PROCEDURES FOR EVALUATION OF TEXTUAL MATERIALS FOR
TEACHING BASIC MATHEMATICAL UNDERSTANDINGS IN THE
ARITHMETIC CURRICULUM OF THE ELEMENTARY SCHOOL

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by
Lucretia C. Story
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PROCEDURES FOR EVALUATION OF TEXTUAL MATERIALS FOR TEACHING BASIC MATHEMATICAL UNDERSTANDINGS IN THE ARITHMETIC CURRICULUM OF THE ELEMENTARY SCHOOL

by

Lucretia C. Story

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## INTRODUCTION AND STATEMENT OF THE PROBLEM

Many teachers and administrators have assiduously been seeking a method for evaluating and selecting thear. The Problem

Statement of the problem

Scope of the study

II. REVIEW OF THE LITERATURE

The purpose of this study was to develop criteria which could be used by elementary teachers in evaluating materials and procedures to be used in teaching basic mathematics.
INTRODUCTION AND STATEMENT OF THE PROBLEM

Many teachers and administrators have asked for criteria to be used in the evaluation of textbooks for a particular area of the curriculum in the elementary school. The time which teaching personnel can devote to the study of the materials, combined with the numerous areas in the elementary curriculum, limit the understanding of the individual teacher of the philosophy and the thinking which has preceded the publication of materials for a particular curricular area.

The criteria were presented to teachers in ten even elementary schools who were teaching one through six, seven through eight, and nine through twelve grades. The following questions were raised in this regard:

A. What does a review of the literature present as the accepted philosophy, content, and methodology of the teaching of mathematics in the elementary school?

B. How do teachers evaluate the criteria as a standard for judging materials and procedures in the elementary arithmetic curriculum?
C. How do teachers evaluate, by the standards of these criteria, the materials and procedures in "The Basic Mathematics Program" for Grades One through Six, *Seeing Through Arithmetic*, Scott, Foresman & Co., Copyright, 1955, as an example of application of the criteria?

**Scope of the study.** The investigator reviewed the literature of the past thirty years in the teaching of mathematics in the elementary school, with regard to the philosophy, the content, and the method or psychological approach to the teaching of mathematics. From the literature criteria were developed for evaluating materials and procedures to be used in teaching basic mathematical understandings in the arithmetic curriculum.

The criteria were presented to teachers in ten Iowa elementary schools who were teaching "The Basic Mathematics Program" for Grades One through Six, *Seeing Through Arithmetic*, Scott, Foresman & Co., Copyright, 1955.

Two kinds of data were obtained and reported: (1) criticisms and suggestions concerning the criteria, and (2) an evaluation of their materials as an example of application of the criteria.

The criticisms and suggestions of the teachers were used to revise the original criteria.
CHAPTER II.

REVIEW OF THE LITERATURE

Publishing companies have always needed to be aware of the trends in educational thinking and to publish materials which incorporate those trends most acceptable for classroom use.

The purpose of this chapter was to review the literature of the past thirty years regarding the three major concerns in the field of arithmetic: the philosophy, the content, and the method or psychological approach to the learning of arithmetic.

In 1930 a change from the idea that arithmetic was a mental discipline which must be taught to children in preparation for adult living was in evidence. The National Society for the Study of Education under the Chairmanship of F. B. Knight published in its Twenty-ninth Yearbook, Report of the Society's Committee on Arithmetic the following philosophy:

The philosophy of this Yearbook, then, finds aims in the future as well as in the present. It suggests the desirability of preparation for adult living and holds it to be evident that a prediction of the demands of the future is feasible to a reasonable and useful degree of certainty. We should teach, then, those skills, informations, judgments, attitudes, habits, ideals, and ambitions which the child will find adequate and satisfying to the most important part of his whole self; that is, to his future adulthood as well as to his present childhood.  

The content of the field was also in question. Should elementary arithmetic be confined to computational skills, or should it encompass the broader area of mathematics? "The Arithmetic Curriculum" as discussed by R. L. West, Charles E. Green, and W. A. Brownell in the Twenty-ninth Yearbook suggested the elimination of parts of the curriculum in arithmetic. However, they advised that topics should be retained which contributed "in a real way to the development of general quantitative concepts" or that laid a foundation for later mathematical work.¹

The newer contributions in the psychology of learning were not acceptable at the time of the publication of the Twenty-ninth Yearbook. The authors agreed on the more conservative behavioristic approach.

