a drawing to show what this section might have looked like before it was changed by weather.

Reports that should be of interest:

1. How the Earth was formed.
2. Petrified forests.
3. The valley of ten thousand smokes.
4. Prehistoric animals and plants of Kansas.
5. Krakatoa.
6. The first Kansas.
7. The formation of oil.
8. Dust storms and why we have them.
9. Erosion.
10. The Kansas sea.

Attention should be called to these present day problems:

1. Soil conservation.
2. How to prevent floods.
3. Conservation of natural resources.
4. Preserving places of natural beauty.

Activities that might be used to culminate the work of the unit:

1. Begin a geologic museum to which the whole class

makes a contribution.

2. The class might be divided into divisions and each of the divisions asked to prepare a chapter in a geologic time book. This book might contain fictitious stories, poems, drawings, and explanations of what took place in each period of geologic time.

3. Plan an exhibit of all material gathered during the work on the unit and ask the parents in to see it.

4. Send out a mimeographed student planned bulletin on different interesting phases of the unit to parents and friends.

5. Construct a large relief map of the Chanute area.

Has your work produced results?

1. Do your pupils understand how the earth's surface undergoes change?

2. Do your pupils understand and appreciate better the value of the natural resources of this community?

3. Do your pupils understand how coal, oil, and natural gas have been formed?

4. Do your pupils have a keener appreciation for their community because of their increased knowledge regarding it?

5. Do your pupils have a better understanding of the series of events that have given Kansas its types of soil, its natural resources, and its topographical features?

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Correlation with industrial arts.

Inasmuch as we have cited a detailed approach to correlation with science in one instance, we are not going to set up such outline but in the following cases will make only broad applications.

It will be remembered that the four units to be covered in the industrial arts are home mechanics, crafts, drawing, and elementary ceramics. We stated that exploration was one of the chief objectives of the course, and, if this is kept in mind, one may see more clearly how science becomes an aid to exploration. For example, elementary ceramics has these important science implications:

1. Why are some clays adapted for some work and not for other?
2. Why would it not be profitable to make fine pottery in the Chanute area?
3. What possibilities are there for utilizing clay products?
4. Why is a high temperature necessary for making clay products?
5. How is the glaze put on jugs, etc.?
6. Are the Indians of the Southwest better potters than some trained in our schools of higher education?
7. Why is Wedgewood to be desired above others?
8. What should I know about clays to be able to follow pottery as a hobby?

Drawing has one very important implication for science; its use is almost universal when graphical representation of plans is desired. Planning in different branches of science, such as electricity, mechanics, physics, and others makes use of the elements of drawing. This implication is a broad one and need not be given a great amount of emphasis other than to show its application.

Home mechanics and crafts imply science correlation in the following ways:

1. Understanding of electricity in work with home appliances.
2. Understanding of materials worked with, such as insulators, plastic woods, paints, paper mache', wax, plaster Paris, dyes, etc.

Correlation with home economics.

The girls find many implications for inclusion of some science consideration in their home economics course. Outstanding among the places for such emphasis on science would be:

1. Selection of foods
    a. For calorie content
    b. Vitamin content
    c. Other considerations such as mineral content.

d. When source is considered such as

(1) its care in handling

(2) freedom from contamination

2. Preparing foods

a. To retain their vitamin value

b. For greater digestibility

c. To meet certain needs, such as sickness

3. Home care of foods

a. To keep free of contamination

4. Use to the human body

a. Classes of foods

b. Use

c. Content of various types of common foods

d. Necessity for vitamins

e. Conditions requiring special foods

Correlation with mathematics.

The implications for science correlation in mathematics are almost unlimited if one cares to apply mathematics to its broader and more generally needed uses. For example, the problem of conservation in our own community must be one of concern to us sooner or later. Junior high school pupils, to be sure, are not in a position to apply directly their mathematical knowledge to these conservation problems, but an understanding of these problems is necessary. A unit might well be set up which has as its purpose the application of mathematical application to science problems is that of propaganda in advertising. Only one phase, the patent medicine racket, might be covered or the whole field might be studied. Here is a problem that each child does have to meet. Many needed additions might be made to homes, to wardrobes, to vacation plans, to educational advantages, and to the general happiness of home situations if the actual value of patent medicines were better understood.

Heating devices, electrical equipment for the home, washing compounds, cheap appliances, and the buying of canned goods could easily take the whole year's time for mathematical study even though done in the most elementary fashion. This point is emphasized quite forcibly as one looks over newer texts in seventh grade mathematics. Trends in curriculum development also indicate a need for this type of approach to mathematical training.

