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An Analytic Comparative Study of Certain Biology Textbooks Used At Secondary School Level

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AN ANALYTIC COMPARATIVE STUDY OF CERTAIN
BIOLOGY TEXTBOOKS USED AT THE SECONDARY
SCHOOL LEVEL

being

A thesis presented to the Graduate
Faculty of the Fort Hays State College
in partial fulfillment of the requirements
for the Degree of Master of Science

by

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Author

9-25-47

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CHAPTER I

INTRODUCTION

Biology is the science of life and therefore deserves every consideration in the high school curriculum. The world today is making an extensive and intelligent use of biology in solving problems of personal and social significance. Scientists have discovered that certain phases of the subject are more important to man's welfare than others. For this reason it is essential that biology be presented to our high school students not as isolated facts, but in relation to the problem of living. Through this science of living things the student can gain a healthy respect for facts and for conclusions based on facts. Biology study can be a meaningful and fascinating experience and a permanent value to the student.

The American emphasis on the textbook method of teaching has been instrumental in securing for American schools the best textbooks in the world. The textbooks of no other country compare with ours in excellence of subject matter, illustrations, typography, binding, paper, and other phases of textbook making.¹

In view of the fact that the textbook is the usual method of teaching in our American schools, is in many instances the teacher, and since the knowledge of most

1. Ward G. Reeder, The Fundamentals of Public School Administration (New York, Macmillan Company, 1930), p. 443.

pupils is limited to what the textbook contains, it is essential that the best available textbooks be selected. It is this realization that in actual teaching the textbook largely determines both the content and the method of instruction that the writer found the roots for the comparative study of certain textbooks in biology at the secondary school level.

Statement of the Problem

The specific problem of this thesis is "An Analytic Comparative Study of Certain Biology Textbooks Used at the Secondary School Level."

The material for the thesis is derived in the comparison of the following textbooks:

- (1) The recently adopted textbook in biology for the State of Kansas, namely, Everyday Biology by Curtis--Caldwell--Sherman;
- (2) The second choice textbook in biology considered by the State Board of Education, but not adopted. Dynamic Biology by Baker--Mills;
- (3) The textbook in biology which the recent adoption displaced. Exploring Biology by E. T. Smith;
- (4) Two textbooks in biology extensively used in nearby states, but not necessarily adopted texts, (a) New Introduction to Biology by Alfred C. Kinsey, an adopted text in the state of Oklahoma, and (b)

New Biology by W. M. Smallwood, a textbook in most common use in the state of Nebraska.

The purpose of the study is not to determine which is the best textbook of the five because there is no one best textbook, but rather to draw attention to the study of textbooks. The study of itself should be valuable to teachers whether they teach biology or any other high school subject. It may likewise be valuable to those who have a choice of textbooks whether in Kansas or any other state.

Technique and Procedure

The technique used in making this comparative analysis involved the formulation of a measuring device. It is possible to analyze textbook material without necessarily evaluating such material, that is, certain phases of content may be analyzed without an attempt to pass judgment as to the worth of such content. An analysis should precede evaluation, but the two processes are so intimately interwoven that it is not always possible to separate the actual processes of analysis and evaluation.

The value of scientific analysis and measuring in selection of textbooks has been well established. The usual "opinion" method of selection has given way to the "data" method. It is believed that the use of a rating form, viewed not as a permanent standard but as a working scale that will change as new ideas are recognized will provide

an objective basis for the selection of textbooks.

The criteria used in this comparative study of certain biology textbooks were compiled after extensive study of check lists and score cards made by reputable authorities on textbook evaluation. The concensus of educational authority is that details on textbook evaluation can be classified under two main headings: first, the general factors which must be considered regardless of subject, grade or location of school, and second, specific factors which vary and depend upon the specific subject being considered. Such things as the authorship, copyright date, mechanical features, and the make-up of the book are general in nature and should be considered in any textbook evaluation. The selection of subject matter, the technique for teaching and the aids to instruction depend on the subject being evaluated.

After considerable study of much available criteria for evaluating textbooks the writer compiled the following check list for analyzing and comparing biology textbooks to be used at the secondary school level:

I. Authorship

A. Scholarship

B. Copyright date and edition

II. Mechanical Features

A. Size

- B. Binding
 - 1. Durability
 - 2. Attractiveness
 - 3. Color
- C. Quality of paper
- D. Size, clearness and attractiveness of type
- E. Attractiveness, appropriateness and usefulness of illustrations
- F. Accuracy and usefulness of charts, diagrams and maps

III. Subject Matter

- A. Selection of Material
 - 1. Relative value of material
 - 2. Scope of field
 - 3. Distribution of content
 - 4. Adaptability of material to class needs
 - 5. Reading ability and ease to comprehension--vocabulary
- B. Organization
 - 1. Method of presentation
 - a. type method--representative form
 - b. group method
 - c. principles method

2. Provisions for individual differences
3. Plans for activities
4. Plans for problem solution
5. Challenging questions
6. Reference readings
7. Degree and emphasis on topics

IV. Instructional Aids

- A. Visual aids
- B. Paragraph headings
- C. Summary
- D. Study questions
- E. Adequate index
- F. Adequate Glossary
- G. Adequate illustrations
- H. Effectiveness and appeal of illustrations
- I. Teachers manual or guide book
- J. Preface of information for teachers
- K. Table of content

Explanation of items used in the check list for analyzing and comparing the biology textbooks.

