1960

Analysis of three basal series of arithmetic textbooks for their fractional content

Thesis
Russell, L.F.
1960

BOSTON UNIVERSITY

SCHOOL OF EDUCATION

Thesis

ANALYSIS OF THREE BASAL SERIES OF ARITHMETIC TEXTBOOKS FOR THEIR FRACTIONAL CONTENT

Submitted by

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(B.S., Winston-Salem Teachers College, 1949)

In Partial Fulfillment of Requirements for

the Degree of Master of Education

1960

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INTRODUCTION

A fundamental objective of the modern elementary school is the development of the child mentally, physically, socially, emotionally, and morally. The teacher should recognize the possible contributions that instruction in arithmetic can make to the objectives of education.

Every effort possible should be made toward building favorable attitudes toward arithmetic through application of meaningful number experiences in democratic living.

Glennon[1/] states:

> "The teacher of arithmetic in the modern elementary school is well aware of the fact that a child's success or failure in arithmetic affects his attitude toward the teacher, toward his classmates, and even toward the inanimate book. The child who has many success experiences in number situations is the child who likes arithmetic and tends to use it in everyday life situations. The child who has few success experiences and many failure experiences is the child who dislikes arithmetic."

The study of fractions in the seventh grade is a very significant part of the arithmetic program. The pupils' previous experiences in using fractions will largely determine the amount of understandings and meanings that must be developed in order to do an effective job on the seventh grade level.

1/Vincent J. Glennon, Teaching Arithmetic in the Modern Elementary School, Bureau of School Service, Syracuse, N.Y., 1935, p. 5.

Thiele[1] suggests:

> "As the arithmetic curriculum is now organized, it is assumed that pupils will be schooled in the fundamentals of arithmetic when they complete the sixth grade or shortly thereafter. Included in the fundamentals are a working knowledge of whole numbers, common and decimal fractions, percentage, part whole relationships, simple ratios, and the common measures."

The purpose of this study is to survey the material on fractions in three series of basal arithmetic textbooks from grades one through six in order to ascertain the degree of variation, if any, in the treatment of this subject, and to see how the background for seventh grade fractions develops.

1/Carl L. Thiele, "Arithmetic in the Middle Grades," The Teaching of Arithmetic, Chapter IV, Part II, Fiftieth Yearbook, National Society for the Study of Education, The University of Chicago Press, Chicago, Illinois, p. 76.

CHAPTER I

SUMMARY OF THE LITERATURE AND RESEARCH ON FRACTIONS

The research in this chapter is concerned with the need for fractions in everyday life, how early the work should be introduced, incidentally and as a formal program.

According to Clark[1] children are continually being confronted with the need to count, to put together, to separate, and to compare numbers of things in their everyday experiences. They need skillful guidance in order to arrive at mature ways of reasoning in an atmosphere that provides opportunities to question, to explore, to experiment, to think things through, and to try various ways of doing things. The teacher should utilize every opportunity to stimulate maximum pupil growth in planning the arithmetic program.

Koenker[2] recognized the need for a rich arithmetic-readiness program, but feels in reality little has been done at the kindergarten and first grade level to aid children in developing the necessary background for the more formal systematic program of arithmetic instruction that will be intro-

1/John R. Clark and L. K. Eads, Guiding Arithmetic Learning, World Book Company, Yonkers-on-Hudson, New York, 1954, pp. 1-4.

2/Robert H. Koenker, Arithmetic Readiness for the Primary Grades, Arithmetic 1949, Supplementary Educational Monographs, Number 70, The University of Chicago Press, Chicago, Illinois, p. 26.

duced in grades two and three.

Adams[1] reported children's use of fractions in simple forms everyday, but they need to have such experiences translated into appropriate terms and thus add to their vocabularies words such as "half," "quarter," "parts of," and "equal." The science of arithmetic uses many technical expressions which the pupil must understand in order to acquire meaning from the exercises that he works with. It is the teacher's role to provide the kinds of experiences which will help the class to understand the vocabulary used in arithmetic.