Theoretically, the main psychological basis is a behavioristic one, viewing skills and habits as fabrics of connections. This is in contrast, on the one hand, to the older structural psychology which has still to make direct contributions to classroom procedure, and on the other hand, to the more recent Gestalt psychology, which, though promising, is not yet ready to function as a basis of elementary education.²

In 1935 the National Council of Teachers of Mathematics devoted its Tenth Yearbook to the Teaching of Arithmetic. C. I. Thiele discussed the mathematical viewpoint in the teaching of elementary school arithmetic. He believed that "both the organization and the teaching of arithmetic can conform to sound pedagogical doctrine and

¹Ibid., pp. 82-83.
²Ibid., p. 5.
at the same time follow the lines of mathematical development." In summary he stated that a complete revamping of the elementary arithmetic program would have to take place with three major emphases: pupils must discover relationships, the arithmetic of the elementary grades must be simplified, and rather than emphasizing skills there must be the development of understandings.1

Wheat further emphasized the mathematical approach in the teaching of arithmetic. He stressed the number system and quantitative relationships as essential to the child's quantitative understanding.

The purpose of instruction in arithmetic is not to teach children how to solve problems; the purpose is to provide them with methods of thinking, with ideas of procedure, with meanings inherent in number relations, with general principles of combination and arrangement, in order that the quantitative situations of life may be handled intelligently and without doubt and uncertainty. The purpose is so to order and systematize the child's methods of dealing with combination and arrangement of objects that he may go through life freed from the necessity of confronting problems of an arithmetical nature.2

The National Council of Teachers of Mathematics published its final report of the work of the Council Committee on Arithmetic in 1941. At that time they stressed two outstanding phases of arithmetic. The "mathematical" and the "social" phase must both function

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in the lives of children. Leo J. Brueckner believed the stand of the committee to be; instruction should teach the nature and use of the number system in daily life and help the student use quantitative procedures effectively in his social situation.

This point of view recognized two major mutually related and interdependent phases of instruction in arithmetic, namely, the "mathematical" phase and the "social" phase. Full recognition of both phases is essential. Emphasis on the social phase to the neglect of the mathematical phase will not develop in the pupils the quantitative concepts, understandings, and insights that should be the outcomes of a well-rounded program of instruction in arithmetic. On the other hand, emphasis on the mathematical phase will not lead the learner to sense completely the social significance of number in the institutions and affairs of daily life. A balanced, well-integrated treatment of both phases is essential. Arithmetic should be both mathematically meaningful and socially significant. This is essential if arithmetic is to make its maximum contribution to the development of socially competent individuals.1

Following World War II there was increased concern about the teaching of arithmetic. One factor was the limited knowledge of mathematical understandings evidenced by the personnel of the armed forces. Possibly the other was the increased necessity for understanding in the field of science. The Board of Directors of the National Council of Teachers of Mathematics created a commission to plan mathematics programs for secondary schools in the post-war period. The commission recognized at once the need for the improvement

of arithmetic in the elementary school. 1

The commission made its second report in May of 1945. It stated at the outset "the arithmetic of the elementary school can and must be improved." They sought to arrive at a set of principles to guide the building of a stronger mathematical program. They included thirty-four theses for the improvement of mathematics in grades one to fourteen. The following are those most relevant to this review. 2

Mathematics in Grades 1-6

Thesis 2: We must discard once and for all the concept of arithmetic as a mere tool subject.

Thesis 3: We must conceive of arithmetic as having both a mathematical aim and a social aim.

Thesis 4: We must give more emphasis and much more careful attention to the development of meanings.

Thesis 5: We must abandon the idea that arithmetic can be taught incidentally or informally.

Thesis 6: We must realize that readiness for learning arithmetical ideas and skills is primarily the product of relevant experience, not the effect of merely becoming older. 3

The National Society for the Study of Education published its second yearbook on arithmetic in 1951. The investigator was unsuccessful in obtaining a copy of this yearbook and in lieu of it, has included generalizations relevant to this review from the Master's thesis of Frank C. DeLucia. In his comparison of the concepts in


3Ibid.
arithmetic teaching in the 1930 and 1951 Yearbooks of the National Society for the Study of Education he stated the following:¹

The basic generalization, psychological in nature, shows:
1. A change from a position that stood beyond the structural level of psychology, but which because of lacking experimental evidence could not accept and apply Gestalt psychology to elementary education, to the almost unqualified acceptance of Gestalt and the associated field theories of the physical sciences.