Then there is the field of measurements so closely allied with science that its application to both fields is almost a necessity. To include each topic suggested here would mean that some things would have to be spread so thin that the value of the course would be doubtful. Therefore, it seems more desirable to concentrate on one suggested topic. This topic should be of environmental interest to the pupil, and we choose arbitrarily conservation of natural resources as a point of emphasis.

The Eighth Grade Phase of Science Instruction

This phase concentrates more time to science proper by requiring all eighth grade pupils to take one semester of science training. Whereas natural environment has had the greater emphasis in the seventh grade, the major emphasis in this course will be upon the home environment. The course consists of a series of units that are not related in continuity, and, as more units are included than can be covered in the time allowed, a rather free range of choice in units to be used is given. A provision is made, however, to include a variety of units by requiring that at least one unit chosen from each group be developed in the course. Each teacher is furnished with the outlines of units that may be given in the course.

In addition to this independent science course direct applications of science principles will be continued in every course possible, more especially in industrial arts and home economics. Health remains as an important part of the physical education program.

It is not possible to obtain a single science text that covers the whole range of subject matter needed for the course. Supplementary texts and reference material are to be used and a wide range of these books are to be furnished. All books and other reference material will be kept in the classroom library.

Units offered for development in this course are listed below. At least one unit from each group must be chosen.

Group A. The home.

1. How home appliances do the work of many slaves.
2. Electricity in the home.
3. How to keep the home comfortable in all seasons.
4. Science builds a model home.
5. Beauty at home.

Group B. Health.

1. How the health of Chanute is safeguarded.
2. How to keep the family well.
3. What to do in case of accident.
4. How chemistry has aided man in his battle with disease.

5. How to combat home pests.

6. Chemistry in the home.

Group C. The scientific approach to spending money wisely.

1. Patent medicines and your pocketbook.

2. You get what you pay for--if you are careful.

3. How science can save you money.

4. Popular fads and fallacies.

5. Read the ads and believe what?

6. Filling the family market basket.

Group D. Leisure time.

1. Reading for pleasure.

2. Seeing stars.

3. What bird was that?

4. Picture that.

5. Up a family tree.

6. What about a pet?

7. Fly and bait casting.

8. Cooking out of doors.

Outline of Unit for Eighth Grade

Picture That.

Note to teacher:

In keeping with the accepted thought that every one who can should have some sort of leisure time activity that completely takes him away from his vocation, this unit on photography is offered as a means of interesting children in some worthwhile activity. As a source of great pleasure no hobby has more to offer than photography. As an activity that has more implications for a pleasant approach to a good foundation of science, photography probably has no equal. It has the advantage of providing a lasting interest to those who nurture it, an interest that all but takes the place of one's vocation if not controlled. Photography should prove of immediate interest to the eighth grade child. Every one has at some time a desire, even though slight, to take a picture or make a picture. The apparent mystery of photography soon gives way to wonder when the child finds he can master some of its secrets.

You should be able to give the pupils enough of a start in this unit to build an interest that will be lasting for a few of them. Others will develop an appreciation of science and its results while some may become interested in still other phases of art.

The following generalizations may be developed:

1. Photography is an art that all may enjoy with care in following directions.

2. Photography is a worthwhile hobby.
3. The art of photography is comparatively young.
4. New fields for photography are abundant.
5. Little expense is necessary to set up a home dark-room.

Suggested approaches to this unit:

1. Ask a local photographer to talk to the group on the possibilities of photography as a hobby.
2. Exhibit one of the collections of photographs that may be obtained from several sources (University of Iowa, Extension Service, will send a beautiful exhibit free of charge).
3. Exhibit work done by a local amateur photographer.
4. Demonstrate the workings of a good camera.

Suggested informational activities:

1. Find out how a camera works.
2. Find out how films are made.
3. Read about the ways that photography is used.
4. Determine the best methods of getting good results in picture taking.
5. Read how negatives are developed.
6. Find out how to expose pictures correctly.
7. Read how to enlarge pictures.
8. Find out how to print pictures.
9. Determine what lighting conditions are best for

night pictures.

10. Find out the differences in film speed.
11. Read how lenses do their work.
12. Find out how the candid camera works.
13. Learn the function of each part of a box camera and of a good folding camera.
14. Find out how to mix chemicals.
15. Find out how photography has become the art that it is.

Expressional activities:

1. Build a dark-room at home.
2. Collect equipment for a dark-room.
3. Build a printer for printing snap-shots.
4. Build an enlarger.
5. Mix chemicals for developing films.
6. Develop a roll of films.
7. Print a series of pictures from negatives you have made.
8. Mount prints in a suitable way.
9. Take a series of pictures with a box camera using an exposure table. Take pictures under a variety of conditions.
10. Enlarge a picture from a negative you have made.