Authorship--scholarship, training and experience of the author

Mechanical features:

Size--convenient

Binding--durable and attractive

Quality of paper--good weight and quality, not
glazed

Type--proper size for the grade

Illustrations--adequate and useful, appealing to
the child

Charts, diagrams and maps--accurate and useful

Subject Matter:

Selection--relative value, scope, adaptability
to students needs, suitable vocabulary
for comprehension

Organization--method of presentation, provision
for individual differences, plans
for activities, plans for problem
solving, challenging questions

Instructional Aids:

Visual aids--pictures, charts, diagrams, para-
graph headings

Summary--pointed and thought provoking reviews
at the end of each unit

Study questions--relevant and suggest methods of
study

Index--full and so arranged that material may be
easily found

Glossary--meaning and pronunciation of unusual
and different words

Illustrations--simple, clear, suitable and attract-
ive

Teachers manual or guide book together with pre-
face of information for teachers--should give an
outline of the book and aid in teaching
Table of contents--complete enough to permit ready
location of important topics

Method of Comparison

The method, for the comparison of the five textbooks in biology, is the descriptive technique. This analytical procedure represents a necessary preliminary step in any effort to pass judgment on the value of textbooks. Each of the texts was analyzed in accordance with the four major divisions in the evaluating scale compiled by the writer. These five analyses were compared and the results noted.

Also from the findings of the various authorities on textbook evaluation a score will be worked out for the divisions in the writer's check list.

Related Studies in Textbook Evaluation

The writer found relatively few studies in the field of biology and none in the form of a comparative study of biology textbooks.

The following studies have been made in biology:
Jessie A. Menzies, of the University of Chicago, made an analysis of the generalization and applications of a number

of college biology textbooks.¹ M. F. Kuhlmann, of the University of Iowa, conducted a study on the basic concepts of biology.² Jessie C. Rohey, of the University of Cincinnati,³ compared six widely used textbooks in biology in terms of range of material-space devoted to selected topics, vocabulary and difficulty of content.

Studies in textbook selection were made by Edward Bechtholt of the University of Washington, who studied methods of textbook selection in various states, state printed textbook selection, and the relations of publishers to textbook selection. He recommends free selection and shows that state printing of textbooks is a failure.⁴ Willis O. Underwood, of the University of Colorado, attempted to determine how familiar teachers are with facts essential in analyzing textbooks objectively. He ascertained criteria used in actual practice in judging textbooks, and developed a score

1. Jessie A. Menzies, An Analysis of the Generalization and Applications of Ten College Textbooks in Biology (Chicago, University of Chicago, Master Thesis, 1927).

2. M. F. Kuhlmann, The Basic Concepts of Biology in Three High School Texts (Iowa University, Master Thesis, 1934).

3. Jessie C. Rohey, The Study of the Content of Secondary School Textbooks in Biology with Reference to Student Experience (Cincinnati, Ohio, Cincinnati University, Master Thesis, 1937).

4. Edward Bechtholt, An Investigation of Textbook Selection (Washington, University of Washington, Master Thesis, 1940), p. 80.

card for making the study of textbooks objective. ⁵ Lowell O. Yasmer of Fort Hays Kansas State College made a comparative study of agriculture textbooks. He presented a plan ⁶ by which a choice of "better textbooks" could be made. Also a comparative study was made by Trillie Albert James of Fort Hays Kansas State College on textbooks in citizenship for the ⁷ purpose of establishing a measuring scale.

5. Willis O. Underwood, The Analysis and Selection of Elementary School Textbooks (Colorado, University of Colorado, Master Thesis, 1938).

6. Lowell O. Yasmer, A Comparative Study of General Agriculture Textbooks Used in Senior High School (Kansas, Fort Hays State College, Master Thesis, 1940).

7. Trillie Albert James, A Comparative Study of Textbooks in Citizenship for High Schools (Kansas, Fort Hays State College, Master Thesis, 1938).

CHAPTER II

COMPARATIVE STUDY OF THE TEXTBOOKS

The textbooks selected for analysis and evaluation are five in number and constitute the following titles:

- (1) Everyday Biology by Curtis, Caldwell, Sherman; to be referred to as textbook "A".
- (2) Dynamic Biology by Baker, Mills; to be referred to as textbook "B".
- (3) Exploring Biology by Ella T. Smith; to be referred to as textbook "C".
- (4) New Introduction to Biology by Alfred Kinsey; to be referred to as textbook "D".
- (5) New Biology by Smallwood, Reveley, Bailey; to be referred to as textbook "E".

As was previously stated it is not the purpose of the writer to determine which is the best textbook of the five for use in high school, but to critically compare them. During this comparative study a complete analysis was made of each textbook according to the criteria in the evaluating scale which appears in Chapter I. It is the belief of the writer that a descriptive analysis of what exists in the content of textbooks is an important initial step to any appraisal or evaluation, but no attempt was made to place the items considered in the order of their importance.

The evaluating scale for this comparison is divided

into four major divisions. These major divisions are further divided into sub-divisions. The four major divisions are: Authorship, Mechanical Features, Subject Matter and Instructional Aids.

Authorship Data

The importance of the authorship of a textbook is often given too little consideration. The reputation of an author as a scholar and his superior standing as a college instructor do not guarantee a good textbook, but they are important in so far as his style of writing and his research in the particular subject or field are concerned. The reputation of publishers is to be considered, not as a major factor, but knowledge is essential of the publisher's habit of turning out a product which stands up under the usage given a school textbook. The date of copyright is another element of importance in the selection. Education is dynamic and therefore a text should represent the latest and best thought in any given subject field.

Textbook "A"

"Everyday Biology"

Name and Scholarship of Authors

Francis D. Curtis, Ph. D.

Head of the Department of Science, University High School, Ann Arbor, Michigan, and Professor of the Teaching of Science, University of Michigan.

Otis W. Caldwell, Ph. D., LL. D.

Professor Emeritus, Teachers College, Columbia University, and General Secretary of the American Association for the Advancement of Science.

Nina Henry Sherman, A. M., M. A.

Teacher of Biology, University High School, Ann Arbor, Michigan.

Copyright date 1940 revised 1943

Publisher--Ginn and Company

Textbook "B"

"Dynamic Biology"

Name and Scholarship of Authors

Arthur O. Baker, B. S., M. A.

Supervisor of Science in the Junior and Senior High School, Cleveland, Ohio.

Lewis H. Mills, B. S., M. A.

Principal William Dean Howells Junior High School, Cleveland, Ohio.