The other generalizations show:
2. A change from learning as a preparation for life to learning as a well-rounded living, contributing greatly toward understanding of democratic ideals through the actual living of children.
3. A change from the teaching of accepted judgments, attitudes, ideals, and ambitions to the guiding of experiences to develop the ability of children to arrive at much desirable ends.
4. A change from arithmetic as a body of objective scientific data to an arithmetic which goes beyond this limited scope and includes also the means of meeting many social needs of the child.
5. A change from utilization only of "known" facts in the educational program to welcoming of classroom experimentation as a necessity for a growing curriculum.
6. A change from great concern regarding grade placement for content materials to a greater concern for an understanding of readiness so as to teach effectively whenever the child is ready.
7. A change from perpetuating an isolated arithmetic course to its integration into the general curriculum.
8. A change from "atomizing" the subject matter of arithmetic to its integration into meaningful units.
9. A change from the major aim of mastery of accuracy and facility for mastery's sake to mastery for the purpose of meeting social needs through understanding.
10. A change from concern only about answers to greater consideration of details of the related process.²

²Ibid.
constructive suggestions and discussion of the current situation in the teaching of mathematics. Interest in mathematics is widespread at this time and the recent studies have implications at all grade levels from kindergarten to the graduate school. Some topics in the curriculum which were at one time considered important are no longer in the mainstream of current mathematical thought. The modern mathematics requires liberal use of abstractions and generalizations. They suggest that everyone needs to take a fresh look at the teaching of mathematics but caution should be applied that the content and presentation of mathematical skills follow a logical system.¹

While it is essential that mathematical skills be developed, teachers must recognize that the ultimate goal is to structure the ideas of mathematics into a logical system. This system makes possible applications which cannot be achieved if mathematics is learned only as a collection of memorized techniques. In order to achieve this ultimate goal, many mathematics teachers, at school and college level, must drastically revise their conception of how to develop mathematical power.²

In summary: Although it must be assumed that the author of an arithmetic series would include the philosophy, content, and method in which he believed, it would seem that the following major trends would be observable in a present day arithmetic series for elementary school:

1. The trend in philosophy has been toward helping the child adjust to his present role in society, and to recognize the possible

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²Ibid.
contributions instructions in arithmetic can make to the social objec-
tives of all education.

2. The trend in content has been toward inclusion of those
mathematical understandings which are inherent in quantitative reason-
ing. The use of computation and drill have been placed in secondary
position, following the thinking and understanding of a quantitative
situation.

3. The trend in method or psychology of learning has been
toward the Gestalt or field theories, through which the child’s experi-
ence with broader concepts and their related parts established an
understanding toward the situation.
CHAPTER III.

DEVELOPMENT OF CRITERIA

To enable the investigator to develop criteria for evaluating materials and procedures in elementary arithmetic in accordance with the philosophy, content, and methodology of the literature, seven major categories were chosen: (1) authorship, (2) content, (3) meaningful approach, (4) methodology, (5) organization, (6) vocabulary and physical make-up, and (7) controversial issues.

The purpose of this chapter was to present evidence from the literature supporting the selection of the items included in each category of the criteria.

I. AUTHORSHIP

Authorship was placed first as the authors' philosophy must be the foundation of an arithmetic program. The publication of the National Council of Mathematics, As We See It, suggests that teamwork is essential among mathematicians, educators, and the American public to bring reform in mathematics. ¹ Harold F. Fehr further advises that only as teachers undertake to incorporate the recommendations of mathematicians and educators in their classroom teaching...

¹Ibid.
can modern mathematics become a practical reality.\(^1\) Therefore, the authorship of an arithmetic program must include persons with a sound philosophy in mathematical concepts as well as the understanding of how children learn these concepts.

One item was included under authorship. Are the authors recognized as authorities in both mathematics and education?

II. CONTENT

The scope or content of the arithmetic program has two major aspects, the social aspect and the mathematical aspect. Both must have a place in the classroom. Brownell has stated the two aspects in the form of outcomes; the investigator used this as a source in isolating the areas of concern.\(^2\)

In the literature there is considerable evidence indicating that children and adults alike do not show an interest in mathematics. Two causes are most prominent; mathematics makes little sense to many, and others have consistently failed to succeed. Irvin H. Brune believes that more important than curricular changes in mathematics must be changes in attitude. Mathematics does not involve choosing the proper trick, rather it is a search for relations, patterns and

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systems. Only as pupils understand mathematics as a unified subject can they see sense in what they are doing.1

Four major items were included under content.