The following list of technical words are reported by Brueckner and Grossnickle[2] to be needed in the study of fractions: <u>numerator</u>, <u>denominator</u>, <u>terms</u>, <u>proper fractions</u>, <u>improper fractions</u>, <u>mixed number</u>, <u>reduce</u>, <u>invert</u> and <u>ratio</u>. They indicate that it is essential that pupils begin early to form correct and clearly visualized concepts of the basic ideas of fractional quantities, and the meanings of words used in expressing those ideas because of their difficulty to comprehend.

Rosenquist[3] feels that when children have learned to talk about fractions and use them in their activities, occasions

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1/Olga Adams, <u>Arithmetic Readiness in the Primary Grades</u>, <u>Arithmetic 1947</u>, Supplementary Educational Monographs, Number 63, The University of Chicago Press, Chicago, Illinois, p. 342.

2/Leo Brueckner and F. Grossnickle, <u>Making Arithmetic Meaningful</u>, The J. C. Winston Company, Philadelphia, 1954, p. 342.

3/L. L. Rosenquist, <u>Young Children Learn Arithmetic</u>, Ginn and Company, Boston, 1949, p. 156.

arise when they will need to read and write them. They should be shown how to do so at that time.

Manipulative materials play an important part in developing meaning in the teaching of fractions.

Grossnickle[1/] indicates that:

> "In order to see how the use of manipulative materials function in a meaningful program, it is necessary to know the sequence of steps involved in a presentation of a new process in arithmetic. This sequence includes:
>
> 1. Readiness for the process
> 2. Teacher-pupil demonstration
> 3. Pupil discovery-for-himself period
> 4. Textbook presentation
> 5. Mastery at the adult level."

Understandings are easily built with real life situations and concrete materials. They should precede symbolic material and drill in order to make them more meaningful.

The Fiftieth Yearbook[2/] indicates that...."The lowest level of quantitative thinking begins with real objects, and the highest level results from dealing with abstract symbols."

Hollister[3/] suggests that children's first experiences

1/Foster E. Grossnickle, The Use of Multi-Sensory Aids in Developing Arithmetical Meaning, Arithmetic 1948, Supplementary Educational Monographs, Number 66, The University of Chicago Press, Chicago, Illinois, p. 4.

2/Committee on the Teaching of Mathematics, National Society for the Study of Education, The Teaching of Arithmetic, Fiftieth Yearbook, 1951, Part II, University of Chicago Press, Chicago, Illinois, pp. 161-163.

3/George E. Hollister, Teaching Arithmetic in Grades 1 and 2, D. C. Heath Co., New York, 1954, p. 39.

with fractions should begin with concrete materials that they are familiar with and can manipulate and compare. These materials include candy, fruit, cookies, water, milk, paint, lemonade, and cocoa. Clark[1/] indicates that fractional symbols that are used for measuring should be included in their experiences. They use recipes for preparing cocoa, cookies, and lemonade with the aid of measuring spoons and containers which have fraction symbols on them. When these symbols are used by the teacher or children, various forms are used and written on the blackboard so that children learn to use them with understanding. Mathematical symbols for fractions are introduced after children have learned enough word symbols to read with some degree of skill, and after they have learned to use mathematical symbols representing whole numbers and processes.

This indicates that the average class will not have achieved arithmetical background enough to begin a formal study of fractions before it reaches the latter part of the second grade or enters the third grade.

Fractions in the first and second grades as indicated by Sauble[2/] should include the study of the terms <u>one half</u> and <u>one fourth</u>. In the first grade children should develop an understanding of half an object and compare things which have

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1/John R. Clark and L. K. Eads, <u>op. cit</u>., pp. 149-150.

2/Irene Sauble, <u>Teaching Fractions, Decimals, and Per cents: Practical Applications</u>, <u>Arithmetic 1947</u>, Supplementary Educational Monographs, Number 63, University of Chicago Press, Chicago, Illinois, p. 33.

been divided into halves to discover that they are the same size. The half sections should be compared to the whole objects and to unevenly divided objects. Morton[1/] feels that pupils in grade one or any other grade should not be presented any phase of arithmetic if they are not mature enough to understand it, but their needs should be satisfied as soon as it is feasible to do so.

The needs of the learners are the chief determining factors as to how much fractional material should be taught and when it should be taught.

