

AN ANALYSIS OF THE GENERAL SCIENCE TEXTBOOKS USED  
IN THE KANSAS SCHOOLS SINCE 1915

A THESIS

SUBMITTED TO THE DEPARTMENT OF  
EDUCATION AND THE GRADUATE COUNCIL OF THE KANSAS STATE  
TEACHERS COLLEGE OF EMPORIA IN PARTIAL FULFILLMENT OF  
THE REQUIREMENTS FOR THE DEGREE OF  
MASTER OF SCIENCE

By

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C.M.D.

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## CHAPTER I

### INTRODUCTION

#### The Nature of the Study

Many people have said, "What does a course in general science consist of?" "Why should a student choose the general science course?"

It seems advisable to point out the aims of a course in general science and to explain the content of such a course. The objectives of the general science course have changed in the last twenty years. The course is now a more composite study of all the sciences than it has ever been before. If there has been a change in the aims, methods of teaching, and material covered, there must be a definite change in the textbook used. This study presents an analysis of the five general science textbooks that have been used in the Kansas schools since 1915. Such an analysis will show the change in subject matter and point out the features of the newer textbooks. This study also presents a score card containing the criteria for evaluating general science textbooks. The five textbooks used in this study were evaluated on the basis of the score card presented.

#### The Scope of the Study

This study undertakes the analysis of the five general science textbooks that have been used in the Kansas schools since 1915. The following is a list of the books that were used in this study:



1. John C. Hessler; The First Year of Science; Benj. H. Sanborn and Company; Boston. 1915. Used 1915-25.
2. George W. Hunter and Walter G. Whitman; Civic Science in the Community; American Book Company; Chicago. 1922. Used 1925-30.
3. Charles J. Pieper and Wilbur L. Beauchamp; Everyday Problems in Science; Scott, Foresman and Company; New York. 1925. Used 1930-35.
4. Anna B. Regenstein and William R. Teeters; General Science; Rand McNally and Company; New York. 1925. Used 1930-35.
5. George W. Hunter and Walter G. Whitman; Problems in General Science; American Book Company; Chicago. 1934. Used 1935-40.

From 1930-1935 there was a dual adoption in general science, schools having the privilege of selecting one of the books listed for use.

#### Method of Procedure

In the last few years the textbooks that are introduced into our schools are very attractive and highly illustrated.

It has been said many times "There is a real need for a valid rating scale for textbooks," and, "When is a textbook suitable for a ninth grade student?" The problems confronting the administrators are: "How do we know when a textbook is satisfactory?" "What are the criteria on which to judge a textbook in a particular field?"

It is the desire of the writer to present a score-card for rating General Science textbooks that is simple enough in form to be usable.

After forming the score-card containing the criteria that are considered necessary for a good textbook, the general science textbooks that have been used in the Kansas schools in the last twenty years will be evaluated on this basis.

Classification of Material under Topics

1. Air and its use.
2. The use of Fire and Heat.
3. Water and its use.
4. Force and Energy.
5. Weather and Climate.
6. Astronomy.
7. Time and the Seasons.
8. Magnetism and Electricity.
9. Light.
10. Sound and Communication.
11. Power and Machines.
12. Transportation.
13. Rocks and Soil.
14. Foods and how we use them.
15. Personal Health and our Environment.
16. Clothing.
17. Fighting Diseases.
18. Plant and Animal Life.

19. Nerves and the Sense Organs.
20. Construction of Homes.
21. First Aid.
22. Improvement of the Human Race.

In a few cases it was very difficult to decide the exact classification into which some material should be placed. This difficulty was not commonly met with, however. A sincere effort has been made to classify all of the material in the texts.

#### Types of Data Collected

The following types of data were obtained from the five textbooks which were analyzed:

1. Number of pages in each textbook.
2. Number of pages devoted to the preface.
3. Number of different units.
5. Number of references given in the index.
6. The degrees held by the author.
7. The copyright date.
8. The name of the editor if the textbook was edited.
9. The type of binding for each book.
10. The number of illustrations used.
11. The method used to attack the problems.
12. A check on whether or not experimentation is used in the books.
13. A check on the use of a summary.
14. The average number of exercises used throughout the units.

15. A check on the use of black fact type for headings.
16. A check on the use of italics.
17. The average number of questions or exercises at the end of each unit in the book.
18. The average number of preliminary exercises before each unit if such are used.
19. A comparison of the number of pages devoted to the different topics.

#### Definition of Terms

The term "general science" is used to denote a rather composite study of the different sciences, each topic being presented in an elementary manner.

The "score-card" is a form to follow in evaluating the textbook.

The term "criteria" is referred to as being a selective standard of judgment.

The term "topics" refers to those various units of science such as light, astronomy, heat, and air which go to make up a composite course in elementary science.

The term "evaluate" is used in an attempt to express numerically the actual worth of the textbook on a definite rating scale.

The term "work book" refers to a specially prepared booklet that is published by the same company which puts out the textbook. The work book follows the unit work and has exercises to fill in as written work.

As used in this report, "educational trends" refers to the latest up-to-date educational theories and methods that should be followed in teaching young people.

The term "administrator" is used to refer to superintendents and principals who are in charge of the school systems.

The term "adopt" refers to the choice of textbook that the state has made for standard use in the schools.

#### Sources of Data

The five general science textbooks were analyzed and much of the material in the thesis was derived from this source. Other material was gathered from previous studies in which textbooks both in general science and other fields had been analyzed. Books written on textbook selection and textbook evaluation were consulted.

Many magazine articles were read and much valuable information was obtained from this source.

## CHAPTER II

### METHODS OF EVALUATING GENERAL SCIENCE TEXTBOOKS

Teachers and textbooks are obviously the two outstanding factors (discounting pupil mentality) in school achievement. If textbooks are inferior teachers must be correspondingly superior. The American school is dependent upon the textbook very largely for the content of instruction and almost equally largely for the method of instruction. It follows therefore that one of the best ways for improving the content and method of instruction is to improve the textbook to get improved textbooks into the hands of the teachers and pupils.

Both of these methods of improving instruction--getting better textbooks made and getting better textbooks used raise numerous and complicated problems.

The leaders of educational research in America are fully conscious of these two problems. Important studies have been made and others are in the making on such topics as:

1. Who writes our textbooks?
2. What methods are followed by these writers in the construction of textbooks?
3. Do textbooks lead or do they follow courses of study prepared by state and city school systems?
4. How do publishers select textbooks from the flood of manuscripts offered them?

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Guy M. Whipple, "The Modern Textbook and the School," Journal of Education, 109:637-8. (June 10, 1929.)

5. What should be the size and face of type, the length of line, the color and style of binding to make a textbook effective and attractive for use in each school grade?
6. What should be the number, size, and nature of the illustrations for books on each subject and for each grade?
7. How much money is being spent in the United States for textbooks? What is, and what should be the ratio of this expenditure to the expenditures for teaching, school buildings, administration, etc.? Can the cost be reduced, and if so, how?
8. Who selects textbooks? Who should do so?
9. Are score cards useful in the evaluation of textbooks by superintendents, supervisors, or committees of teachers?
10. What are the merits, if any, in the state adoption of textbooks? In the state printing of textbooks?
11. To what extent, in what ways, and with what effect do legislative enactments and legal decisions affect the adoption, sale, cost, and use of textbooks?
12. What are the advantages and disadvantages of free textbooks?
13. How may reprehensible practices on the part of authors or publishers in the marketing of textbooks, when and if proved to exist, be suppressed?

The above topics are only a few of the many problems that are investigated in this country when the construction of textbooks is in progress. It is certain that the general quality of the textbook in American schools has steadily improved in the last few years.

The content of the modern book has been particularly shaped by the numerous studies of social utility. The vocabulary and style of the modern book is adapted, on the basis of objective evidence, to the capacity and needs of the grade for which it is designed. Much has been done to fit the text to the pupils mental ability.

The modern book is designed to avoid sheer memorizing and to stress real assimilation and active response by the pupil. The hearing of recitations, in the sense of securing a series of verbally correct replies to formal questions on the content of the textbook, is fast disappearing; its futility is perfectly apparent to any intelligent teacher. Most interesting in this connection is the appearance of all sorts of "work books," "laboratory pads," "diagnostic tests," and "self remedial tests," which are of such obvious usefulness as to be eagerly welcomed by all teachers who see the psychological merit of such supplementary and accessory material in leading to real learning.

Improvements in textbooks, like improvements in other merchandise, cost money. Superior textbooks are almost certain to cost more than inferior ones, and they are worth the difference. Teachers and administrators ought to always look at quality first and price second.

Improved textbooks cannot be gotten into use in our schools unless those who select the materials of instruction set up as their basic principle of selection: "Not how cheap is this book, but how good is it?"<sup>2</sup>

The American textbook is an educational tool of obvious importance and universal use. It presents problems that are psychologically and pedagogically challenging and that are at the same time practically important to publishers, editors, and authors.

The following is a group of ten problems that have been discussed by a group of Boston textbook editors.<sup>3</sup>

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<sup>2</sup> Ibid., p. 638.

<sup>3</sup> Guy M. Whipple, "Needed Investigations in the Field of the Text-book," Elementary School Journal, 35:575-82, (April, 1935.)



1. Is the Problem an Unnecessary Pedagogical Adjunct?

A problem that is presenting itself is whether or not the textbook should be discarded in favor of experimental learning, supplemented by class discussion, projects, and that type of activity somewhat comically designated by the term "research." Some people see in the textbook an example of undesirable "subject-matter-set-out-to-be-learned." Publishers would like to know if this is true and have proof to back it up. For purposes of investigation this problem can be restated as a series of part problems: Is the use of the textbook declining or likely to decline? If so, for what reasons? In what types of schools, in what school grades, and in what subjects? What forms of learning are used as substitutes for the textbook? With what success?

2. Is it Advantageous to Replace a Single Set of One Textbook with Several Sets of Different Textbooks?

To take an example, a class in general science might be supplied with two copies each of six well known science reference books rather than twelve copies of the same particular book.

3. What is the Extent and the Nature of the Demand for Master Copies of Material to be Reproduced by Duplicating Devices?

This problem brings up the following questions: How much are school people willing to pay for master copies? What bearing has the copyright law on this matter? It is obvious that the publishers, who, quite properly, have been striving to get school men to respect the copyright law, would, in a sense, be inviting them to break this law if they went into the business of selling master copies of this classroom material.