Copyright date 1943

Publishers--Rand McNally and Company

Textbook "C"

"Exploring Biology"

Name and Scholarship of Author

Ella T. Smith

A classroom teacher in the high school in Salem, Ohio.

Copyright date 1938-1942

Publishers--Harcourt, Brace and Company

Textbook "D" "New Introduction to Biology"

Name and Scholarship of Author

Alfred C. Kinsey, Sc. D. Harvard

Professor of Zoology, Indiana University.

Author: Field and Laboratory Manual in Biology;
Workbook in Biology; Methods in Biology; The
Gall Wasp Genus Cynips; Origin of Higher Cate-
gories in Cynips; etc.

Copyright date 1933 revised 1938

Publisher--J. B. Lippincott Company

Textbook "E" "New Biology"

Name and Scholarship of Authors

W. M. Smallwood, A. B., A. M., Ph. D., Harvard

Formerly of Syracuse.

Ida L. Reveley, Ph. D., M. A.

Wells College.

Guy A. Bailey, B. S., M. S.

Formerly of Genesee State Normal School

Copyright date 1937

Publishers--Allyn and Bacon

Textbook "A" has three authors, two of whom, Curtis
and Caldwell, were science teachers in mid-western high

schools, and are recognized by "American Men of Science". Caldwell is starred in "American Men of Science" for his excellent research in Botany.

Textbook "B" has two authors, both are men prominent in the field of biology. They are recognized as having a working knowledge of the pertinent principles of biology.

Textbook "C". The author is a classroom teacher and has a sound working knowledge of biology.

Textbook "D". The author is a professor of Zoology and has published many articles on biological subjects. He has done much research in his field and has traveled thousands of miles to obtain materials for his study. He is recognized by "American Men of Science".

Textbook "E" has three authors. W. M. Smallwood is a recognized zoologist and is mentioned in "American Men of Science".

Mechanical Features

In attempting to set up bases for appraising textbooks the mechanical features or format should not be given a place equal to content and organization or to instructional aids, but this item is an important one. Durability and quality of paper and binding represent elements of financial economy. The hygiene of reading as related to the typography of the book is of considerable educational significance. The size of the book can probably only be determined by its use as a

sole text or as one among others used. Correctness of graphic reproduction is of great educational significance.

Textbook "A" is larger in cover size than the other books. It is $9 \frac{3}{4}$ inches by $6 \frac{7}{8}$ inches. It contains 698 pages. The book is durably and attractively bound in blue-green cloth, and has a pleasing cover design. The paper is of good quality. The type is 10 point, the lines 29 ems long. The topic headings are black face. The inside cover designs are quite unique and there is a wide variety of appropriate illustrations and useful diagrams.

Textbook "B" has a cover size of 9 inches by $6 \frac{1}{2}$ inches and contains 822 pages. The book has a durable, flexible binding which should withstand hard usage. The cover is dark green with a pleasing design in a contrasting color. The paper is semi-gloss which admits of good cuts but is still not too glaring to the eye. The lines are 26 ems. There are more diagrams and illustrations in this text than in any of the others. These illustrations are attractive but their number might distract the mind of the reader from the printed facts.

Textbook "C" has a cover size of $8 \frac{6}{8}$ inches by $5 \frac{7}{8}$ inches and contains 696 pages. The book has a durable cloth binding. The cover is blue with gold lettering and design. The quality of paper is a good

semi-gloss. The type is 10 point and the lines 25 ems. The topic headings are black face. There are not as many illustrations and diagrams as are usually found in a biology text and they are not exceptionally attractive.

Textbook "D" has a cover size of $7 \frac{7}{8}$ inches by $5 \frac{6}{8}$ inches and contains 845 pages. The book has a good cloth binding that should withstand handling. The cover is simple but attractive in design, and has a clear green color which would not soil easily. The paper is thin but takes the printing well. The type is 10 point, the lines 24 ems, and the topic headings are black face. There are numerous clear, useful illustrations and diagrams throughout the book.

Textbook "E" has a cover size of $7 \frac{5}{8}$ inches by $5 \frac{1}{8}$ inches and has 636 pages. This book is smaller than the majority of biology textbooks. The binding is flexible and durable. The cover of the book is green cloth with contrasting design and lettering. The paper is of good quality and a very light cream in color. It is glossy enough to make the cuts clear and yet is easy on the eyes. The type is 10 point, the lines 24 ems, and the topic headings are black face. The book has an attractive inside cover design and there are several colored cuts throughout the pages as well as numerous appropriate diagrams and illustrations.

The comparative study of the mechanical features of the textbook show some similarity in many respects. Textbook "C" is perhaps the most nearly average size for textbooks and therefore is most convenient. The bindings are all durable, flexible, and reasonably attractive. The quality of the paper is about equal. Textbooks "A", "D", and "E" are more nearly white; "A" is the thinnest paper; "B" is the most highly glazed. None of the texts have gloss enough to cause eye strain and yet all have sufficient gloss to make attractive cuts. All five books are 10 point type and are easily read. They conform closely to the standards of typography derived from the studies of Dearborn, Huey, and others. The standards are generally accepted: length of line, 25-90 mm.; height of letters, 1.5 mm.; space between letters, .5-.75 mm.; space between vertical strokes, .3-.5 mm.; space between words, 2.0 mm.; space between lines, 2.5 mm. Textbooks "A", "B", and "C" have three-quarter inch margins. "D" has five-eighths inch margin, and "E" has about a half inch margin. Due to the length of line the pages of each retain a proper balance. Each text changes its type to denote relative importance of topic headings, and all use italics for emphasis of important words or phrases. Textbook "B" uses more and clearer illustrations and diagrams, "C" less illustrations, "A", "D", and "E" have adequate cuts to appeal to the student and to prove useful in the study of biology.