I. Are all areas of concern adequately emphasized?
   A. Number system
   B. Operations and processing of whole numbers, fractions and decimals
   C. Ratio or rates and comparisons
   D. Percentage
   E. Problem solving
   F. Measurement
   G. Graphs and charts
   H. Geometry

II. Is there a proper amount of developmental work, practice work (examples), and verbal problems (story problems)?

III. Do the problems involve social situations which develop quantitative thinking and the power to reason?

IV. Is the material designed to develop a genuine interest in mathematics?

III. MEANINGFUL APPROACH

The meaningful approach is concerned with the understanding of how children grow and develop, and how they learn. Mathematical concepts must be introduced as children can understand them, and through methods which they can experience or visualize.

The place of drill is generally agreed upon today. The research of Brownell and Chazal supports other research of the use of repetitive practice: it must be preceded by a thorough teaching program aimed at the building of meanings or understandings; or, practice must follow understanding.2

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Four items were included in this category.

I. Do instructional approaches develop mathematical understandings within the framework of children's experiences?

II. Is the development of concepts and skills approached from the concrete, through the semi-concrete (picture), to the abstract?

III. Is a general understanding of the nature of a process taught before minor difficulties within the process are presented?

IV. Do meaning and understanding precede practice?

IV. METHODOLOGY

There has been some confusion in the minds of teachers on the planning of the general elementary school curriculum for the development of the whole child. Some believed that a planless curriculum should be used. However, if we discuss specifically the arithmetic curriculum there is much evidence in the literature to indicate general agreement on the need for a planned curriculum. Wheat developed a detailed, systematic program around the related ideas of arithmetic.1 Brueckner and Grossnickle further advocate that systematic, planned instruction must proceed from grade to grade.2

V. In a planned program there must be concern for individual differences. As We See It suggests that studies of grouping is one of the needs at the present time in the arithmetic field.3 Van Engen


has said, "The forward movement in mathematics can only come if we learn how to teach abstractions and how far pupils of varying abilities can go in making abstractions." 1

If the teacher is to guide the development of the child, he must have some means of evaluating progress. The teacher needs varying techniques to determine how the child learns as well as techniques to determine the outcomes of the learning. Today we recognize that individuals need to evaluate themselves and their own learnings. Therefore, a variety of techniques and devices would be needed for thorough evaluation.2

II. Seven major items were included under methodology.
   I. Do adequate teachers' manuals provide the theory and method as applied in the content, to enable the administering of continuous skill development from level to level?
   II. Are instructional explanations presented through a systematic method of presentation (lesson plan) that continues through the series?
   III. Are all instructional explanations consistent with true mathematical understandings?
   IV. Are relationships among the four fundamental processes emphasized?
   V. Are opportunities provided for pupil discovery of relationships and generalizations?
   VI. Are provisions made for individual differences?
      A. Reteaching and maintenance of previous learnings
      B. Readiness for each new step
      C. Adjustment of varying levels of ability and rates of learning (enrichment and remedial needs)
   VII. Is systematic evaluation an integral part of the program?
      A. Self-evaluation by pupils
      B. Teacher's diagnostic evaluation

V. ORGANIZATION

Five major items were included in this category.

The organization of materials is important for it provides the setting in which the child discovers relations, builds generalizations, and knows when as well as how to apply his learnings. Teachers emphasize that arithmetic is a meaningful system. Therefore, the units must be examined with reference to their grade placement, the sequence of learning experiences, the length of time spent with one concept, and the amount of repetition through the program.

I. Are units of learning functionally arranged in terms of length and sequence?

II. Is the grade placement of specific learnings consistent with principles of child growth and development as well as with research findings?

In examining the literature the investigator found many controversial issues. Teachers need to be aware that there is controversy among many.

VI. VOCABULARY AND PHYSICAL MAKE-UP

The vocabulary and physical make-up of materials can be an aid or a detriment to the learning process. If pupils are to "think mathematically," the vocabulary must be controlled to permit understanding of the mathematical situation; precision in terminology must be maintained; and the true meanings of the signs and symbols of mathematics must be taught consistently.