4. What are the Merits--Quality of Material and Cost per Word being Considered--of the Very Cheap, Ten-Cent-Store Type of Books as Compared with Standard Textbooks?

This problem seems to be clerical rather than experimental and a question of what one expects to get at ten cent store prices.

5. Why are School Administrators Adverse to Buying Elementary School Books that Deviate from the Format of the Typical Textbook?

There are published by trade publishers numerous juvenile books that differ in format (width of margin, page size, color of binding, etc.) from the typical textbook. These textbooks are usually higher in price than the school textbook.

The American schoolbook has undergone great changes in the last fifty years until today it is the most interesting, the most effective, and the most beautiful textbook in the world.

The method of selecting textbooks has changed also.<sup>4</sup> At the beginning and for a long time after, books were selected by teachers with no suggestion from any superior authority. The books were simple in character, an example being The New England Primer, which in type, illustrations, contents, and fitness for the work did not at all resemble the modern primer, or first reader. The spelling books in use were generally composed of mere lists of words of one syllable and proceeding to words of two, three, and four syllables, and sometimes more. It was the custom in American schools in the late nineteenth century to base all teaching upon what were widely known as the "three R's," otherwise called "readin' ritin' and rithmetic." Accompanying these subjects were spelling, English, grammar, geography, and United States history.

The reform brought on better schoolbooks in contents, in durability, in appearance, and lower in price, and the weeding out of dubious methods in marketing schoolbooks.

The city of New York has an open or multiple list. Once every year opportunity is given for adding new books to the list. At that time publishers may submit books to the board of superintendents who in turn submit them to committees of teachers for examination. If the books are found by these committees to be satisfactory and suited to the course of study for the city of New York, listing is then authorized usually for five year periods.

In Chicago, the plan for adopting textbooks requires first, that the books must be submitted to the instruction department for examination

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<sup>4</sup> Alfred I. Branham, "The Development of the American School Textbook," American School Board Journal, 81:58-9 (August, 1930).

by committees that make their reports to a superintendent, who in turn makes his recommendation to the board. The multiple plan prevails in Chicago. When the board adopts the recommendation of the superintendent, the books are put on the list of books that may be used in the Chicago schools. The principal of each school then makes a selection from this approved list, and under the Illinois law, the books so selected must remain in use for a period of five years.

Cincinnati has a board of education which adopts textbooks under the Ohio law. In that state, five kinds of districts are established by the law; county, rural, village, exempt village, and city. The board of education of each of these districts, with the exception of the county district, adopts textbooks under the same law. The county district cannot "adopt" books, but it may have a "recommended" list. Each board of education in Ohio--and all that follows applies to the Cincinnati board--adopts books for a period of five years, at the expiration of which any board may change or readopt such books.

Some states have what is called "state uniformity laws." These laws provide that the state board of education or the state textbook commission shall adopt both basal and supplementary textbooks for use in the public schools; that there must be one series of basal textbooks upon each subject; that the names and prices of these textbooks must be listed in contracts with the publishers, the prices to include net wholesale, exchange, and retail. These laws provide that textbooks cannot be changed during a period of five years unless a three-fourths vote of members of

the board or the commission is made in favor of the change. Adopted supplementary books are listed by name and the prices are fixed as in the case of basal books. Some of the states having "state uniformity laws" permit so called independent school systems to make adoption of textbooks by their own boards of education, ignoring the adoptions made by the state board or state commission. Independent school systems are usually those which, whether receiving money for the support of the schools from the general state school funds or not, tax their own citizens for the support of their schools.

To further show the progress in textbooks the following is related:<sup>5</sup>

It is a long step from, the New England Primer, Webster's Elementary Spelling Book ("old Blue-Back," 1867), to Pennell and Cusack's Primer (1930). In the preface to the revised edition of "old Blue Back" we find the claim that one of the features of the book is "an improved form of type," and it was this type which with slight variations was generally used in the books prior to 1890.

While the books of that period were in striking contrast to the first crude attempts at textbook making, it is in the present period, commencing about 1890, that the most radical changes have occurred. These have been concurrent with the extensive investigations carried on by the various educational agencies in the leading institutions of learning. This research work has been directed chiefly toward the improvement of teaching in the elementary grades as it is reflected in the character of the textbooks.

This optical hygiene, the study of eye movement, the length of line, the amount of interlineage, rhythm, uniform line beginnings, unbroken phrases, indicate the kind of activities which has placed the construction of textbooks on a truly scientific as well as artistic basis.

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<sup>5</sup> O. J. Laylander, "Forty Years of Textbook Progress," American Schoolboard Journal, 32:47-8. (March, 1931.)

The books of 1890 showed remarkable improvement in the type page, and yet, in this point alone, the greatest advance has been made in recent years. There is now a wider use of basal type with more color. In the primers and readers of today there is being used increasingly a type especially designed by the largest type founder in the country for use in textbooks. The design of this type embodies the result of the studies of investigators here and abroad and its increasing use has contributed greatly to the legibility of the modern book. The art quality of illustrations shows a distinct advance. The old-time drawings, lacking in perspective and delineation, have been displaced by well drawn, simple, relevant illustrations, brilliant with artistic coloring. The development of the half-tone processes, the availability of excellent photographs, the better use of color in maps, and numerous other factors have contributed to the remarkable degree of variety and style that makes the textbook of today a delight to the eye,

The durability of the textbooks of today also offers a striking contrast to the earlier books. The old board and leather covers went into discard. The paper found in the best textbooks today stands the wear and tear of use better than the papers of forty years ago. New developments in the binding process, the use of stronger materials, the substitution of stitching for sewing in certain kinds of books, the great variety of beautiful cover cloths that lend themselves to unique decoration, the discovery of cover material proof against bugs and water, are a few factors that make the modern textbook more usable and much more beautiful than its predecessors.

It is not in mechanical excellence only that the modern textbook surpasses those of previous periods. There is another even more important factor, the content of the text. The day has passed when just anybody can write a textbook. The successful book of today is long planned in advance. Publishers vie with each other to secure the best possible authorship. Writers must be of recognized authority in their chosen fields. They must be in touch with the trend of requirements as reflected in the findings of the educational experts and the developments reached by professional research. Manuscripts must pass under the scrutiny of numerous competent critics and very often be subjected to the test of experimental use in the classroom before final acceptance for publication. The publishers must make sure that the content of the textbook will meet the generally accepted current educational requirements before he will proceed to put the book into appealing form.

Today the textbook salesman must be a man who is acquainted with current educational trends and demands. The agent must know not only his own but competing books thoroughly. He must know more about his subject than his prospective purchasers and demonstrate his fitness to serve as a guide. It is almost imperative that he have had classroom experience. So, it has come to pass that, although forty years ago the school people looked askance at the book agent, today in the great majority of schools he is regarded as a valuable asset an indispensable bearer of helpful messages. The growth of free textbooks, the fixing of prices in state departments of education, insuring against discrimination and disastrous price wars, the general practice of superintendents to consult with leading teachers, all have contributed toward raising the standard of salesmanship as well as the quality of the books used.

While the school textbook business as exemplified in the United States has many aspects which are assuring and gratifying, it also has a future for enlarged service. The constant effort of educators to adjust the scheme of popular learning more nearly to the needs of a rising generation, also implies changes in the aids and agencies that enter into school life. A textbook is never quite modern unless it serves its purpose directly and adequately. The publisher must keep an eye on the movements and trends in the field of education and select his authors accordingly.

In recent years the educational publisher has availed himself more than ever before of the art of printing. While the everyday schoolbooks, as far as its mechanical makeup is concerned, has aimed at durability, it has also been a model in printing and binding.

Those who appreciate a well planned, well printed, and well found book have also noted the improvements made in recent years on the purely artistic side of book production. The selection of type faces is more

carefully made. The designs which embellish the covers are neatly and tastefully drawn. The publisher, author, and artist in order to continue with enthusiasm and with an ambition to produce a more attractive and utilitarian product, must have the cooperation and support of the school public. It is the encouragement thus far extended that has led to the excellence of the school textbooks which the country now enjoys. Likewise the future of the educational publishing business will depend upon the measure of recognition extended to meritorious and worth-while school-books.

Before the criteria of a good general science text can be set down it seems necessary to mention a few of the objectives of a good course. The objectives of a good general science course should be, to create an interest in the special sciences given in the Senior High School, to effect an understanding of the practical value of science and the ability to practice it in every day life, to build up a scientific vocabulary, to instill an interest in scientific literature, to teach future citizens to study civic problems from a scientific standpoint, and to develop a desire to lead a clean hygenic life.

A course in general science was taught, with the above objectives, in the Junior High Schools of Los Angeles. The content of the course was changed at intervals, no textbook had been used. Wide use was made of the libraries, newspapers, periodicals, and other supplementary reading. Pupil activity was constantly urged. In the last year of such practice it became evident that the course was sufficiently stabilized to warrant the use of a textbook. In order to select one as scientifically as possible the following method was followed:<sup>6</sup>

1. Each science teacher was asked to write his ideas of the prime requisites of a good science text.

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<sup>6</sup>  
W. L. Nourse, "General Science in the Junior High Schools of Los Angeles," School Science and Mathematics, 30:671-3. (June, 1930.)

2. The replies were tabulated and condensed to 14 which were then weighed.
3. Each teacher was asked to name two or three texts which he considered worthy of evaluation.
4. The replies were tabulated, and the six texts having the largest number of votes were selected for evaluation.
5. Committees examined these texts in the light of each of the 14 requisites, and made reports in which the texts were designated by numbers. The reports of these committees were distributed to all teachers of lower eighth grade science. These teachers were asked to rank the texts in each of the 14 requisites, basing their judgment solely on the reports of the committees.
6. The votes in each requisite were tabulated, and the texts were ranked according to the combined judgment of all the teachers. The rank of the text multiplied by the weight of the requisite gave the final result for that requisite. The final results for all requisites were added, and the book holding the highest rank was recommended for adoption.

The teachers heartily approved of this method of evaluation, and were almost unanimously satisfied with the result.

The fourteen requisites for a good text which were used are given below<sup>7</sup> (The weight of each item is given in parenthesis.)