Subject Matter

A textbook fulfills its purpose through its content. If the organization of a textbook is effective it will make the purpose of the author clear. The main justification for a textbook is that it should meet the particular needs of its user. Other factors are important because they either hamper or extend its use, but they are secondary considerations in the fulfilling of the purpose of the textbook. Selection and organization of subject matter have been separated in this descriptive analysis, but in actual administration in the classroom, they go on at the same time.

Any textbook should be examined for logical organization of material and also to determine whether or not relationships which should be brought out, have been presented in such a way that the student will see the connection.

The writer investigated various studies made by reputable authorities on content for high school biology textbooks. The study made by Otis Caldwell and Florence Weller¹ seemed representative of other studies. The thirty college biologists who judged biological content in this study were successful teachers from various colleges in different states

1. Otis W. Caldwell and Florence Weller, High School Biology Content as Judged by Thirty College Biologists, School Science and Mathematics, Vol. XXXII (April, 1932) pp. 411-424.

and would seem to be in a position scholastically and by experience to have gained worthwhile ideas regarding what high school pupils do or should do in biology. Included in the study of twenty-one textbooks were two that are being compared in this analysis. They were earlier editions of Textbooks "D" and "L". The content agreed upon as essential by these biologists includes:

1. Definition of sub-branches of biology
2. Classification of plants and animals
3. Study of elements, compounds, matter, energy, physical and chemical changes
4. Geographic distribution
5. Human behavior and mental hygiene
6. Alcohol, tobacco, drugs
7. Structure and function of plants and animals including man
8. Hygiene
9. Economic value of plants and animals
10. Structure of protoplasm and the processes of metabolism
11. Heredity and environment
12. Theories of the origin of life
13. Scientists and their contributions to biology
14. Devices and helps for study

Selection of Material for Textbook "A"

The authors of textbook "A" were guided in their selection of specific content by their own extensive research and by that of other investigators.² The topics included are the most important included in the minimal essentials of high school biology, according to a summary of judgments of college teachers of biology who had previously taught in secondary schools. The authors also checked the content of the textbook against a large number of representative state and city syllabi and included materials in the textbook in harmony with the requirements of these syllabi.

Textbook "A" presents biological facts everyone should know. The content material makes abundant provision for individual differences by a wide variety of problems and activities. There are many more activities included than any pupil or class could expect to complete. This allows for a wide latitude of choice to serve the preference of pupils and also to serve the needs and capacities of homogeneous groups.

Comprehension depends on simplicity of vocabulary and simplicity and clarity of style. The authors of textbook "A" have employed, for the most part, short simple

2. Otis W. Caldwell and Florence Weller, "High School Biology Content by Thirty College Biologists", School Science and Mathematics, Vol. XXXII, (April, 1932), pp. 411-424.

sentences and short paragraphs. They also limited the non-scientific vocabulary chiefly to the seven thousand words most frequently used, as presented in Thorndike's list of "Twenty Thousand Words". When other words are used the word is defined. Scientific terms are defined in the body of the text and also in the glossary, and are repeated to provide necessary drill in their use.

Organization for Textbook "A"

The essential facts are so organized that they give the textbook unity, definiteness, and proportion. The content is organized into eight units which present the material in terms of its largest ideas and principles. Each unit is a well-rounded section of material. Each unit is subdivided into sections and any problem or chapter is a small unit in itself, dealing with a relatively complete topic. Each unit is introduced with a two-page article to capture the interest of the pupil and to orient him by presenting the major problems which the unit discusses.

The materials in textbook "A" are graded to the abilities of the student. It is expected that everyone should read all of the material and each should master an amount appropriate to his ability. Many activities are included for the more precocious student, including suggestions for leisure time pursuits. Many exercises on scientific

attitudes, scientific principles, and scientific methods are included in experiments, in illustrations, and in special exercises at the ends of chapters in order to achieve the aims of science teaching that are in harmony with the most authoritative suggestions and recommendations. A list of reference books supplementing the material discussed is found at the end of each unit, and also a bibliography of books for recreation are included near the back of the book. Self tests and experiments occur at intervals throughout the chapters. Some of these tests are objective, some are on organization of facts, some on biological terms, and some on biological principles. The topics of greatest importance are starred. These starred topics are among the essentials of any course in biology.

Selection of Material for Textbook "B"

The textbook provides for thorough teaching of the fundamental facts and principles of biology and their application to problems of everyday life. The content is organized around problems of personal and social importance. The textbook claims that thirty-seven per cent of the content deals with application of biology to everyday problems. This

3, The Thirty-first Yearbook of the National Society for the Study of Education, Part I, A Program for Teaching Science, (Bloomington, Illinois, Public School Publishing Company, 1932).

application is made by a wide range of problems and situations in the everyday lives of pupils--health, first aid, recreation, agriculture, conservation, some aspects of consumers biology, vocational biology, and the employment of activities for scientific thinking. These applications are closely related to the major biological principles which every student should know, and are drawn from situations with which he is familiar. Relative importance of various aspects of the subject are made clear by this application.

The textbook is written in a style easy to read and comprehend. A full glossary of terms is found in the back of the book giving pronunciation as well as meaning of each term. The more difficult terms are also pronounced and defined at the first point of use in the subject matter.

Organization for Textbook "B"

The organization of textbook "B" is well balanced. It does not emphasize one phase and neglect another. The content is organized into twelve units based on problems of personal and social importance. This organization relates the facts and principles to the needs and interests of the student. The sequence of units is in the author's preferred order, but each unit is independent of the others with respect to essential facts and principles and the definition of terms, so the order may be changed if desired. Each unit has a preview and a postview. The preview provides

a problem approach to the study of the unit, gives a background of the problems of the unit, and lists the areas for study. The postview summarizes the facts and principles taught, tests the pupils understanding, provides practice in applying scientific method, and includes a topical list of references. Each unit has questions, problems, and projects which challenge the student to critical thinking.