Illustrations can provide learning experiences for children, or they can merely add interest to the material. It is commonly believed that well designed illustrations are a definite aid to modern materials.
Those included in the criteria seem to be of most common concern.

Five major items were included in this category.

I. Is the vocabulary sufficiently controlled?

II. Are true mathematical terms presented meaningfully and continued consistently through the materials?

III. Are the signs and symbols of mathematics taught with understanding?

IV. Are meaningful illustrations and other multisensory aids amply provided?

V. Are general characteristics desirable?
   A. Size of page
   B. Size of print
   C. Illustration
   D. Spacing
   E. Use of color
   F. Charts and diagrams
   G. Paper
   H. Durability and binding

VII. CONTROVERSIAL ISSUES

In examining the literature the investigator found many controversial issues. Teachers need to be aware that there is controversy among the mathematicians and educators as to how certain issues are handled. For this reason the final section was made in the criteria.

The issues which seemed most relevant to this study were listed below.

I. Zero facts
II. Estimation
III. Use of equations
IV. Concept of division

The criteria, as presented to the teachers, have been included in the appendix of this study.

The investigator developed a rating sheet for teachers to use as they examined the criteria. The first section included a numerical evaluation of the textbook which they were using. It appeared as follows:
I. Authorship  
II. Content  
III. Meaningful Approach  
IV. Methodology  
V. Organization  
VI. Vocabulary and Physical Make-up  
VII. Controversial Issues

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<td>VI.</td>
<td>100</td>
</tr>
<tr>
<td>VII.</td>
<td>100</td>
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The second section included four questions concerning the criteria. They have been listed below:

I. In examining these criteria, were there any questions which you think could be stated in a clearer manner?

II. Are there any points you believe should not have been included?

III. Are there any important points which you believe have been omitted?

IV. Do you have any suggestions for making these criteria more useful to teachers who might be evaluating arithmetic textbooks?

The rating sheet has been included in the appendix of this study.

These schools were distributed in the following groups: Allen 6, Altamont 6, Centerville 22, Eagle Grove 11, George S. Beebe 7, Millersville 4, Otterfield 6, Prescott 8, Story City 5, and Westham Community Schools.

The investigator met with each group of teachers and explained the criteria with the accompanying rating sheet. To enable the teachers to have an opportunity to study the criteria, the criteria and the rating sheet were left in their possession for one week. The rating sheets were then collected by the administrator in each school and returned by mail to the investigator.

The information obtained from the rating sheets was recorded.
The purpose of this chapter was to report the evaluation and application of the criteria by teachers and to analyze their suggestions and criticisms.

The investigator chose ten Iowa schools which were currently teaching "The Basic Mathematics Program" for Grades One through Six, Seeing Through Arithmetic.¹ The schools chosen were Alden, Alton, Centerville, Eagle Grove, George, Gilbert, Goldfield, Prescott, Story City, and West Lyon Community Schools. The one hundred teachers from these schools were distributed in the following numbers: Alden 6, Alton 10, Centerville 22, Eagle Grove 23, George 7, Gilbert 4, Goldfield 6, Prescott 6, Story City 6, and West Lyon Community Schools 10.

The investigator met with each group of teachers and explained the criteria with the accompanying rating sheet. To enable the teachers to have an opportunity to study the criteria, the criteria and the rating sheet were left in their possession for one week. The rating sheets were then collected by the administrator in each school and returned by mail to the investigator.

The information obtained from the rating sheets was recorded

The following introduce the two changes in the criteria:

- Changes were made in two criteria as suggested by the teachers that concerned the teachers. However, the criteria were reexamined and the statements in the criteria were altered and included the improper.

The other papers contained no suggestions on the criteria.

Do you have any suggestions for making these criteria more

- EW teachers suggested that fewer points under each measurement should be given.
- JH teachers suggested there should be some way of having a separate criterion.
- A teacher suggested that each teacher should need to teachers who might be evaluating arithmetic textbooks

III Are there any important points which you believe have been

- It is not important and should not be included.
- A teacher suggested a more detailed statement of the theme.
- They suggested a more detailed statement of the theme.
- JH teachers suggested that the criterion of method for AI, Methéodology should have been included.

For each question, as follows:
A. How are zero facts presented?
B. How much use is made of estimation?
C. Are equations used in teaching problem solving?
D. Are the two concepts of division taught? If so, are they presented without unnecessary confusion?

The revised criteria were placed in the appendix of this study.