1. The book must be up to date. (8)
2. It must contain historical background, tying the present to the past. (3)
3. It should contain a large amount of material required in the course of study, and a wide range of other appropriate material. (29)
4. It must be suited to the environment (the daily life of the pupil). (12)
5. It must have clear print, good paper, and binding. (3)

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<sup>7</sup>

Ibid., pp. 672.



6. It must contain suggestions for applying knowledge. (21)
7. New topics should have a complete index, references to books, and a glossary. (9)
8. There should be many illustrations, labeled and aptly placed. (7)
9. There should be clear definitions, and in foot notes the pronunciation of difficult words. (3)
10. Simple experiments should be given throughout the text. Suggestions for home experiments, collections, and projects should be numerous. (13)
11. There should be adequate explanation of demonstration experiments. (3)
12. The relationship between plants and animals should be clearly shown. (3)
13. Thought questions should be numerous. (1)
14. The text should be suited to various mental ages. (4)

It is generally agreed among educators that if a topic occurs in 75% of the textbooks it should be retained as part of the subject matter offered in that subject. If 95% of the high schools in Wisconsin use only 8 textbooks, then the subject matter to be retained should be included in these textbooks. If the material occurs in at least six of the eight books it should be included in the subject matter taught. An investigation was conducted to determine what subject matter should be included in eight of the most widely used general science textbooks in Wisconsin, and with what frequency the subject matter occurred.

The units in which the subject matter was to be organized was determined by analyzing the contents of the textbooks and by selecting

the units that were selected for other investigations by different investigators.

A preliminary investigation of the textbooks was conducted to determine what topics were to be included at the beginning. The textbooks that contained the greatest number of topics was selected as the basis for the investigation of that unit. A topic was retained for any textbook when it contained sufficient material to make that subject teachable (not necessary to get the necessary information from some outside source.) Topics selected were obtained by a careful evaluation of the subject matter offered. In some cases diagrams offered the necessary information. In other cases it was an experiment. If the pupils followed the instructions in the textbook or the experiment, the information would become available through performing the experiment. The topics here are not included simply because they occur in the index.

At the completion of the investigation of the first unit in the first textbook, the number of topics to be retained was determined. Other textbooks were analyzed in the same way. If a topic occurred in the second textbook that was not included in the first it was added to the list. In this way all of the textbooks were analyzed for the topics to be included. It was necessary to re-examine the textbooks to determine whether the topics added as the investigation progressed were to be found in any of the other texts. The topics for the other units were selected in the same manner. At the completion of the investigation it was possible to determine what topics were to be included in each unit, and the number of textbooks in which each topic occurred.

In the final tabulation a topic was retained (with five exceptions) if it occurred in six or more textbooks. This procedure gives a total of 137 topics. Seventy-three topics occur in all of the textbooks, 37 in 7, and 22 in 6. The 5 topics were retained for five

textbooks because there was some doubt whether the topics were treated completely enough. The textbooks were given the benefit of the doubt. If a topic occurred in less than 6 textbooks it was discarded because it did not occur in 75% of the textbooks.

The Units, the Topics in Each Unit, and the Number of Textbooks in which Each Topic Occurs,

(Investigations based on the latest editions available for use in the school year 1929-30).<sup>8</sup>

TABLE I

THE RESULTS OF AN INVESTIGATION OF THE SUBJECT MATTER CONTAINED IN EIGHT GENERAL SCIENCE TEXTBOOKS USED IN WISCONSIN

Topics	Number of textbooks in which each topic occurs (total of eight)
<u>Air</u>	
1. Air occupies space	7
2. Air has weight	8
3. Air exerts pressure	8
4. Measuring air pressure, barometers	8
5. Air is compressible--elastic	8
6. Air and fire	8
7. Composition of air--physical and chemical changes	8
	<hr/> 7
<u>Water</u>	
1. Composition of water	6
2. Water and solution	8
3. Purifying water, boiling, filtering, distilling	8
4. Water pressure	8
5. City water systems--pure water supplies	8
6. Water and soap	8
7. Hard and soft waters, softening hard waters	8
8. Sewage disposal	7
	<hr/> 8

<sup>8</sup> Ira C. Davis, "Analysis of the Subject Matter in the Eight most Widely Used Textbooks in General Science," School Science and Mathematics, 31:707-14. (June, 1931.)

TABLE I (continued)

THE RESULTS OF AN INVESTIGATION OF THE SUBJECT MATTER CONTAINED  
IN EIGHT GENERAL SCIENCE TEXTBOOKS USED IN WISCONSIN

Topics	Number of textbooks in which each topic occurs (total of eight)
<u>Heat</u>	
1. Heat, how produced, sun, chemical action, friction, etc.	7
2. Temperature and heat, calories, thermometers	8
3. Expansion of solids, liquids and gases by heat	6
4. Change of state, fusion, vaporization, specific heat	6
5. Distribution of heat, conduction, radiation, convection	8
6. Heating the home	8
7. Methods of starting a fire, matches	8
8. Fuels	7
9. Convection currents--ventilation	8
10. Distillation	7
11. Refrigeration--ice machines--evaporation	8
12. Heating water in the home	8
	<u>12</u>
<u>Weather and Climate</u>	
1. Weather and climate, defined	8
2. Water vapor in the air	8
3. Dew and its formation--dew point	8
4. Clouds--fogs	8
5. Humidity--relative humidity	8
6. Rain, snow, rainfall	8
7. Winds, wind belts	8
8. Storms, cyclones, tornadoes, hurricanes	7
9. The Weather Bureau, weather maps, weather service	6
10. Climate and health	6
11. Effect of water on climate	5
	<u>11</u>

TABLE I (continued)

THE RESULTS OF AN INVESTIGATION OF THE SUBJECT MATTER CONTAINED  
IN EIGHT GENERAL SCIENCE TEXTBOOKS USED IN WISCONSIN

Topics	Number of textbooks in which each topic occurs (total of eight)
<u>Light</u>	
1. Methods of producing light, luminous objects	8
2. Light travels in straight lines, transparent objects	8
3. Reflection--diffusion, images	8
4. Refraction, lenses	8
5. Color and the prism	8
6. The eye and the camera	8
7. Lighting our homes	8
	<hr/> 7
<u>Sound</u>	
1. How is sound produced	8
2. How is sound transmitted, air-voice	8
3. The ear and how we hear	8
4. Noise and tone, pitch	8
	<hr/> 4
<u>Magnetism and Electricity</u>	
1. History of Magnetism--natural magnets	6
2. Magnets--magnetic fields	8
3. The earth as a magnet--compass	7
4. Static electricity, lightning	8
5. What is electricity--electron	7
6. Units of electricity--volt, ampere, ohm	7
7. Making electricity--chemical action, storage battery, dynamos	8
8. Series and parallel connections, circuits, grounding	6
9. Magnetic effect of a current--electromagnets	8
10. Chemical effect of a current	5
11. House circuits--fuses, switches, sockets	7
12. Electric meter, electric power	7
13. Electrical appliances--doorbells	8
14. Telegraph	8
15. Telephone	8
16. Radio	6
17. Heating effects of an electrical current	8
18. The electric arc	8
19. The electric motor	8
	<hr/> 19

TABLE I (continued)

THE RESULTS OF AN INVESTIGATION OF THE SUBJECT MATTER CONTAINED  
IN EIGHT GENERAL SCIENCE TEXTBOOKS USED IN WISCONSIN

Topics	Number of textbooks in which each topic occurs (total of eight)
<u>Energy and Machines</u>	
1. Energy--definition--forms of	8
2. Force--work--power, how measured	7
3. What is a machine, law of machines	8
4. Lever, pulley, wheel and axle	8
5. Inclined plane, wedge, screw	7
6. Friction	8
	<u>6</u>
<u>The Solar System</u>	
1. The solar system, the sun and its planets	8
2. The constellations	8
3. The moon, its phases	8
4. The eclipses	7
5. Causes of day and night	5
6. Causes of the seasons	7
7. Comets--meteors	8
	<u>7</u>
<u>Rocks and Soil</u>	
1. How the earth was formed	5
2. Changing rocks to soil, weathering, freezing, plants; chemicals, gravity	6
3. Erosion--water, wind, glaciers--tides	7
4. Classification of rocks, igneous, sedimentary, metamorphic	6
5. What is soil. Kinds of soil	7
6. Keeping the soil fertile	6
7. Tilling the soil	7
8. Drainage and irrigation	7
9. Water in soil	7
10. Minerals, oils and ores in the earth	6
	<u>10</u>

TABLE I (continued)

THE RESULTS OF AN INVESTIGATION OF THE SUBJECT MATTER CONTAINED  
IN EIGHT GENERAL SCIENCE TEXTBOOKS USED IN WISCONSIN

Topics	Number of textbooks in which each topic occurs (total of eight)
<u>Plants</u>	
1. General description, structure of living things	7
2. Seeds--germination of--kinds of seeds	6
3. Leaves--kinds, how they breathe, how they make food	8
4. Stems--how sap rises--buds	7
5. Roots--how they get food--how moisture rises	7
6. Flowers--parts--how seeds are formed--how seeds are scattered	7
7. Reproduction--seeds--stems	7
8. Bacteria--yeasts and mold	7
9. Use of plants for foods	8
10. Leguminous plants	7
11. Forests--uses of wood	7
12. Improving plants	7
13. Plant disease	6
	<u>13</u>
<u>Animals</u>	
1. Birds, bird migration	6
2. Insects, bees, ants	7
3. Animal pests, flies, mosquitoes	5
4. Diseases of animals	5
	<u>4</u>
<u>The Human Body</u>	
1. Structure of the body	7
2. Digestion	3
3. Breathing and respiration	6
4. Circulation and the blood	8
5. The skin	7
6. The teeth	8
7. The eyes	8
8. The ear	7
9. First aid	6
	<u>9</u>

TABLE I (continued)

THE RESULTS OF AN INVESTIGATION OF THE SUBJECT MATTER CONTAINED  
IN EIGHT GENERAL SCIENCE TEXTBOOKS USED IN WISCONSIN

Topics	Number of textbooks in which each topic occurs (total of eight)
<u>Foods</u>	
1. Why we eat foods	8
2. Cooking of foods	8
3. Action of yeast on food	8
4. Why foods spoil, bacteria	8
5. How to keep foods from spoiling	8
6. Molds	8
7. Sources of foods, organic and inorganic	8
8. Food calories--heat value of foods	7
9. Carbohydrates	8
10. Water and mineral matter--ash	8
11. Fats	8
12. Proteins	8
13. Vitamins	8
14. Balanced diets	8
15. Food adulterants	6
16. Stimulants and narcotics	7
	<u>16</u>
<u>Clothing</u>	
1. Sources of fibers, silk, wool, cotton, linen	6
2. Heat conduction properties of the fibers	6
3. Washing clothes	6
4. Cleaning clothes--dry cleaning, removal of stains, bleaching	6
	<u>6</u> 4

Read table thus: For the unit air, the topic "air occupies space," occurs in seven of the eight textbooks. For the same unit, the topic "air has weight," occurs in all eight of the textbooks. Read in like manner for the remaining topics on the unit air, and for the topics in the other units.