Selection of Material for Textbook "C"

The author of textbook "C" selected and arranged the material for this textbook by a process of trial and error, and by attention to many reports and investigations of teaching procedure. Its form is the result of the cooperative efforts of several hundred biology students and the author. The nine units were chosen by the author in consultation with college specialists, high school teachers, and experts in teaching methods which she lists in the Acknowledgment in her preface. These units represent the most important principles of modern biology, such as the structure and importance of the cell, classification, use of food and oxygen by living things, the interdependence of living things, the control of health, reproduction, heredity, evolution and behavior.

The subject matter of textbook "C" is presented in a style that is easy to comprehend. The number of technical terms has been reduced so that only those terms most

useful in the course or those of value in the vocabulary of the average person in later life are included. Each technical term included is pronounced at the point of its first appearance and later defined in the glossary. The author of the textbook believes that words look less formidable with a small initial letter, so many names of organisms appear without the initial capital letter that is customary for biological terms.

Organization for Textbook "C"

The content of textbook "C" is organized in the unit-problem plan. It contains nine major units subdivided into thirty-four problems. Each unit idea is a basic biological principle. The emphasis is placed upon the mastery of principles rather than upon the memorizing of information. Activities such as observations, experiments, demonstrations, field trips and reference readings are included in the text. Of the four hundred activities about half of them are observational in which the student gets direct experience. As motivation the author has introduced what she calls dramatic episodes, chosen from incidents in biological history, and has used exploratory questions to arouse the curiosity of the student. At the end of each unit is found a research which is a selection from the writings of some famous biologist. The reading references are listed in the back of the book under the heading "Classroom Library".

Subject Matter for Textbook "D"

The author of textbook "D" says that this textbook is concerned with the importance of giving students a bird's-eye view of the world as a whole, an idea of the unity of life processes in plants and in animals, and some grasp of the general principles that they may see demonstrated in everyday life. This aim he develops by including such practical things as control, conservation, hygiene, nutrition, and disease, but at the same time giving much attention to things that are vitally interesting to the student. The textbook is written on the secondary school level and the style of writing invites attention. Biological terms are italicized in the content of the book and are marked for pronunciation and defined in the glossary. The glossary is so adequate that it will serve a very helpful aid for review as well as for daily use.

Organization for Textbook "D"

Textbook "D" is divided into seven units. Each unit deals with one of the sub-sciences of biology. The seven sciences are taxonomy, distributional biology, morphology, physiology, genetics, ecology, and behavior. There are forty-five chapters included under these seven main headings dealing with various phases of their particular field. Each unit has a preview, a review, and references for its special

branch of science. Each chapter has a summary, words to define, and problems to solve.

Selection of Material for Textbook "E"

The subject matter in textbook "E" deals with some outstanding principles of biology, the biology of animal life, the biology of plant life, and the biology of the human body. The unit on the biology of plant life is given in more detail than the other units, but each seems to have adequate treatment. Special attention is given to human biology and public health and to the personal factors which control mental health. The writer of this analysis believes that the simplicity of statement and the appropriateness of the subject matter are the significant facts about this textbook. The brief simple manner of presentation is valuable in developing scientific attitudes and methods. The vocabulary is adapted to secondary school level. All important biological terms are defined in the glossary.

Organization for Textbook "E"

Textbook "E" is organized in a balanced manner. The content is divided into five units with thirty-seven chapters. Laboratory exercises, objective tests, diagrams of life processes, and pictures correlated with the subject matter create student activity and add conciseness to the fundamental facts. Ample reference lists following each chapter

are provided for supplementary work. The authors of the textbook state in the preface "The fact that New Biology is at present the national leader in the subject indicates that the present treatment has the endorsement of most teachers of biology".⁴

From the writer's investigations as presented in the preceding pages the conclusion may be drawn that all of the five textbooks contain some phase of each of the fourteen essentials as judged by thirty college biologists. They vary in the space and importance given to different points.

All five textbooks have similar organization. Each uses the unit method with subdivisions under each unit, and all make use of the glossary, questions, activity and reference reading. Textbooks "A", "B", "C", and "D" are accompanied by workbooks.

Instructional Aids

Instructional aids pertain to the various devices and helps for using a textbook, found directly within the textbook or elsewhere. Some textbooks include more of these aids than others, and also in some cases these devices and helps are better arranged than in others. Except in case of table of contents, indices, appendices, and glossaries the exact

4. Smallwood, Reveley, Bailey, New Biology preface.

placement of these aids is not necessarily of great consequence. In the matter of placement, the problem becomes almost one with that of mechanical construction of the textbook. It is essential that the table of contents, lists of tables, indices, and other like aids be complete and significant, and that visual aids and collateral readings and workbooks suggested to supplement the textbook be meaningful and expressive. Both the quality and quantity of instructional aids are an essential part of a biology textbook.

Textbook "A"

Visual Aids--Several motion picture films are suggested at the end of each unit. Diagrams and charts are clear and suitable.

Paragraph Headings--Topic headings are in black type with special topics starred.

Study Questions--Self-tests on biological terms, biological principles, and organization of facts are placed at the end of each section in each chapter. Problems to provide for individual differences; suggestions for special reports adjusted to differences in interest, aptitude, and ability; projects to challenge the interest of the pupil, are found at the end of each chapter.

Adequate Index--The index is full and provides a convenient and accurate guide to the topics.

Adequate Glossary--The glossary gives the meaning and pronunciation of difficult words and biological terms and gives the reference page. Four hundred fifty-six words are included in the glossary.

Illustrations--The illustrations are an integral part of this textbook. They provide a visual basis for an understanding of topics discussed. The unique feature of the illustrations is the pictorial designs which frame the unit preview. More than four hundred fifty illustrations are included. There are many attractive photographs, modern scientific diagrams, and up-to-date pictorial graphs. Eight full pages are in color.

Teacher's Manual--A teacher's manual and a pupil's workbook accompany the textbook.

Preface--The preface explains the view point of the author and gives some suggestions for the use of the text.

Table of Content--The table of content shows a clear outline of the book.

Textbook "B"

Visual Aids--Charts and diagrams are clear and helpful. The workbook that accompanies the textbook names suitable motion pictures for various topics.