For meaningful examination of the criteria the teachers needed to apply them to materials which they were using. The schools were selected because each was using the same textbook series. Listed below are the categories, the total value given to each category, the range of the ratings made by the one hundred teachers as they applied the criteria to "The Basic Mathematics Program," and the mean rating for each category.¹

<table>
<thead>
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<th>Category</th>
<th>Total Value</th>
<th>Teacher Rating</th>
<th>Mean Rating</th>
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<tr>
<td>I. Authorship</td>
<td>50</td>
<td>50 - 30</td>
<td>48.6</td>
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<tr>
<td>II. Content</td>
<td>100</td>
<td>100 - 25</td>
<td>77.8</td>
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<tr>
<td>III. Meaningful Approach</td>
<td>100</td>
<td>100 - 50</td>
<td>94.0</td>
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<td>IV. Methodology</td>
<td>100</td>
<td>100 - 50</td>
<td>90.1</td>
</tr>
<tr>
<td>V. Organization</td>
<td>100</td>
<td>100 - 50</td>
<td>88.8</td>
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<td>VI. Vocabulary and Physical Make-up</td>
<td>100</td>
<td>100 - 50</td>
<td>89.1</td>
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<tr>
<td>VII. Controversial Issues</td>
<td>100</td>
<td>100 - 50</td>
<td>92.2</td>
</tr>
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The overall mean total rating was 89.8.

¹Ibid.
CHAPTER V.

SUMMARY AND RECOMMENDATIONS

The purpose of this field report was to develop criteria which teachers could use as they evaluated materials and procedures used in teaching elementary arithmetic.

From the review of the literature it was evident that reform in arithmetic teaching has been advocated for the past thirty years. It was also evident that the pressure for reform has increased through the years, and at the time of the writing of this report it was undoubtedly stronger than at any time during the thirty years.

Mathematicians and educators advocate change at the elementary level as a basis for change at the upper grade levels. They stressed logical, practical change in keeping with mathematical understandings and acceptable methods of teaching. They did not advocate crash programs. But, change will only be made to the degree that teachers understand the nature of mathematics, familiarize themselves with the subject matter, and apply sound methods in their teaching.

It was the premise of the investigator that published materials should incorporate the philosophy, content, and methodology that have evolved through the literature of the past thirty years, in order that these materials could be used by teachers as a guide in their arithmetic instruction. Although there continues to be controversy among the mathematicians and educators over minor points in content
and methodology, they agree that the true nature of mathematics must be presented to boys and girls in an understandable manner. Therefore, the investigator attempted to develop criteria which could be used by teachers to evaluate all published materials in the arithmetic curriculum of the elementary school, grades one through six, in the hope that boys and girls could be assured of better instruction in mathematical understandings.

The investigator presented the criteria and the rating sheets to teachers in ten Iowa schools currently using the same textbook. One hundred teachers were presented with the criteria, one hundred teachers returned the rating sheet. Of the one hundred only eighteen teachers gave a suggestion or criticism of the criteria. Two possible reasons for the limited number of suggestions might include: (1) lack of motivation for examining evaluation techniques when the school has accepted a text and the teachers know that they are not actively involved in evaluation, and (2) the suggestion from the literature that teachers have a limited understanding of mathematical concepts and in spite of materials tend to teach as they were taught.

From the eighteen suggestions two changes were made in the criteria: (1) the suggestion made by six teachers changed category II, Content, item 6 -- Measurement, to include time and money, and (2) the other change suggested by three teachers involved category VII, Controversial Issues, in which a more detailed statement of the items was needed. The investigator did not deem the other suggestions to be of sufficient number or importance to advocate change in the
The teachers were asked to apply the criteria to the text which they were teaching; "The Basic Mathematics Program" for Grades One through Six, Seeing Through Arithmetic, Scott, Foresman & Co., Copyright, 1955. In their evaluation it can be observed that category II, Content, received the lowest mean rating, 77.3. This could be due to the changes from the traditional elementary school content that have been made in this program. However, though it received the lowest rating, none of these changes in content was criticized. The highest mean rating of 94.0 was given to category III, Meaningful Approach. This would indicate that these teachers have accepted the Gestalt approach to learning which was incorporated in this arithmetic program.

The worth of the criteria, from their application in this study, was definitely limited by applying them to only one series of textbooks. The overall mean total rating of 89.8 cannot have too much value since there was no other mean with which to compare it. Therefore, the investigator would suggest that the true worth of this evaluating instrument cannot be ascertained without further application to a variety of arithmetic textbooks.