TABLE II  
FREQUENCY OF TOPICS IN TEXTBOOKS OF THE WISCONSIN STUDY

Number of textbooks	8	7	6	5	Total number of 5 topics accepted
Air (number of topics)	6	1			7
Water	6	1	1		8
Heat	8	3	1		12
Weather and Climate	7	2	1	1	11
Light	6	1			7
Sound	3		1		4
Electricity and Magnetism	10	5	3	1	19
Energy and Machines	4	2			6
Solar System	3	2	1	1	7
Rocks and Soils		5	5		10
Plants	2	9	2		13
Animals		1	1	2	4
Human body	5	3	1		9
Foods	13	2	1		16
Clothing			4		4
Totals	73	37	22	5	137
Per cent of total	53.28	27.01	16.06	3.65	100.00

Read table thus: Of the seven topics accepted for air, six occur in eight textbooks, and one in seven. Of the eight topics accepted for water, six occur in eight textbooks, one in seven, and one in six. Read in like manner for each succeeding topic.

TABLE III  
NUMBER OF TOPICS IN EACH TEXTBOOK

	Accepted Number	A	B	C	D	E	F	G	H
Air	7	7	7	7	7	6	7	7	7
Water	8	8	7	8	8	7	6	7	8
Heat	12	12	12	11	12	12	11	12	10
Weather and Climate	11	11	9	10	11	11	8	10	10
Light	7	7	7	7	7	7	7	6	7
Sound	4	4	4	3	4	3	4	3	4
Electricity and Magnetism	19	19	19	18	16	15	14	18	17
Energy and Machines	6	6	6	6	5	5	6	6	6
Solar System	7	6	6	5	7	7	5	7	6
Rocks and Soil	10	10	7	9	8	10	10	7	5
Plants	13	13	13	12	13	13	13	4	10
Animals	4	4	4	1	3	4	3	1	3
Human Body	9	9	9	9	9	9	9	8	6
Foods	16	14	16	15	15	16	16	16	16
Clothing	4	4	4	4	2	4	2	2	2
<b>Total</b>	<b>137</b>	<b>134</b>	<b>130</b>	<b>125</b>	<b>127</b>	<b>128</b>	<b>121</b>	<b>113</b>	<b>117</b>

Read table thus: For the unit Air, the total number of topics accepted is seven and seven topics in the unit Air occur in each of the eight textbooks. For the unit Water, eight topics are accepted; four textbooks have eight topics while books B, E, and G have seven topics accepted, and book F has six topics accepted. Read in like manner for each succeeding unit.

A summary of the above study would tend to conclude that there is a high agreement in the textbooks for the units air, water, heat, weather and climate, light, magnetism and electricity, energy and machines, plants, the human body, and foods. There is fair agreement in the units sound, the solar system, and rocks and soils. Several topics were discarded in these units because they occurred in only a few books. There is very little agreement in the units on animals and clothing. It is questionable whether there is enough acceptable material to retain the units of sound, animals and clothing. Some of the textbooks include sound with air. Some of the textbooks include animals and clothing with the human body or foods.

Our leading textbooks in general science agree on subject matter. They are no longer a hodge-podge or piecemeal mixture of science.

While the agreement in subject matter in general science is not as high as it is in physics, it is higher than it is in biology or chemistry. Of the 137 accepted topics, the least number accepted for any of the textbooks was 113 and the highest 134. Over 53% of the topics are found in all the textbooks, 27% in 7, and 16% in 6. Over 96% of the material is found in at least 6 of the eight textbooks.

In an effort to determine the nature of score-card standards for textbooks, the items on twenty-four cards were summarized. The other cards were eliminated because they contain items applying to books in only one subject. The following table showing the items considered on

twenty-four cards, reveals three facts concerning the score-card standards reported:<sup>9</sup>

1. There is practically unanimous agreement concerning the importance of "content," "physical makeup," and "aids to instruction" (Items 1, 2, and 3), as is shown by the high frequencies for each of these items.
2. There is wide disagreement concerning the importance of many standards. A large majority of the items listed are mentioned on only a few score cards and receive small percentages of mention.
3. Few qualities reported are described in objective terms. In fact, only 13 per cent of the total number of items listed on the score cards may be considered objective.

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<sup>9</sup> Gertrude Whipple, "Procedures Used in Selecting Textbooks," Elementary School Journal, 36:560-75, (June, 1936.)

TABLE IV  
ITEMS CONSIDERED IN SELECTING TEXTBOOKS  
WHEN SCORE CARDS ARE USED

Item	Percentage of Score Card Mentioning Item	Percentage of Total Frequency of Mention
<b>1. Content</b>		
(a) Ease of Comprehension	100.0	14.5
(b) Value	100.0	13.1
(c) Scope	70.8	4.4
(d) Abundance of Material	16.7	.6
(e) Unspecified	8.3	0.5
Total	100.0	33.1
<b>2. Physical makeup</b>		
(a) Type	91.7	5.7
(b) Binding	83.3	5.0
(c) Paper	70.8	3.9
(d) Arrangement of page	41.7	1.6
(e) Lines	33.3	1.6
(f) Illustrative material	33.3	1.3
(g) Spacing of words and letters	25.0	1.0
(h) Size of book	25.0	1.0
(i) Width of margins	20.8	.8
(j) General appearance	20.8	.8
(k) Shape	12.5	.5
(l) Size and clearness of marginal notes and index	4.2	.2
(m) Weight of book	4.2	.2
(n) Unspecified	8.3	.3
Total	100.0	23.9
<b>3. Aids to instruction</b>		
(a) Study exercises	70.8	6.8
(b) Graphic material	58.3	3.9
(c) Index	58.3	2.3
(d) Table of contents	45.8	1.9
(e) Provision for efficient use by teacher	37.5	1.9
(f) References and bibliography	33.3	1.3
(g) Tests and norms	20.8	1.1
(h) Preface	25.0	1.0
(i) Pupil material accompanying book	20.8	1.0

TABLE IV (continued)

ITEMS CONSIDERED IN SELECTING TEXTBOOKS  
WHEN SCORE CARDS ARE USED

Item	Percentage of Score Card Mentioning Item	Percentage of Total Frequency of Mention
(j) Glossary	20.8	.8
(k) Appendix	20.8	.8
(l) Pronunciation aids	16.7	.6
(m) Introduction to pupil	8.3	.3
(n) Remedial material	4.2	.2
(o) Title-page	4.2	.2
(p) Drill material	4.2	0.2
<b>Total</b>	<b>83.3</b>	<b>24.3</b>
<b>4. Method</b>		
(a) Development of reading habits and skills	25.0	1.4
(b) Correlation with other subject matter and activities	20.8	1.0
(c) Recognition of group and individual differences	16.7	.6
(d) Variety in types of activities	16.7	.6
(e) Provision for enrichment of vocabulary	12.5	.5
(f) Flexibility of method	12.5	.5
(g) Recognition of principles of psychology	8.3	.3
(h) Opportunity to develop general principles	8.3	.3
(i) Opportunity for pupils to discover cause and effect	8.3	.3
(j) Attention to pupil interest	4.2	.2
(k) Opportunity for applying general principles	4.2	.2
(l) Total emphasis	4.2	.2
(m) Provision for supervised study	4.2	.2
(n) Unspecified	12.5	0.5
<b>Total</b>	<b>62.5</b>	<b>6.8</b>

TABLE IV (continued)

ITEMS CONSIDERED IN SELECTING TEXTBOOKS  
WHEN SCORE CARDS ARE USED

Item	Percentage of Score Card Mentioning Item	Percentage of Total Frequency of Mention
<b>5. Objectives</b>		
(a) Harmony with educational aims	16.7	0.8
(b) Desirable attitudes and economical habits and skills	8.3	.5
(c) Strong motives for, and permanent interest in reading	8.3	.3
(d) Objectives of the course of study	4.2	.5
(e) Rich and varied experience	4.2	.2
(f) Correct standards and ideals in use of English	4.2	.2
(g) Vision of man in relation to his environment	4.2	.1
(h) Ideals of high-grade human living	4.2	.1
(i) Unspecified	4.2	0.2
Total	45.8	2.9
<b>6. Organization</b>		
(a) Organization around significant problems	12.5	0.5
(b) Psychological rather than logical organization	8.3	.3
(c) Possibilities of omissions without destroying sequence	8.3	.3
(d) Organization within selections	8.3	.3
(e) Placement of pedagogical material	4.2	.2
(f) Distribution, amount, and balance of drill	4.2	.2
(g) Unspecified	16.7	1.0
Total	29.2	2.8

TABLE IV (continued)  
 ITEMS CONSIDERED IN SELECTING TEXTBOOKS  
 WHEN SCORE CARDS ARE USED

Item	Percentage of Score Card Mentioning Item	Percentage of Total Frequency of Mention
<b>7. Author or authors</b>		
(a) Experience	20.8	0.8
(b) Reputation	16.7	.6
(c) Training	8.3	.3
(d) Previous publications	4.2	.2
(e) Scholarship	4.2	.2
(f) Familiarity with scientific investigation	4.2	.2
(g) Participation in scientific investigations	4.2	0.1
Total	25.0	2.4
<b>8. Adaptation to specific needs</b>		
	20.8	1.0
<b>9. Series to which book belongs</b>		
(a) Plan	8.3	.5
(b) Gradation in difficulty	4.2	0.1
Total	12.5	0.6
<b>10. Scientific basis for method and content</b>		
	12.5	.6
<b>11. Type of book</b>		
	12.5	.5
<b>12. Recent of copyright date</b>		
	8.3	.3
<b>13. General merit</b>		
	4.2	.2
<b>14. Special features</b>		
	4.2	.2
<b>15. Publisher</b>		
	4.2	.2
<b>16. Price</b>		
	4.2	0.2
Total		100.0
Total frequency mention		616

Read table thus: Under the division, content, the first item is ease of comprehension. One hundred per cent of the score cards mention this item, and there is fourteen and five-tenths percentage of total frequency of mention. The second item value is mentioned by one hundred per cent of the score cards and the percentage of total frequency of mention is thirteen and one-tenth. Read in like manner for each item under the remaining divisions.