Paragraph Headings--The topic headings are in Gothic

type and attract attention.

Study Questions--The preview and the postview provide questions, problems, and projects which challenge the student to critical thinking.

Adequate Index--The index outlines alphabetically the contents of the textbook and provides a guide to these topics. The index is cross-referenced to facilitate locating topics that may be listed under more than one heading.

Adequate Glossary--Scientific names of things discussed are defined and pronounced in the glossary. This glossary includes about eleven hundred terms.

Illustrations--The illustrations are very numerous in textbook "B". Over five hundred illustrations are included, which make up about one-third of the content space. The drawings are large, clear and simple. The photographs are interesting and related to the material discussed.

Pupils' Workbook--A workbook to supplement the text is written by the authors.

Preface--The preface gives a clear picture of the text as a whole.

Table of Contents--The table of contents is full and gives a complete outline of the textbook.

Textbook "C"

Visual Aids--Charts and diagrams are clear and useful. Provision is made for many experiments with the use of the microscope. No reference is made to specific movies, but the author suggests their use.

Paragraph Headings--The topic headings are in black type.

Study Questions--Conclusions are made at the end of each unit-problem. Some of these are in the form of completion tests from which the student draws his own conclusions. Each new problem opens with a dramatic episode and a list of exploratory questions to motivate the subject.

Adequate Index--The index is adequate and serves as a guide to the topics.

Adequate Glossary--The glossary gives the meaning and pronunciation of about five hundred unusual or difficult words.

Illustrations--There are about four hundred illustrations, all closely related to the subject matter.

Workbook--A student's workbook accompanies the textbook. The workbook includes objective tests to go with the text.

Preface--The preface outlines the activities and subject matter of the textbook.

Table of Contents--The table of contents is complete enough to permit ready location of important topics.

Textbook "D"

Visual Aids--The charts and diagrams are clear and suitable to the subject matter. No mention is made of the use of movies.

Paragraph Headings--The main topics are centered and the paragraph headings are in black type.

Study Questions--Each unit opens with a preview and closes with a review. Each chapter closes with an excellent list of questions and problems.

Good summaries and a list of words to define are given at the end of each chapter.

Adequate Index--The index is adequate and arranged to facilitate location of the material in the content.

Adequate Glossary--The glossary contains over five hundred words marked and defined. Pages are listed where terms are found.

Illustrations--The textbook contains over five hundred attractive illustrations with three full page color plates.

Workbook--A pupil's workbook accompanies the text.

Preface--The preface is brief, but gives the author's purpose in writing the book.

Table of Contents--The table of contents is complete and furnishes a good outline of the text.

Textbook "E"

Visual Aids--Aids in the form of numerous charts and diagrams accompany every phase of the subject.

Paragraph Headings--Questions follow each chapter.

An objective test follows each unit. A summary is given at the end of each chapter covering the topics discussed.

Adequate Index--The index is full and arranged so that the material is easily found.

Adequate Glossary--The glossary clearly defines six hundred forty-six words.

Illustrations--About four hundred illustrations including eight attractive color plates and twenty-nine portraits of noted biologists are found in the textbook.

Teacher's Manual or Workbook--New Laboratory Manual with text.

Preface--The preface gives a brief discussion of what the book proposes to do for the student.

Table of Contents--The table of contents is full

enough to outline the textbook.

From careful study of the instructional aids and helps included with the five textbooks in biology the writer concludes that in the matter of visual aids, paragraph headings, indices, and tables of content, the textbooks are quite similar. Textbooks "A", "B" and "C" suggest the use of movies as visual aids. Textbook "B" has a much more complete glossary than the other textbooks. It also includes more illustrations. In fact, there are so many illustrations that the printed matter is almost crowded out. Textbooks "A", "B" and "C" contain more helpful prefaces. Most of the textbooks are accompanied by either a teacher's manual or a pupil's workbook or both. In the matter of study questions "A", "B" and "C" are similar in the amount and kind of questions. "D" and "E" have fewer questions, but they are challenging.

Evaluation of Textbooks

Not all textbooks rank equally high according to all the elements considered in an appraisal. Some textbooks are outstanding in one item and some are strong in another. The writer found that one of the biology textbooks though not superior in all respects has certain definite merits, and other textbooks possess certain other definite merits also worthy of consideration. This is the difficulty involved in attempting to determine the superiority of one book as a whole over another. But in trying to face this difficulty there is the possibility of correcting some errors that are likely to occur in a cursory appraisal of textbooks. Score cards for judging textbooks are not perfect but they give obviously better results than unguided judgments. The teaching staff as a whole are greatly benefited by having a common background of approach in making textbook analyses. For this reason the following evaluation chart has been devised for judging biology textbooks. On the basis of 1000 points and considering the relative merits of the four major divisions as determined by taking an average of the values assigned by the authorities listed in Appendix A, page 45, the writer determined the values on the following chart. From these values he made his own evaluations of the textbooks.

Evaluating Criteria for Scoring Biology Textbooks

Basis 1000 points

Textbooks

A B C D E

I Authorship 120

A. Scholarship	72	72	68	65	71	70
B. Copyright	48	48	48	45	43	42
Total Score	120	116	110	114	112	

II Mechanical Features 140

A. Size	10	9	9	10	9	9
B. Binding	25	25	25	25	25	25
C. Quality of paper	15	15	15	15	15	15
D. Type, Size, Clear- ness	40	40	40	40	40	40
E. Illustrations, attractiveness, appropriateness, usefulness	25	24	25	20	21	23
F. Charts, Maps, Dia- grams, Accuracy, Usefulness	25	24	24	20	21	23
Total Score	137	138	130	131	135	

Evaluating Criteria for Scoring Biology Textbooks

Basis 1000 points

Textbooks

A B C D E

III Subject Matter 520

A. Selection of Material 290

1. Relative value	58	56	54	54	54	54
2. Scope	58	56	56	54	55	54
3. Distribution of content	58	56	53	54	54	53
4. Adaptability	58	56	56	54	56	55
5. Ease of comprehension	58	56	56	54	56	56
Average Score		280	275	270	275	272