RECOMMENDATIONS

Based on experience in developing this study, the investigator would make the following recommendations:

1. Teachers need to review their present arithmetic programs,
and to study the past and current literature in mathematics to understand the philosophy, content and methodology of modern mathematics.

II. Criteria for evaluating textbooks should be an outgrowth of the understanding of the subject area.

III. Criteria developed by one outside the group could be used as a model, but each group through its own study should modify the criteria to meet its own needs.

IV. Teachers of all grade levels need to be included in the evaluation of arithmetic materials in order to insure a systematic, planned curriculum.


"The First Report of the Achievement in Primary Years," The Mathematic's Teacher, XXIII (May, 1940), 145-149.

BIBLIOGRAPHY


Brueckner, Leo J. "Testing, Diagnosis and Follow-up in Arithmetic," National Elementary Principal, XXXIX (October, 1939), 33-36.


Criteriëngraduates on Science in Education

To Be Used in the Administration, Centers (1961)

I. AUTHORITY
A. Are the authors recognized by authority in their specialties and education?

II. CONTENT
A. Are all areas of academic mathematics effectively
1. Number system
2. Operations and properties of number systems, fractions, and decimals
3. Ratio of relevant proportions
4. Percentages
5. Problem solving
6. Measurement
7. Graphs and charts
8. Geometry

B. Is there a proper balance of exercises, routine work (examples), and non-routine problems?

APPENDIX

G. Do the problems require students to analyze, study quantitatively, think critically and the outcome in writing?

D. Is the material sufficient to resolve a problem situation in mathematics?

III. MEANINGFUL APPROACH
A. Do instructional approaches involve psychological considerations within the framework of teaching and learning?

B. Is the development of concepts not simply presented rather than the concepts, through the understanding, appreciation, and evaluation?

G. Is a general understanding of the concept of the process taught versus other administrative units together as is presented?

D. Do meaningful and valuable assessments occur?

IV. METHODOLOGY
A. Do routine instruction, routine assignments, and routine work as outlined in the content? To what extent are meaningful or meaningful assignments made?
CRITERIA FOR EVALUATING AN ARITHMETIC SERIES
TO BE USED IN THE ELEMENTARY SCHOOL, GRADES 1-6.

I. AUTHORSHIP
A. Are the authors recognized as authorities in both mathematics and education?

II. CONTENT
A. Are all areas of concern adequately emphasized?
   1. Number system
   2. Operations and processing of whole numbers, fractions, and decimals
   3. Ratio of rates and comparisons
   4. Percentage
   5. Problem solving
   6. Measurement
   7. Graphs and charts
   8. Geometry

B. Is there a proper amount of developmental work, practice work (examples), and verbal problems (story problems)?

C. Do the problems involve social situations which develop quantitative thinking and the power to reason?

D. Is the material designed to develop a genuine interest in mathematics?

III. MEANINGFUL APPROACH
A. Do instructional approaches develop mathematical understandings within the framework of children’s experiences?

B. Is the development of concepts and skills approached from the concrete, through the semi-concrete (picture), to the abstract?

C. Is a general understanding of the nature of a process taught before minor difficulties within the process are presented?

D. Do meaning and understanding precede practice?

IV. METHODOLOGY
A. Do adequate teachers’ manuals provide the theory and method as applied in the content, to enable the administering of continuous skill development from level to level?
B. Are instructional explanations presented through a systematic method of presentation (lesson plan) that continues through the series?

C. Are all instructional explanations consistent with true mathematical understandings?

D. Are relationships among the four fundamental processes emphasized?

E. Are opportunities provided for pupil discovery of relationships and generalizations?

F. Are provisions made for individual differences?
   1. Reteaching and maintenance of previous learnings
   2. Readiness for each new step
   3. Adjustment of varying levels of ability and rates of learning (enrichment and remedial needs)

G. Is systematic evaluation an integral part of the program?
   1. Self-evaluation by pupils
   2. Teacher's diagnostic evaluation

V. ORGANIZATION
   A. Are units of learning functionally arranged in terms of length and sequence?

   B. Is the grade placement of specific learnings consistent with principles of child growth and development as well as with research findings?