Hartung[2/] reports:

> "The major burden of the instructional program in arithmetic is the responsibility of the teachers of the intermediate grades. Within a period of three or four years pupils are introduced more or less formally to nearly all the fundamental concepts and skills in arithmetic and are faced with most of the acute learning difficulties.
>
> Teachers should give much careful thought to the selection, variation, and use of modern methods, since it is not likely that emphasis upon any one device or method will maximize achievement."

The presentation of arithmetical materials in the third and fourth years of school can greatly influence pupils' attitudes toward and achievement in arithmetic fundamentals.

Teaching fractions by family groups, i.e., halves, fourths,

1/Robert L. Morton, The Place of Arithmetic in Various Types of School Curriculums, Educational Monographs, Number 70, The University of Chicago Press, Chicago, 1949, p. 90.

2/Maurice L. Hartung, "Major Instructional Problems in Arithmetic in the Middle Grades," Elementary School Journal, (October, 1949), 50:20.

eighths, thirds, sixths, and ninths is considered by Moser[1/] to be an approved practice because rehabilitation of learning, after loss of ability to recall, is easier where well understood relationships and unifying practices are available to the pupil.

Moser[2/] further states:

> "Counting is the best means for studying the progression peculiar to each fractional series. There are two kinds of counting that are useful when working with fractions:
>
> a. Simple or non-reduction counting, e.g., 1/2, 2/2, 3/2, etc.
>
> b. Reduction counting, e.g., 1/2, 1, 1 1/2, 2, and 2 1/2.
>
> Counting is the best process of showing the system of compounding used by each fraction family. It provides for learners a low order attack on such quantitative problems as "How many in all"? "How many left"? etc.
>
> Counting is also invaluable as an introduction to the study of fractional equivalents of related families of fractions when families of related fractions (denominators having common factors) are presented on the same scale (as fractional parts of an inch are shown on a ruler), children are helped to recognize the same number ideas as they appear in new forms."

The family groups of fractions are more easily understood, and when there is loss of recall, rehabilitation of learning is easily restored.

1/Harold Moser, "Current Trends in Teaching Common Fractions," Notes for the Arithmetic Teacher, World Book Company, Yonkers-on-Hudson, New York, 1954.

2/Harold Moser, op. cit., p. 172.

Mulholland[1/] reports: "If children are given suitable materials they will make discoveries of mathematical relationships on their own." However, after understandings are built, Sauble[2/] indicates that "Pupils will cease to depend upon visual aids as they gain familiarity and a sense of security in dealing with fractions."

Manipulative materials are used primarily to aid in building concepts and understandings which facilitate learning. After they have been built, learning will continue with the use of pictures and other symbolic materials such as charts, graphs and fractional parts.

In the middle grades children find that it is necessary to reduce fractions.

The Fiftieth Yearbook[3/] reports:

> "As a first step toward developing meaning in the reduction of fractions, middle grade pupils may engage in activities which involve the division of whole and parts of wholes into equal parts and putting them together again. Wholes may successfully be divided into 2, 4, 8 and 16 equal parts. The results will be recorded as $1 = 2/2, = 4/4, = 8/8 = 16/16$, etc. Wholes may be divided successively into 2 parts, 3 parts, 4 parts, and the divisions symbolized as $1 = 2/2 = 3/3 = 4/4$. Equal parts may also be combined in this fashion: $1/4 + 1/4 + 1/4 + 1/4 = 1$. In this manner children may comprehend

1/Vernie Mulholland, "Fifth Grade Children Discover Fractions," School Science and Mathematics (January 1954), 59:13.

2/Irene Sauble, *op. cit.*, p. 172.

3/Committee on the Teaching of Mathematics, National Society for the Study of Education, The Teaching of Arithmetic, Fiftieth Yearbook, 1951, Part II, University of Chicago Press, Chicago, Illinois, p. 88.

the relationships between wholes and parts and between parts themselves.

In order to make reducing and finding equivalents more meaningful, parts of wholes should be analyzed and synthesized. Children should divide parts of wholes such as 1/2, 1/3, 1/5 into smaller parts by successive halving of parts. The results would be recorded as 1/2 = 2/4 = 4/8 = 8/16; 1/3 = 2/6 = 4/12; 1/5 = 2/10 = 4/20, etc. Experience with fractions with more than one part like 2/3 and 3/4 may also be included."