B. Organization 230

1. Method of presentation	56	56	56	56	56	56
2. Individual differences	29	29	28	28	28	28
3. Plans for activities	29	28	29	29	29	29
4. Plans for problem solving	29	28	28	28	28	28
5. Challenging questions	29	28	28	28	28	28
6. Reference readings	29	28	28	28	28	28
7. Degree and emphasis on topic	28	28	28	28	28	28
Average Score		225	225	225	225	225

Evaluating Criteria for Scoring Biology Textbooks

Basis 1000 points

Textbooks

A B C D E

IV Instructional Aids 220

A. Visual aids	15	14	14	13	12	12
B. Paragraph headings	10	10	10	10	10	10
C. Summary	10	9	10	9	10	10
D. Study questions	10	10	10	10	10	10
E. Adequate index	10	10	10	10	10	10
F. Adequate glossary	35	32	33	30	32	31
G. Adequate Illustrations	25	25	25	23	23	23
H. Effectiveness and appeal of Illustrations	25	25	25	24	24	24
I. Teacher's Manual	10	10	6	6	6	6
J. Preface	20	19	20	18	15	15
K. Table of contents	50	45	47	47	45	46
Average Score		209	210	200	197	197

Summary

Authorship total	120	116	110	114	112
Mechanical feature total	137	138	130	131	135
Subject matter total	505	500	495	500	497
Instructional aids total	209	210	200	197	197
Totals	971	964	935	942	941

The writer makes no claim that the course followed in making the foregoing evaluation chart is the only or the best method of procedure. However, to the extent that an analytical objective means of procedure does reveal the relative points of superiority and inferiority of a textbook, the cause of education has been advanced. There have been many desirable effects as a result of experiments in objective evaluation of textbooks. As time goes on better methods of measuring will be found.

CHAPTER III

CONCLUSION

The first step in the comparison of the textbooks was to determine the categories by which textbooks in biology should be judged. For this purpose the writer investigated all the criteria he could obtain from authoritative sources--Appendix A, and from these criteria he compiled the evaluating scale on page 38. The next step was an analysis of the five textbooks in biology to discover how well each complied with the criteria. The third step was to place a value for each item considered for each of the five textbooks.

In the matter of authorship, the writers of textbooks "A", "D" and "E" have higher scholarship. Textbooks "A" and "B" have more recent copyright dates. Progress along educational lines is being made rapidly so a textbook should represent the latest thought.

The mechanical features of the five biology textbooks show much similarity. The illustrations, charts and diagrams in textbooks "A" and "B" are more appropriate. Other features are of about equal value.

The subject matter in textbooks "A", "B" and "D" make the best application to everyday life and would seem to meet the needs, capacities, and experiences of various groups of students. All of the textbooks contain some

phase of the fourteen essentials for biology as listed on page 20. The organization of all of the textbooks is similar. Each is organized around various units of study and all are logical in arrangement.

The glossary, preface and table of contents are very good in textbook "B". Textbook "A" is accompanied by a very good teacher's manual. Textbooks "A" and "B" have more and better illustrations. In other respects the instructional aids of the textbooks have a general likeness.

In the comparative analysis which has been described in Chapter II no attempt has been made to present comparative data with respect to relative merits of biology textbooks. The purpose of this study has been to describe a plan of procedure which takes a step in the direction of scientific studies, and to suggest specific studies which can be made in the process of selecting a basic textbook in biology.

The evaluation chart on page 38 does represent the writer's opinion on relative values of the five textbooks compared. A score card has certain definite values but weightings are a matter of opinion in most cases. After careful study of the various criteria for judging textbooks the writer arrived at the values for the main headings by finding the average which the authorities studied had given to similar divisions. From this study the writer assessed values to the various divisions of the scale on the basis

of 1000 points.

The writer concludes from the findings and evaluations that textbook "A" has the highest authorship value; textbook "B" the best mechanical features; textbook "A" the best subject matter and organization; and textbook "B" the most valuable instructional aids. Textbook "A" has the highest number of points on the basis of 1000 points.

In conclusion it is believed that this study has helped to establish the facts that evaluation studies are of value to remind teachers of characteristics which should be thought of in making a selection of textbooks, and that these evaluations prescribe a value so that appropriate emphasis may be placed on the characteristics of the textbooks.

APPENDIX A

Authorities for Evaluating Scale

Authorities whose evaluation criteria were studied in the preparation of the writers check list.

Burr, S. E. Selection of Textbooks and Use of Rating Scales. (American School Board Journal. Vol. 79, p. 130, August 1929)

A basic rating scale.

Clement, J. A. Manual for Analyzing and Selecting Textbooks. (p. 85)

Analysis outline.

Eggertsen, C. We Choose Our Own Book. (National Educational Association. Vol. 26, No. 5, May 1937)

A check list for textbooks.

Franzen, R. H. and Knight, F. B. Textbook Selection. (Baltimore, Warwick and York, Inc., 1922, p. 19)

Score card for judging the value of biology textbooks.

Hall-Quest, A. L. The Textbook. (pp. 82-87)

The Cincinnati standards for judging textbooks.

Johnson, F. W. A Checking List for the Selection of High School Textbooks. (Teachers College Record, Vol. 27, October 1925, pp. 104-108)

Checking list for high school textbooks.

Maxwell, C. R. The Use of Score Cards in Evaluating Textbooks. (National Society for the Study of Education, Yearbook 30, Part II, pp. 154-159)

Otis, E. M. A Textbook Score Card. (Reeder's Fundamentals of Public School Administration)

Standards for scoring textbooks.

APPENDIX A

Authorities for Evaluating Scale

Waterman, Ivan R. Plan of Procedure for the Evaluation of Textbooks in Reading. (Elementary School Journal, Vol. 35, pp. 662-674, May, 1935)

Good reference on Score Cards.