The evaluation of textbooks presents a persistent problem to every school system. At the present time one finds many textbooks available in every subject that is taught in both the elementary and secondary fields; in fact some of the larger publishing companies have two or three textbooks in the same field. If all textbooks conformed in the organization of material, had the same order of presentation, were written with the same aims and purposes in view, contained vocabularies that were practically equivalent, and gave equal space to similar topics, the problem of selection would not present great difficulties. The selection might then be based on the color of the covers, the excellency of the binding, and the cost of the book. This condition, fortunately, is not the case.

Textbooks are written from many and varied points of view; certain texts have been developed because the author wished to promulgate his point of view in organizing and teaching a subject. When certain theories in education have failed, the surest and quickest way to modify practice based on them has been to place on the market a textbook with a changed point of view. Occasionally teachers in our schools have been conscious of the difficulties and limitations of present textbooks and, to overcome these obstacles, have organized materials which have finally eventuated into textbooks. All of these different influences must be taken into consideration when a school system is confronted by a problem of selecting a new textbook.

From the standpoint of the school system, the evaluation of textbooks must be made in the light of definite educational objectives. For example, a school system has decided that individual instruction should

play an important part in teaching procedure; textbooks, in that case, must be examined with this ideal in mind; or again, if a school system be operated with the idea that one of its chief functions should be the preparation for life outside the school, then the selection of materials must be made largely on their practical values. Such objectives must be given careful consideration by those responsible for selecting textbooks if the objectives are to be attained.

One of the marked tendencies in educational development in recent years has been the tendency for educational organizations to appoint committees on the reorganization of subject matter. Our national educational organizations have published yearbooks on the subject of reorganization, and most subject-matter fields in both the elementary and secondary schools have received consideration from such committees. After the reports of such committees have been published and disseminated, textbooks usually appear with statements in the preface that they have prepared to meet the specific recommendation of these national committees. If a school system is interested in conforming to recommendations of such a committee, it is necessary to analyze these textbooks carefully to find out whether or not they really have been written from the standpoint of such recommendations or whether on certain minor details of the reports have been featured in the texts.

In many subjects the proportion of space devoted to different units of subject matter presents an important problem. If one takes the field of general science, for example, he is immediately confronted by the

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problem of the amount of space that should be devoted to different units of the field which this subject of necessity must treat; if the school administrator wishes to select a text with the biological aspect of science predominating, the book must be analyzed carefully to find whether or not the author has stressed that aspect in preparing his manuscript. In American history the author may give undue emphasis to the period or aspect of which he is a student; the only way this can be discovered is through a careful check of the content.

The organization of subject material should be another important consideration in the selection of a textbook. The author may have approached the material from the standpoint of the logical development of the subject, with little thought of the learner. Textbooks that have been written by authorities in their field may not be suited to the immature pupils in an elementary or secondary school who approach the subject, not from the standpoint of its logical organization, but from the functional point of view. The only way one may discover the suitability of a textbook from the standpoint of organization is to make a careful and complete analysis of the content in the light of the psychology of the students who will study the text.

Many textbooks that have many admirable qualities have been found practically valueless owing to the character of the vocabulary used. An expert in a given field is inclined to use the technical vocabulary of the scholar rather than the vocabulary of the immature student who is a novice in the subject. A school administrator who fails to examine a

textbook from this point of view may early regret the selection that he makes. Other reasons could be elaborated to show both the desirability and necessity of analyzing textbooks before a selection has been made; the foregoing reasons, however, are sufficient to point out that a cursory examination of a book is not adequate and the scientific studies that have been made to improve our educational practices will be of little avail unless they are incorporated in textbooks that the children use.

In the past the method of selecting textbooks has not received the attention it has deserved. Owing to faulty methods of selection school systems and administrators have been the target of much unfavorable criticism. This criticism has been due perhaps in some measure to the pernicious activity of unscrupulous representatives of book companies and also to the lack of justifiable standards for selection on the part of school administrators. When these selecting textbooks were not supplied with a technique that would insure analysis, specious arguments were effective and were widely used. A scientific attitude toward the study of all school problems has brought about a change in many quarters in the techniques used in evaluating books, but unfortunately we still find arguments for adoption used that should be accepted with reservations, if at all. Five such arguments are these: First, the prestige of the author: it is taken for granted in this argument that an author who has a reputation as a scholar in his field is well equipped to prepare a textbook for children in the elementary school. Publishing companies have made much use of this argument as one of the basic considerations for the excellence of a textbook. Second, the prestige of the publisher has frequently been

an argument used by the representative of large book publishing companies, and they have frequently disparaged the books of more recent comers in the field. Third, the general appearance of the book has received undue emphasis. Of course, the esthetic qualities of a book have some value and should receive consideration, but other factors should have more weight. Fourth, the wide use of a text is one of the most persistent arguments. It is a very common thing for school administrators to receive an advertisement of some book wherein the most potent reason for its adoption is its wide use. Occasionally a map of the United States covered with red dots will be enclosed, each dot representing a city or institution in which this particular book has been adopted. Even though the fallacy underlying such an argument is easily seen, apparently it must have much force or publishing companies would discontinue its use. The wide use probably means that this textbook meets general conditions in an admirable way, but it may be an argument against its use in a system having specific problems which it is attacking. Fifth, the cost of the book is an argument that has made a distinctive, but undue, appeal when recommendations have been made to school boards. When publishing companies bid against one another for adoptions, it naturally appears as a vital consideration; but today legal restrictions on the selling price of textbooks and the slight differences that prevail in prices of similar texts have made this argument less potent.

## CHAPTER III

### SCORE-CARD FOR EVALUATING GENERAL SCIENCE TEXTBOOKS

The following score card contains criteria for an evaluation of general science textbooks. The form for this card is taken from the Strayer-Engelhardt score card for junior high school buildings.

TABLE V

## SCORE CARD FOR EVALUATING GENERAL SCIENCE TEXTBOOKS

	1	2	3
<b>I. Mechanical Elements of the Textbook</b>			<b>345</b>
<b>A. Binding</b>		<b>50</b>	
1. Stiff Cover	10		
2. Cloth or Buckram Covering	15		
3. Well Sewed	25		
<b>B. Type of Paper</b>		<b>80</b>	
1. Dull Finish	25		
2. Opaque Grade	20		
3. Adequate Margins	35		
<b>C. Appearance of Paper</b>		<b>105</b>	
1. Ten or Twelve Point Type	15		
2. Length of Line--3 3/4 to 5 inches	15		
3. Legible Type	25		
4. Use of Italics	15		
5. Use of Paragraph Headings	35		
<b>D. Price of book</b>		<b>20</b>	
1. Range from one to two dollars	10		
2. Ease of obtaining supply	10		
<b>E. Authorship</b>		<b>60</b>	
1. Degrees	5		
2. Work in field	20		
3. Probable knowledge of educational trends	35		
<b>F. Copyright Date</b>		<b>30</b>	
1. Recent enough to meet changes	30		
<b>II. Content of the Textbook</b>			<b>285</b>
<b>A. Subject Matter Presented</b>		<b>285</b>	
1. Air	25		
2. Water	25		
3. Heat	25		
4. Weather and Climate	25		
5. Light	25		
6. Magnetism and Electricity	25		
7. Energy and Machines	25		
8. Solar System	25		
9. Sound	25		
10. Plants and Animals	25		
11. The Human Body	15		
12. Foods	10		
13. Clothing	10		
<b>III. Presentation of Material</b>			<b>370</b>
<b>A. Table of Contents</b>		<b>5</b>	
1. Units with problems listed	5		
<b>B. Index</b>		<b>20</b>	
1. Main topics in basal type	20		
<b>C. Glossary</b>		<b>30</b>	
1. Important terms with pronunciation	30		
<b>D. Motivation</b>		<b>25</b>	
1. Introductory paragraphs to arouse interest	25		
<b>E. Vocabulary</b>		<b>55</b>	
1. Language suitable to the beginner	55		
<b>F. Illustrations</b>		<b>35</b>	
1. Number	35		
2. Association with material	50		
<b>G. Experimentation</b>		<b>85</b>	
1. Adequate amount	50		
2. Nearness to material	35		
<b>H. Questions to test student</b>		<b>65</b>	
1. Nearness to topics	15		
2. Number of exercises to write	50		
<b>Totals</b>	<b>1000</b>	<b>1000</b>	<b>1000</b>

Read table thus: Part I, "Mechanical Elements of the Textbook," is allowed 345 points. Fifty of those 345 points are allowed for binding. Of the 50 points allowed for binding, 10 points are given over to the stiffness of the cover, 15 points if the textbook has a cloth or buckram covering and 25 points if the book is well sewed. Read in like manner for the other parts of the score card.

## Part I. Mechanical Elements of the Textbook-----34.5%

## A. Binding-----5%

Although ninth grade students do not handle textbooks as roughly as younger children, they do need a book that is well bound as everyday handling alone will cause a certain amount of wear. In a score-card for evaluating general science textbooks by J. O. Frank,<sup>10</sup> 5% is allowed for the binding of the book. Also in a score-card for evaluating biology textbooks by Franzen and Knight,<sup>11</sup> 5% is allowed for binding.

1. Of the 5% allowed for binding, 20% of that is given over to the cover and 30% to the type of cover on the book. One half or 50% of the amount allowed for the binding is given over to the sewing of the book. A book must be well sewed so that when it is opened out flat the stitches will not break and the leaves come out.

## B. Type of paper-----8%

For this item 8% or 80 points is allowed. In the score-card by Frank,<sup>12</sup> 5% of the total was allowed for type of paper used. There is reason to believe that 8% is none too much to allow because if a textbook is hard to read from a physical standpoint the student not only injures his eyes but it is another reason why he dislikes to read the assignments. Of the 80 points, 31.3% was allowed for the finish of the

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<sup>10</sup> J. O. Frank, How to Teach General Science, Philadelphia: P. Blakiston's Son and Company, 1926. pp. 68-72.