11. Prepare a mounted collection of films (undeveloped and developed), blank printing paper, and printed, diagrams of steps in developing and printing pictures, and explanations of processes.
12. Take a series of trick pictures.

Reports that should be of interest:

1. The history of photography.
2. How to print pictures.
3. Color Photography.
4. Wire-photo.
5. Portrait making.
6. Trick photography and how to do it.
7. Tinting enlargements.
8. Taking pictures at night.
9. Action pictures.
10. Photography and the news.
11. Motion pictures.
12. How to take landscapes.

Attention should be called to these present day problems:

1. The possibilities of color photography.
2. Infra-red distance pictures.
3. The possibilities of the candid camera.
4. What camera will be the best in the long run for

the amateur of limited means?

5. How can the amateur pay for his hobby?

Activities that may be used to culminate the unit:

1. Present an exhibit of work done by the class.
2. Organize an amateur's club.
3. Give an assembly program based on the development of photography.
4. Sponsor an exhibit of enlargements from some amateur group in one of the larger cities. (Mr. Steve Smith, of the Hall Stationery Co., Topeka, Kansas, will be of assistance in securing such an exhibit.)
5. Ask the parents in to a program and exhibit of photographic interest.

Has your work produced results:

1. Have some of your pupils developed an appreciation for photography?
2. Have some of your pupils become adept in taking and making pictures?
3. Do some of your students indicate an interest that promises to become lasting?
4. Have some of your pupils interested their parents in photography?

5. Do your pupils show a keener appreciation and understanding of the scientific method and its application?

6. Does photography take the place of other interests?

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The Ninth Grade Phase of Science Instruction

In the eighth grade phase of instruction in science the practical application of scientific principles to home situations was emphasized. This emphasis was general in nature, but it brought out the value of science contributions to life situations most common to boys and girls. The ninth grade phase has as its chief objective emphasis of the contributions the special sciences have made in the service of man. Two ultimate objectives are to work toward in developing this course, first, that in the study of these contributions to man some pupils will be guided in their choice of vocation or avocation, second, that each pupil will have a better understanding and appreciation of the possibility for science to serve man even more than it has in the past.

This course which is required of all ninth grade pupils will be given five days each week for one semester. The lack of a text book that will cover all of the different phases to be studied will necessitate supplying a large number of different kinds of texts and a wide range of reference material. This need has already been taken care of in part, and additional texts and references will be supplied for the course and kept in the classroom library. The use of the community as a laboratory will eliminate the necessity for equipping a school laboratory. Contacts have been made with a number of industries in the community, where the special sciences are given practical application, to study these applications first hand. The use of a classroom laboratory, that is as one thinks of the old general science laboratory, will not be necessary. We are interested primarily in projecting our group into practical situations and the classroom laboratory would be rather lame pretense at being very practical. However, this does not mean that the demonstration of methods and devices used in practical science will not be made in the classroom. On the contrary, the classroom will be used to greater advantage by having local representatives of the industries and other establishments make demonstrations of instruments used, tell of methods, and explain how the different sciences are used in their work.

We have demonstrated the type of unit development and procedure that will be used in both the seventh and eighth grade courses and will not show a sample unit for this course. Instead we will present here an outline of the field to be covered. We have attempted to include the wider field of the special sciences which means that the more or less limited fields are not included in a group by themselves but as one large group. The teacher will follow the outlines of the units in developing the course but will not be expected to present the units in the order given here. The course outline follows:

How the Special Sciences Have Aided Man

1. Chemistry in the service of man.
    - A. How chemistry is used in the safeguarding of public and personal health.
    - B. How chemistry is used in industry.
    - C. How chemistry is used in the home.

2. Physics in the service of man.
   - A. Engineers and physics.
   - B. Physics in industry.
   - C. Physics in communication and transportation.
   - D. Sound and light in motion pictures.
   - E. Physics used in the home.
3. Agriculture in the service of man.
   - A. How agriculture serves the home.
   - B. How agriculture serves industry.
   - C. Agricultural problems.
4. Bacteriology in the service of man.
   - A. How bacteriology serves the home and community.
   - B. Bacteriology in industry.
5. Geology in the service of man.
   - A. How geology serves industry.
   - B. How geology serves in the location of minerals and other valuable natural resources.
6. Astronomy in the service of man.
   - A. How astronomy aids in transportation.
   - B. How time is determined.
   - C. Astronomy as a hobby.
   - D. Seasons.
7. Special branches of zoology in the services of man.
   - A. Entomology and man.
   - B. Conservation of wild animal life.

8. Other sciences in the service of man.

    A. Archeology.

    B. Physiology.

    C. Embryology.

    D. Psychology.

    E. Endocrinology.

    F. Pathology.

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