Weber, O. F. Methods Used in the Analysis of Textbooks. (School and Society, Vol. 24, p. 678-684, November 27, 1926.)

Score card for general Science text.

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Almack, John C., Research and Thesis Writing. New York; Houghton Mifflin Company, 1930, p. 310.

Information on thesis writing.

Andrews, H. D., "Selecting a Textbook." (School Board Journal, Vol. 73, p. 67, September, 1926).

100 questions that cover all points essential in consideration of a new book.

Barr, A. S., and W. H. Burton, The Supervision of Instruction. New York; D. Appleton and Company, 1926.

Includes Franklin W. Johnson's, "A Checking List for the Selection of High School Textbooks", and the Cincinnati standards for judging textbooks by Hall-Quest. Pp. 258-268, Chapter VII on subject matter.

Barnham, A. I., "The Development of the American School Textbook", (American School Board Journal, Vol. 81, page 58. August, 1930).

An interesting article on the development of the American textbook. Traces change from old-time method of selection of textbook to recent scientific method.

Burr, S. E., "Selection of Textbooks and Use of Rating Scales." (American School Board Journal, Vol. 79, p. 130, August, 1929).

Good information on the selection of textbooks and

the use of rating scales and score cards.

Caldwell, Otis W. and Florence Weller, "High School Biology Content as Judged by Thirty College Biologists." (School Science and Mathematics. Vol. 32, 1922, pp. 411-421).

A good basis for content of biology texts.

Carpenter, W. W. and John Rufi, The Teacher and Secondary School Administration. Chicago; Ginn and Company, 1931, pp. 415-419.

Gives a criteria for selecting textbooks and includes Carter Alexander's score card for comparing the merits of books.

Clements, John A., Manual for Analyzing and Selecting Textbooks. Champaign, Illinois; The Garrard Press, 1942.

An excellent text concerning the selection of textbooks.

Dahl, E. J., "Choosing a Textbook in Senior High School Social Sciences." (School Review, Vol. 35, pp. 621-626, October, 1927).

The need for scientific selection of textbooks.

Dickerman, H. E., "The Selection of High School Textbooks." (School Board Journal, Vol. 76, pp. 90-94; February, 1928).

Pertinent information on selecting textbooks.

Eggertsen, Claude, We Choose Our Own Book. (National Educational Association. Vol. 26, No. 5, May, 1937).

A check list prepared by junior high school students.

Engelhardt, N. L. and F. Engelhardt, Scientific Selection of Textbooks. Public School Business Administration, 1927, pp. 717-739.

Contains a distribution of points for a score card.

Franzen, R. H. and F. B. Knight, Textbook Selection.

Baltimore; Warwick and York, Inc., 1922, pp. 19-21.

Includes a tentative score card for judging the value of biology texts.

Coulet, F. X., Selecting the Best Textbooks. (National Educational Association. Vol. 17, pp. 183-184, June, 1928).

Gives plan for evaluation worked out in Los Angeles.

Hall-Guest, Alfred L., The Textbook, How to Use and Judge It. New York; Macmillan Company, 1928. p. 85.

A detailed suggestive form which was used as a basis for selecting textbooks in Cincinnati.

Jensen, F. A., "The Problem of the Selection of Textbooks."

(American School Board Journal. Vol. 75, pp. 43-44, November, 1927).

The importance of more scientific means of judging textbooks.

Johnson, Franklin W., "A Checking List for the Selection of High School Textbooks." (Teacher's College Record, Vol. 27, pp. 104-108, October 1925).

A very helpful checking list for selection of high school texts.

Judd, C. H., "Analyzing Textbooks." (Elementary School Board Journal, Vol. 19, pp. 143-154, October 1918).

Information on how to analyze a textbook.

Kyte, G. C., "Experimentation in the Development of a Book to Meet Educational Needs." (Educational Administration and Supervision, Vol. 14, pp. 86-100, February 1928).

Deals with the beginnings of scientific technique in selecting textbooks.

Marye, Mary E., "A Form for Rating Textbooks." (School Review, Vol. 38, pp. 124-127, February 1930).

Contains good forms and tables for evaluating purposes.

Maxwell, C. R., The Selection of Textbooks. Boston; Houghton Mifflin Company, 1921, pp. 19-21.

Gives a general rating form for all books and more specific forms for particular subjects.

Maxwell, C. R., "The Use of Score Cards in Evaluating Text-books," National Society for the Study of Education, Thirtieth Yearbook. Bloomington, Illinois: Public School Publishing Company, 1931, pp. 143-162.

Gives valuable information on score cards.

Miller, David F. and Glenn W. Blaydes, Methods and Materials for Teaching Biological Sciences. New York: McGraw-Hill Book Company, Inc., 1938, pp. 110-119.

Gives criteria for choosing a text.

Reeder, Ward G., The Fundamentals of Public School Administration. New York: Macmillan Company, 1930; reprint 1934, pp. 443-445.

Very good discussion of the standards for selecting textbooks. Includes "A Textbook Score Card" by J. M. Otis.

Ruch, G. M. and Leo H. Cassman, "Standardized Content of High School Biology." (Journal of Education Psychology, Vol. 15, 1924, pp. 285-296).

Smith, D. B., and J. D. Reeve, The Teaching of Junior High School Mathematics. Chicago: Ginn and Company, 1927,

pp. 204-215.

General considerations in choosing any textbook.

Spaulding, Frank E., Measuring Textbooks. New York: Newson and Company, 1922, p. 29.

Includes score cards for particular subjects.

Wallerstedt, W. A., "Type Was Made to Read." (The Aarend, 1946, pp. 61-63.

Waterman, I. R. and I. R. Melbo, "Plan of Procedure for the Evaluation of Textbooks in Reading." (Elementary School Journal, Vol. 35, pp. 662-674, May 1935).

Discusses the formulation of a score card.

Weber, O. F., "Methods Used in the Analysis of Textbooks." (School and Society, Vol. 24, pp. 678-684, November 1926).

A score card for general science.