<sup>11</sup> R. H. Franzen and Knight, F. H., Textbook Selection, Baltimore: Warwick and York Company, 1932. pp. 19-21.

<sup>12</sup> Frank, loc. cit.



paper. A dull finish is highly desirable so that no gloss will be reflected into the eyes of the reader. Twenty-five per cent was allowed for the grade of the paper used. An opaque grade which will not allow the print to show through from the previous page is best. The other 43.7% is given over to margins. A good textbook should have an inside margin of five-eighths of an inch and an outer margin of three-fourths inches as a minimum.

C. Appearance of paper-----10.5%

An allowance of 105 points or 10.5% of the total is made for this important feature in the makeup of a textbook. Only 5% was allowed by Frank<sup>13</sup> in his scale, but the divisions are not exactly the same in this score card. It seems reasonable that 10.5% or a little more than twice as much should be allowed for this particular feature because an attractive page appeals to a group of youngsters, whether they realize it or not. In secondary school textbooks the use of paragraph headings helps keep the interest of the student in the work. For the use of italics, 33.3% was allowed, while 23.8% was given over to legible type. Fourteen and three-tenths per cent or fifteen points was allotted to length of line which should be from three and three-fourths to five inches. The other 14.3% was allowed for type. Most textbooks use ten point type, some twelve point. Newspapers use from seven to seven and one-half type for the ordinary set, while the "fine print" is five and one-half point type.

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<sup>13</sup> Frank, loc. cit.

## D. Price of book-----2%

Fifty per cent of the total was allowed here for the price range of the book which should be from one to two dollars. The other 50% was set aside for the ease of obtaining a supply. The price of the textbook is of less importance than the other criteria. A statement by Whipple<sup>14</sup> would tend to bear this out. He says, "Improved textbooks cannot be gotten into use in our schools unless those who select the materials set up as their basic principle of selection not 'How cheap is this book, but how good is it?'"

## E. Authorship-----5%

Six per cent was allowed here. It seems proper that some consideration be given the author of any textbook. Fifty-four and two tenths per cent of those sixty points was allowed for a knowledge of the latest educational trends. Any textbook should be worth more if the author is acquainted with current educational theories. The work of the author in the field in which the book was written was given 33.3% and degrees held by the author were rated five points, or 12.5% of the total amount scored for authorship.

## F. The copyright date was allowed-----3%

Such a criterion is worthy of rating, especially in the field of science or economics. In these fields the subject matter is ever changing, for additional facts and methods of procedure are constantly being made available.

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<sup>14</sup> Cf. ante. pp. 11 (June 10, 1929.)

In history, language, or Latin such a rating might not be considered, but in science it is very important to have a textbook recent enough to meet the changes.

Part II. Content of the Textbook-----28.5%

No one as yet has published a quantitative study of the actual materials of general science based upon a classification of the nature of the problems used. Such a study of the materials actually used by teachers of general science would be very instructive.

By inspecting early general science textbooks and then examining present day issues, it is easy to see that the subject matter has changed in the last twenty years. General science is now a more composite study with more efficient textbooks.

For comparison, the results of an analysis of general science textbooks which were copyrighted before 1922 are given in a table compiled by W. L. Eikenberry;<sup>15</sup>

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<sup>15</sup> W. L. Eikenberry, The Teaching of General Science, Chicago: The University of Chicago Press, 1922. p. 98.

TABLE VI

QUANTITATIVE ANALYSIS OF THE SUBJECT MATTER IN  
SEVEN TEXTBOOKS OF GENERAL SCIENCE

Book number	A	B	C	D	E	F	G
Astronomy	U		1.0	9.5	0.0	0.0	10.9
	M	7.3	2.0	6.5	0.0	0.0	10.0
	W	4.1	0.0	2.6	0.0	0.0	0.0
Agriculture	U		6.3	6.0	2.0	1.0	0.0
	M	11.5	5.2	3.0	2.0	0.0	0.9
Physiology	U	Included Physiology in Biology					
	M	10.5	12.6	4.1	26.3	11.5	15.9
	D		5.9	3.7	26.3	1.7	4.9
Biology	U		14.0	6.5	12.2	12.0	10.9
	M	23.9	46.5	17.5	37.0	5.5	6.4
	W	12.2	28.2	9.6	12.2	13.5	7.2
	D		27.0	15.2	12.3	13.8	5.6
Commercial Geography	U		2.8	0.0	0.0	0.0	0.0
	M	0.0	3.0	0.0	0.0	0.0	0.0
Chemistry	U		4.2	0.0	15.0	3.5	10.0
	M	12.6	4.2	2.0	18.0	12.4	8.5
	W	9.8	5.3	0.0	12.4	8.5	7.2
	D		5.2	Trace	12.5	3.8	5.4
Domestic Science	U		6.0	0.0	0.0	21.0	0.0
	W	7.8	0.7	0.3	10.7	20.1	30.0
	D		0.0	0.0	7.5	24.0	
Meteorology	U		19.0	22.0	5.5	5.5	5.2
	M	7.0	13.5	9.0	5.5	0.0	4.5
	W	7.5	13.7	10.8	5.2	3.6	22.5
	D		11.4	10.2	5.7	2.1	23.0
Physiography	U		11.1	44.5	3.0	9.5	28.0
	M	6.1	6.7	43.0	4.0	0.0	28.3
	W	14.5	11.3	46.0	4.5	12.2	3.1
	D		11.0	52.0	5.3	11.1	4.0
Physics	U		17.0	5.0	35.0	24.0	
	M	36.9	16.0	19.0	32.0	53.0	
	W	26.8	22.6	12.3	30.0	28.7	13.3
	D		29.1	14.0	29.0	33.0	25.2
Total		295	302	460	460	467	293
				460			584

Read table thus: Textbook (A) as analyzed by the unpublished manuscript (U) was shown to contain no astronomy. As analyzed by McMahon (M) the same text included 7.3% astronomy, while Webb (W) analyzed the astronomy content as 4.1%. Read in like manner book (A) for agriculture, physiology, etc., and books B, C, D, etc.

In the above table all figures represent percentage excepting the figures for total pages. The responsibility for the figures in each horizontal line is represented at the left of each line by the letters U (unpublished), M (McMahon), W (Webb), and D (Daggett).

A later and much more extensive study of textbooks by Webb<sup>16</sup> was made with the intention of establishing standards of common practice. It includes textbooks. The names of textbooks are not given but are designated arbitrarily by the letters from A to R.

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<sup>16</sup> Honor A. Webb., General Science Instruction in the Grades, Nashville: George Peabody College for Teachers, 1921. pp. 14-15.

TABLE VII  
 A QUANTITATIVE ANALYSIS OF THE SUBJECT MATTER IN EIGHTEEN TEXTBOOKS OF GENERAL SCIENCE

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
Astronomy	1.3	5.3	1.3	10.5	.8	3.9	3.5	1.4	0.0	.2	6.5	5.5	10.1	10.1	7.6	.2	7.2	.7
Biology	3.9	15.7	22.3	17.5	13.3	6.0	19.5	15.0	4.7	12.6	1.0	13.9	14.7	13.4	12.4	14.4	14.7	15.3
Chemistry	4.3	6.0	4.0	2.8	10.9	8.3	7.2	6.2	23.0	10.1	4.8	10.0	8.7	12.4	11.9	12.7	1.4	13.0
Household Art	7.1	6.5	3.2	3.0	12.7	0.0	1.4	6.8	5.0	4.0	10.0	6.6	.7	3.6	6.3	0.0	.9	2.8
Physics	43.4	13.5	24.6	27.3	30.0	30.4	33.3	40.5	43.4	27.9	43.6	32.2	20.0	32.4	31.0	34.6	13.6	12.2
Physiography	24.4	9.9	24.3	17.4	14.8	2.7	26.8	7.9	14.5	10.0	8.5	14.7	29.6	4.7	19.9	11.6	33.2	11.9
Physiology	14.2	17.0	14.6	12.0	12.2	16.9	.7	12.6	.8	21.8	18.2	9.8	3.8	7.5	8.4	9.3	3.5	26.7
Miscellaneous	0.0	4.2	2.2	1.6	0.0	1.0	1.4	1.4	6.0	.6	0.0	1.4	.5	1.3	2.5	3.4	1.5	1.2
Unclassified	1.4	21.0	5.4	7.9	5.3	30.8	7.2	8.2	1.7	12.8	7.4	5.9	11.9	14.6	0.0	13.6	.4	13.1
Total page	588	370	302	395	479	294	283	418	373	468	539	435	306	193	295	609	460	430

Read table thus: In textbook A, 1.3% of the total number of 588 pages was material on astronomy. Three and nine tenths per cent of the total number of pages was biology. Read in like manner for succeeding topics and other textbooks.

Examination of this table shows a rather remarkable agreement among authors in regard to the quantitative importance of the several sciences, which is in opposition to the conditions asserted by opponents of the general science movement. Webb calculates the ranking of the sciences in each of the eighteen books, and finds ~~two~~ median ranks for each with the result shown in Table VII.<sup>17</sup>

TABLE VIII  
THE MEDIAN RANK OF THE SCIENCES  
IN EACH BOOK

	Median Rank
1. Physics	1
2. Physiography	3
3. Biology	3
4. Physiology	4.5
5. Chemistry	4.5
6. Household Art	6
7. Astronomy	7

Read table thus: The median rank for Physics is 1. The median rank for Physiography is 3. Read in like manner for other topics.

<sup>17</sup> Ibid., p. 102.

TABLE IX

THE TOTAL NUMBER OF PAGES FOR EACH  
SCIENCE IN ALL THE BOOKS

	Pages
1. Physics	2,212.5
2. Physiography	1,264.5
3. Biology	908.0
4. Physiology	885.5
5. Chemistry	632.0
6. Household Art	343.5
7. Astronomy	271.5
8. Miscellaneous	120.5

Read table thus: The total number of pages devoted to Physics is 2,212.5. The total number for Physiography is 1,264.5. Read in like manner for each of the other topics.

In order to solve the content problem of general science textbooks, C. M. Howe,<sup>18</sup> of Hughes High School of Cincinnati, Ohio, sent out a questionnaire including a list of topics for general science. The teachers were asked to mark these topics as Fundamental (F) or Supplementary (S), according to their beliefs that they were essential to the subject or only valuable as optional material.