VI. VOCABULARY AND PHYSICAL MAKE-UP
   A. Is the vocabulary sufficiently controlled?

   B. Are true mathematical terms presented meaningfully and continued consistently through the material?

   C. Are the signs and symbols of mathematics taught with understanding?

   D. Are meaningful illustrations and other multisensory aids amply provided?

   E. Are general characteristics desirable?
      1. Size of page
      2. Size of print
      3. Illustrations
      4. Spacing
      5. Use of color
VI. CONVERSATIONAL ISSUES
   A. Zero facts
   B. Estimation
   C. Use of equations
   D. Concept of division

In examining these methods, what other questions might you think could be asked in a conversational context?

Are there any private words or phrases that should not have been used?

Are there any important people whom you believe have been omitted?

Do you have any suggestions for making these methods more useful to teachers who might be considering conversational methods?
Name of Your School

Grade Level You Teach

<table>
<thead>
<tr>
<th>Total Value</th>
<th>Your evaluation of Seeing Through Arithmetic</th>
</tr>
</thead>
<tbody>
<tr>
<td>I. AUTHORSHIP</td>
<td>50</td>
</tr>
<tr>
<td>II. CONTENT</td>
<td>100</td>
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<tr>
<td>III. MEANINGFUL APPROACH</td>
<td>100</td>
</tr>
<tr>
<td>IV. METHODOLOGY</td>
<td>100</td>
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<tr>
<td>V. ORGANIZATION</td>
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</tr>
<tr>
<td>VI. VOCABULARY AND PHYSICAL MAKE-UP</td>
<td>100</td>
</tr>
<tr>
<td>VII. CONTROVERSIAL ISSUES</td>
<td>100</td>
</tr>
</tbody>
</table>

In examining these criteria, were there any questions which you think could be stated in a clearer manner?

Are there any points which you believe should not have been included?

Are there any important points which you believe have been omitted?

Do you have any suggestions for making these criteria more useful to teachers who might be evaluating arithmetic textbooks?
CRITERIA FOR EVALUATING AN ARITHMETIC SERIES TO BE USED IN THE ELEMENTARY SCHOOL, GRADES 1-6.

I. AUTHORSHIP
A. Are the authors recognized as authorities in both mathematics and education?
B. Are opportunities provided for pupil discovery of relationships and generalizations among the four fundamental processes emphasized?

II. CONTENT
A. Are all areas of concern adequately emphasized?
B. Is there a proper amount of developmental work, practice work (examples), and verbal problems (story problems)?
C. Do the problems involve social situations which develop quantitative thinking and the power to reason?
D. Is the material designed to develop a genuine interest in mathematics?

III. MEANINGFUL APPROACH
A. Do instructional approaches develop mathematical understandings within the framework of children's experiences?
B. Is the development of concepts and skills approached from the concrete, through the semi-concrete (picture), to the abstract?
C. Is a general understanding of the nature of a process taught before minor difficulties within the process are presented?
D. Do meaning and understanding precede practice?

IV. METHODOLOGY
A. Do adequate teachers' manuals provide the theory and method as applied in the content, to enable the administering of continuous skill development from level to level?
B. Are instructional explanations presented through a systematic method of presentation (lesson plan) that continues through the series?

C. Are all instructional explanations consistent with true mathematical understandings?

D. Are relationships among the four fundamental processes emphasized?

E. Are equations used in teaching problem solving?

F. Are opportunities provided for pupil discovery of relationships and generalizations?

G. Are provisions made for individual differences?
   1. Reteaching and maintenance of previous learnings
   2. Readiness for each new step
   3. Adjustment of varying levels of ability and rates of learning (enrichment and remedial needs)

G. Is systematic evaluation an integral part of the program?
   1. Self-evaluation by pupils
   2. Teacher's diagnostic evaluation

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VI. VOCABULARY AND PHYSICAL MAKE-UP
   A. Is the vocabulary sufficiently controlled?

   B. Are true mathematical terms presented meaningfully and continued consistently through the material?

   C. Are the signs and symbols of mathematics taught with understanding?

   D. Are meaningful illustrations and other multisensory aids amply provided?

   E. Are general characteristics desirable?
      1. Size of page
      2. Size of print
      3. Illustration
      4. Spacing
      5. Use of color
6. Charts and diagrams
7. Paper
8. Durability and binding

VII. CONTROVERSIAL ISSUES
   A. How are zero facts presented?
   B. How much use is made of estimation?
   C. Are equations used in teaching problem solving?
   D. Are the two concepts of division taught? If so, are they presented without unnecessary confusion?