<sup>18</sup> C. M. Howe, "Can and Should General Science be Standardized," School Science and Mathematics, 19:252, (March, 1919)



TABLE X  
 FUNDAMENTAL TOPICS, OR MINIMUM ESSENTIALS  
 OF GENERAL SCIENCE

	Scores	
	F	S
1. Water--Physical properties and mechanics of liquids	73	4
2. Air--Chemical Composition and Combustion	71	6
3. Air--Physical properties and mechanics of gases	69	7
4. Ventilation	63	15
5. Household heat and light	62	15
6. Water supply and purification	60	15
7. Weather and climate	59	15
8. Bacteria, yeasts, and molds	58	10
9. Foods--Diet and digestion	57	9
10. Combustion and fuels	56	16
11. Hygiene and sanitation	55	9
12. Water--Chemical properties	55	7
13. Plant life--Elementary botany	50	9
14. Everyday chemistry (salt, ammonia, carbon, etc.)	49	19
15. Simple machines	48	13
16. Force, power, and energy	47	11
17. Animal life--Elementary zoology	46	12
18. Systems of measurements	43	22
19. Acids, bases, and salts	43	21
20. Elements, compounds, and mixtures	42	20
21. Density, specific gravity, and buoyancy	42	18
22. Electricity and magnetism	41	25

Read table thus: For water, 73 teachers marked as Fundamental (F) and 4 marked water Supplementary or (S). For air, 71 marked Fundamental (F) and 4 marked Supplementary (S). Read in like manner for succeeding topics.

Table XI that follows lists a group of topics that are optional for the subject matter of a course in general science. The results are from the same investigation as the above table.

TABLE XI  
 SUPPLEMENTARY TOPICS--OPTIONAL MATERIAL  
 FOR GENERAL SCIENCE

	Scores		Total
	F	S	
1. Household chemistry (soda, stains, etc.)	35	30	65
2. Coal, gas, and petroleum	39	25	64
3. Molecular theory	40	22	62
4. Light and its relation to life	40	20	60
5. Astronomy and star study	23	37	60
6. Soils and rocks	37	22	59
7. Steam and gas engines	20	39	59
8. Plumbing and household appliances	32	26	58
9. Sound and its relation to life	26	30	56
10. Cooking and baking	13	33	56
11. Elements of physiology	40	15	55
12. Iron, steel, and metals	17	36	53
13. Trees and flowers	23	29	52
14. Theory and laws of heat	29	22	51
15. Drugs, narcotics, and alcohol	20	21	51

Read table thus: For household chemistry, 35 teachers marked as Fundamental (F) and 30 marked Supplementary (S) making a total of 65. For coal, gas, and petroleum, 39 marked as Fundamental (F) and 25 marked Supplementary (S) for a total of 64. Read in like manner for succeeding topics.

The selection of subject matter was rated 30% on Frank's score-card,<sup>19</sup> and 25% on the Franzen and Knight<sup>20</sup> card. Two hundred eighty five points or 28.5% are distributed over thirteen important topics that go to make up a composite general science textbook. Ten of these thirteen topics were scored twenty five points each which was 8.8% of the total. Three less important topics, The Human Body, Foods, and Clothing, were scored 5.6%, 3.5%, and 3.5%, respectively.

<sup>19</sup> Frank, loc. cit.

<sup>20</sup> Franzen and Knight, loc. cit.

The reason for scoring fewer points for the latter three topics is that each of them is studied intensively in other departments.

Part III. Presentation of Material-----37%

A. Table of Contents-----5%

Only five points are recorded for the table of contents because it is used very little by the student. Part III is given 37% because a textbook is not worthwhile unless it has some appeal to the student. The make-up of a textbook is very important for students at the junior high school level. There should be an appeal.

B. Index-----2%

On the score card by Frank,<sup>21</sup> 10% is given over to the table of contents, index, and glossary. The index is put to some use by the student so 2% is allowed here for that.

C -----3%

The one of these three, table of contents, index, and glossary that is most used is the latter, because of its utility 3% is allowed glossary.

D. Motivation-----2.5%

An introductory page before the beginning of each unit is helpful in arousing the interest of students for the book that is before them. For this reason, twenty-five points are allowed for this important help in presenting the material.

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<sup>21</sup> Frank, loc. cit.

E. Vocabulary-----5.5%

On the score card by Frank<sup>22</sup> 5% is allowed for clear-cut comprehensible English that is in keeping with age and preparation of the pupils, so fifty-five points are allowed here also.

G. Illustrations-----8.5%

The card by Frank<sup>23</sup> and the one by Franzen and Knight,<sup>24</sup> allow 5% and 1.5% respectively for illustrations. After taking into consideration, however, the attraction that a good illustration holds there is every reason to believe that more should be allowed. Of the 85 points allowed for illustrations, 35 points or 41.2% are allowed for the total number of illustrations given with 500 mentioned as a satisfactory number in a good textbook. The other 50 points which figures 58.8% were allowed for association of the illustrations with the material. This is really more important than the actual number because if they are not near the material as it is taken up their effectiveness is lost.

A study made of the changing conceptions of teaching helps in general science textbooks tends to prove that the use of questions<sup>25</sup> is a very important factor in the teaching of general science.

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<sup>22</sup> Frank, loc. cit.

<sup>23</sup> Frank, loc. cit.

<sup>24</sup> Franzen and Knight, loc. cit.

<sup>25</sup> Martland P. Simmons, "Changing Conception of Teaching Helps in General Science Textbooks," Science Education, 20:211-214. (December, 1936.)

Martland P. Simmons says:

Some more or less arbitrary criteria of selection had to be set up to reduce the number of contributing sources of data sufficiently to make the investigation practicable. Therefore, the selection was based primarily upon the availability and wide use of the eighteen general science textbooks listed. For ease of interpretation the twenty-four years included in this analysis have been divided into four periods as indicated."

General science textbooks of four publishers were used for each period.

TABLE XII

EIGHTEEN GENERAL SCIENCE TEXTBOOKS THAT WERE ANALYZED  
FOR TEACHING HELPS

Textbook	Author	Publisher	Copyright Date
Period 1911-1916			
1. First Year Science	Snyder	Allyn and Bacon	1914
2. General Science	Clark	American Book Co.	1912
3. General Science	Elhuff	D. C. Heath and Company	1916
4. Introduction to General Science	Powell	The Macmillan Co.	1911
Period 1917-1923			
1. General Science	Bedford	Allyn and Bacon	1921
2. Civic Science in Home and Community	Hunter and Whitman	American Book Co.	1923
3. The Science of Common Things	Tower and Lunt	D. C. Heath and Company	1922
4. An Introduction to the Study of Science	Smith and Jewett	The Macmillan Co.	1918
Period 1924-1928			
1. General Science	Snyder	Allyn and Bacon	1925
2. New Introduction to Science	Clark	American Book Co.	1928

TABLE XII (continued)  
 EIGHTEEN GENERAL SCIENCE TEXTBOOKS THAT WERE ANALYZED  
 FOR TEACHING HELPS

Textbook	Author	Publisher	Copyright Date
3. General Science	Elhuff	D. C. Heath and Company	1925
4. Science of Home and Community	Trafton	The Macmillan Co.	1926
Period 1929-1934			
1. Our Environment: Its Relation to Us (Book I)	Carpenter and Wood	Allyn and Bacon	1935
Our Environment: How We Adapt Ourselves to It (Book II)	"	"	1934
Our Environment: How We Use and Control It (Book III)	"	"	1934
2. Problems in General Science	Hunter and Whitman	American Book Co.	1934
3. The World About Us	Pulvermacher and Vosburgh	D. C. Heath and Co.	1930
4. General Science for Today	Watkins and Bedell	The Macmillan Co.	1932

Read table thus: The period 1911-1916, the textbook used was "First Year Science" by Snyder, published by Allyn and Bacon, copyrighted in 1914. Read in like manner the rest of the books in each period.

TABLE XIII

## TEACHING HELPS OCCURRING IN GENERAL SCIENCE TEXTBOOKS

Teaching Helps	Allyn and Bacon				American Book Co.				D.C. Heath and Co.				The Macmillan Co.				Total Frequency 1911-1934
	1911-1916	1917-1923	1924-1928	1929-1934	1911-1916	1917-1923	1924-1928	1929-1934	1911-1916	1917-1923	1924-1928	1929-1934	1911-1916	1917-1923	1924-1928	1929-1934	
A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	U
1. Demonstrations			x					x								x	3
2. Exercises				x		x	x	x	x	x	x	x		x	x	x	11
3. Experiments	x	x	x	x		x		x	x	x	x		x	x	x	x	14
4. Footnotes								x			x						2
5. Glossaries								x	x		x						3
6. Key Statements				x													1
7. Key Words				x												x	2
8. Pictures	x	x	x	x		x	x	x	x	x	x		x	x	x		16
9. Projects			x	x	x			x							x	x	7
10. Questions	x		x	x				x		x				x	x	x	9
11. References			x		x			x	x	x				x		x	8
12. Reports			x					x	x							x	4
13. Summaries	x		x	x				x					x	x	x		8
14. Tables				x		x	x	x			x	x	x		x	x	9
15. Tests										x							1
16. Topic Surveys				x													1

Read table thus: Demonstrations appeared in books published by Allyn and Bacon during period 1924-28, in books published by American Book Company during period 1929-1934, and in books published by The Macmillan Company during period 1924-1929. Thus demonstrations appeared three times in the period 1911-1934 in books of these four publishing companies. Read in like manner for succeeding teaching helps.

From Table XII it seems reasonable to assume that aids for teachers add to the value of general science textbooks. There are in the sixteen textbooks examined sixteen different factors which are of special help in general science teaching. These are (1) Demonstrations, (2) Exercises, (3) Experiments, (4) Footnotes, (5) Glossaries, (6) Key Statements, (7) Key Words, (8) Pictures, (9) Projects, (10) Questions, (11) References, (12) Reports, (13) Summaries, (14) Tables, (15) Tests, (16) Topic Surveys. The findings of this investigation may be summarized as follows:

1. An examination of the table shows that "Demonstrations" appear only in the book of the last period. This may mean that Demonstrations are probably in the experimental stage.
2. "Exercises" occur in all periods with few exceptions, thereby indicating the usefulness of this aid.
3. The high frequency for "Experiments" indicates that there is a definite agreement as to the essential importance of these teaching helps. "Experiments" were not included in two books. A further investigation of the matter indicates that these books were the work of one author and that the second was a revision of the first. No reason is apparent to explain the omission of "Experiments" from these two books. These data seem to emphasize that general science is not entirely a textbook subject.
4. "Footnotes" receive very little attention. The reason for this is that the textbook content is adequate without further explanation.
5. Because of the lack of sequence in the appearance of "Glossaries" it seems unsafe to attach significance to their desirability.
6. Both "Key Statements" and "Key Words" occur in the later periods which probably indicates that they are a new form of teaching help.



7. Table 12 indicates that "Pictures" are used quite generally by writers of general science textbooks. They occur in all the books except Introduction to General Science by Powell, published by The Macmillan Company in 1911. The writer's interest in pictures suggested a further investigation of the textbooks. It appeared that for the entire period 1911-34 there was a gradual increase in the number of pictures, there was a general improvement in clearness, and there was a greater coordination with subject matter.
  8. A wide range is shown for "Projects" with a greater emphasis in the later periods.
  9. The data show that "Questions" have been accepted as an essential factor in teaching general science.
  10. "References" come into prominence in the later periods. This should tend to encourage and stimulate worthwhile individual general science reading.
  11. There is evidence to show why "References" should receive a place among teaching helps.
  12. "Summaries" are generally accepted as valuable aids in the learning process.
  13. "Tables" show an increase in the later periods.
  14. "Tests" and "Topic Surveys" are new additions. Textbook writers have not yet evaluated "Tests" and "Topic Surveys" as of enough importance to make their general use desirable.
- G. Experimentation-----8.5%

Eighty five points are given for experimentation, which is 8.5% more than is allowed by Frank.<sup>26</sup> A comparison of eighteen general science textbooks by Martland P. Simmons<sup>27</sup> states that there is a definite agreement as to the essential importance of the experiment as a teaching help.

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<sup>26</sup> Frank, loc. cit.

<sup>27</sup> Simmons, op. cit.

Fifty-eight and eight-tenths per cent of the 85 points is allowed for the number of experiments which vary in number according to the unit that is being studied. The other 41.2% is allowed for association. The experiments should be performed as the class is discussing the work.

H. Questions to be written-----6.5%

On the card by Franzen and Knight, 7.5% is allowed for classroom exercises, and suggestions for outside work; while on the Frank score card there are no points allowed for this important feature. The data from the Simmons<sup>29</sup> investigation shows that "Questions" have been accepted as an essential factor in teaching general science.

It seems that in order to learn, students must be required to do some work. In writing out exercises which deal with the material that is covered, the student either must have absorbed something or must go back over the material that has been covered and re-read it. Seventy-six and nine tenths per cent or 50 of the 85 points are allowed for the number of exercises that are given. The other 23.1% is allowed for nearness of the exercises to the material covered.

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<sup>28</sup> Franzen and Knight, loc. cit.

<sup>29</sup> Simmons, op. cit.

## CHAPTER IV

### AN ANALYSIS OF THE FIVE TEXTBOOKS USED IN THE STUDY

The topics listed below are taken from the five books that were analyzed. In many cases it was difficult to classify some of the material. In the tables in this chapter, book A has reference to "The First Year of Science" by Hessler; book B, "Civic Science in the Community" by Hunter and Whitman; book C, "Everyday Problems in Science" by Hunter and Whitman; book D, "General Science" by Regenstein and Teeters; and book E, "Problems in General Science" by Hunter and Whitman.

TABLE XIV

#### COMPARISON OF PAGES DEVOTED TO TOPICS IN BOOKS ANALYZED

Topic	Book				
	A	B	C	D	E
Air	20	1	23	18	25
Heat	15	2	45	43	40
Water	16	57	31	11	28
Force and Energy	20	0	0	10	5
Weather and Climate	26	36	34	54	26
Astronomy	0	0	20	27	18
Time and the Seasons	0	6	13	6	22
Magnetism and Electricity	25	8	23	20	23
Light	16	4	29	29	32
Sound and Communication	5	17	33	71	34
Power and Machines	14	14	75	82	46
Transportation	0	43	36	28	40
Rocks and Soil	24	10	9	14	22
Foods	0	23	32	39	48

TABLE XIV (continued)  
COMPARISON OF PAGES DEVOTED TO TOPICS  
IN BOOKS ANALYZED

Topic	Book				
	A	B	C	D	E
Personal Health	57	12	31	0	34
Clothing	18	0	21	2	21
Fighting Diseases	31	29	35	20	27
Plant and Animal Life	46	24	12	47	42
Nerves and Sense Organs	29	0	4	0	0
Construction of Homes	0	0	32	0	30
First Aid	0	0	4	10	6
Improvement of the Human Race	0	12	0	0	5

Read table thus: For the topic air, twenty pages are allowed in book A, one page in book B, twenty-three pages in book C, eighteen pages in book D and twenty-five pages in book E. Read in like manner for each of the succeeding topics.

The following facts are important in the selection of a textbook for a high school student.

TABLE XV  
PERTINENT FACTS FOR COMPARISON OF THE  
FIVE GENERAL SCIENCE TEXTBOOKS

	Book				
	A	B	C	D	E
Author's degrees	Ph.D.	Hunter Ph.D. Whitman A.M.	omitted	omitted	Hunter Ph.D. Whitman A.M.
Copyright date	1915	1922	1925	1928	1934
Editor	None	None	Henry C. Morrison	None	None
Binding	Good	Poor	Good	Poor	Good
Experimentation	Yes	A little	Yes	No	Yes
Summary	Yes	No	No	No	No
Black face type for headings	Yes	Yes	Yes	Yes	Yes
Italics	Yes	Yes	Yes	Yes	Yes

Read table thus: The degree of the author of book A is Ph.D., of book B is Hunter Ph.D. and Whitman A.M., of books C and D the degree of the author is omitted and book E it is again Ph.D. for Hunter and A.M. for Whitman. Read in like manner for each of the succeeding items.

The following table contains other facts which are important in a critical analysis of a group of textbooks.

TABLE XVI  
COMPARISON OF THE FIVE GENERAL SCIENCE TEXTBOOKS ANALYZED

	Book				
	A	B	C	D	E
Introductory chapter	0	3	12	2	13
Number of pages	468	423	512	642	662
Number of pages devoted to preface	6	4	3	2	4
Number of different units	20	26	17	17	21
Number of pages of index	11	6	20	22	14
Number of illustrations used	317	314	508	329	532
Exercises throughout the unit	11	0	18	0	18
Preliminary exercises before each unit	0	0	10	0	7
Average number of questions at the end of each unit	11	0	13	0	12

Read table thus: Book A did not have an introduction while book B had 3 pages of introduction, book C, 12 pages, book D, 2 pages, and book E, 13 pages. Read in like manner for each succeeding item.

The following table presents a critical evaluation of the five textbooks that were used in this study. This evaluation is based on the score-card that was presented in Chapter III and follows the form of that score-card in detail. For the different criteria listed it will be necessary to refer to the score-card in reading the following table.

TABLE XVII

## RESULTS OF AN EVALUATION OF FIVE GENERAL SCIENCE TEXTBOOKS

		Book				
		A	B	C	D	E
<b>Part I</b>						
<b>A</b>						
1.		10	8	9	10	9
2.		15	15	15	15	15
3.		25	25	25	15	25
<b>B</b>						
1.		25	0	25	20	25
2.		20	20	20	20	15
3.		35	35	35	35	35
<b>C</b>						
1.		15	15	15	15	15
2.		15	10	15	15	15
3.		25	25	25	25	25
4.		15	15	15	0	15
5.		35	35	35	35	35
<b>D</b>						
1.		10	10	10	10	10
2.		10	10	10	10	10
<b>E</b>						
1.		5	5	5	5	5
2.		20	20	20	20	20
3.		25	25	35	35	35
<b>F</b>						
1.		10	20	20	20	30
<b>Part II</b>						
<b>A</b>						
1.		22	2	25	20	25
2.		15	25	20	10	20
3.		10	2	25	25	25
4.		15	20	20	25	15
5.		15	5	25	25	25
6.		25	10	25	20	25
7.		5	5	25	25	25
8.		0	0	20	25	20
9.		5	5	15	25	25
10.		25	15	10	25	25

TABLE XVII (continued)

## RESULTS OF AN EVALUATION OF FIVE GENERAL SCIENCE TEXTBOOKS

	Book				
	A	B	C	D	E
11.	15	8	15	5	15
12.	0	7	8	10	10
13.	10	0	10	1	10
Part III					
A					
1.	5	2	5	5	5
B					
1.	10	10	20	15	15
C					
1.	18	0	9	0	30
E					
1.	55	55	55	55	55
F					
1.	20	20	35	20	35
2.	50	50	50	50	50
G					
1.	5	40	50	0	50
2.	35	35	35	0	35
H					
1.	15	5	15	0	15
2.	35	0	50	0	40
	705	614	901	691	924

Read table thus: By referring to the score-card presented in Chapter III, it is easy to see that subdivision 1. under division A of Part I refers to the stiffness of the cover of the book. Book A allows 10 points, book B, 8 points, book C, 9 points, book D, 10 points and book E, 9 points. Read in like manner for each succeeding part of the evaluation.

## CHAPTER V

### SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

#### Summary

This study has, as its main objective, an analysis of the five general science textbooks that have been used in the Kansas schools since 1915. The purpose is:

1. To critically analyze the five textbooks used in this study.
2. To relate some of the history of textbook selection.
3. To name the objectives of a good general science course.
4. To present criteria for selecting a good textbook.
5. To form a score-card containing reliable criteria for evaluating general science textbooks.
6. To use the score-card to evaluate the five general science textbooks that were studied.

#### Conclusions

1. There is a great improvement in the textbooks used today over those a few years ago.
2. A good textbook is needed if the best learning is achieved.
3. The general science course has changed to a more composite study of the natural sciences.



4. The most general science textbooks that are on the market now are very attractive books.
5. The newer textbooks are dotted with very interesting illustrations.
6. There are more experiments in the books used now than in the older issues.
7. The general science textbook authors are including many fine teaching helps which are very valuable.

#### Recommendations

The following recommendations seem advisable:

1. A page or two of introduction should be at the beginning of each unit to arouse interest in the material that is to be covered.
2. The textbook should be well supplied with questions and exercises to be written out by the student.

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