With proper guidance, children may discover that the value of a fraction does not change if both of its terms are multiplied or divided by the same number, except to make more parts or less parts.

There is disagreement as to whether common fractions should precede decimal fractions or decimal fractions should precede common fractions, but the explanation is reasonable.

According to Morton[1/] : "Common fractions should and do precede decimal fractions, and decimal fractions should precede percentage as a logical criterion in arithmetic."

Klapper[2/] states:

"From a mathematical view decimal fractions ought to precede common fractions because the former are more closely related to the system of notation in whole numbers. For psychological reasons we teach common fractions first because decimal fractions have such large denominators that objective demonstrations cannot be readily

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1/Robert L. Morton, op. cit., p. 90.

2/Paul Klapper, The Teaching of Arithmetic, D. Appleton and Company, New York, 1921, p. 218.

given. In the life of a child, fractions with small denominators like one-half and one-quarter arise naturally, one-tenth, rather infrequently. Since decimal fractions would be regarded almost as an abstraction for the very young child, it is preceded by the common fraction in the sequence of lessons."

Decimals are built with the tens concept as our number system is, but small children have fewer experiences with tens than with halves and fourths; therefore, common fractions should precede decimals. They can be introduced in the third and fourth grades after children learn to read and write four-place numbers involving dollars and cents.

Johnson[1] feels that after pupils in the third and fourth grades have been made acquainted with whole numbers so that they can read and write four-place numbers involving dollars and cents, they can through the meaning of cents and dimes and dollars take up meaning of the easy decimals of tenths and hundredths. This gives the pupils further practice with the four operations of whole numbers which they have not as yet fully mastered. Decimals are introduced as an extension of whole numbers and not as a new kind of fraction.

To eliminate negative transfer, decimals as fractions should not be formally taught below the fifth grade. The extension of whole numbers is a meaningful approach to decimals below the fifth grade.

If the concepts of common fractions are very clear,

1/J. T. Johnson, The Case of Decimals Versus Common Fractions, Arithmetic 1946, National Council of Teachers of Mathematics Monograph Number 39, New York City, New York, pp. 221-224.

Sauble[1] indicates that it is now necessary to use concrete materials very extensively in introducing decimal fractions. Diagrams and cut-up circles and rectangles help pupils to visualize tenths and hundredths. Clark and Eads[2] suggest that measuring instruments or scales of miles on maps, and clinical thermometers may be helpful when studying tenths.

The ratio concept often receives little treatment in arithmetic textbooks.

Johnson[3] declares:

> "Not enough space is given to the ratio concept in most arithmetic textbooks. After whole numbers are learned and known, the next step should be a study of their relations, for are not number relations a goodly part of the foundation of all mathematics? We have been too much concerned with fractions as a part of a whole. We have cluttered up our textbooks with all kinds of fractions in all their four fundamental operations, addition, subtraction, multiplication, and division--which can be, and are, rapidly taken over by the decimal in a much more simple way....After the relational ideas have been established between visible magnitudes before the pupil, numbers can be assigned to the magnitudes, as a preparation for treating these numbers themselves as magnitudes. Thus in Grades VI, VII, and VIII the ratio idea should be extended to whole numbers in all its three phases. The three phases are:
>
> 1. Finding a number when its relation to another given number is known.
>
> 2. Finding the relation that exists between given numbers.

1/Irene Sauble, *op. cit.*, p. 172.

2/John R. Clark and L. K. Eads, *op. cit.*, p. 186.

3/J. T. Johnson, *op. cit.*, p. 377.

3. Finding a number when a number and its relation to an unknown number are given."

Fractions expressed as a ratio should be developed gradually through experience with fractions, especially in finding what fractional part one quantity is of another. Relational ideas with whole numbers should begin with visible magnitudes and extend to numbers.

The idea of percentage may be introduced with the ratio concept if manipulative materials are used to develop the "per hundred" definition, and a part of the hundred objects is used for comparison.[1]

Sauble[2] indicates that pupils who have a thorough understanding of common and decimal fractions should not find the study of percentage difficult. The concrete materials recommended for teaching hundredths may be applied to percentage by changing the terminology from hundredths to per cents.

1/H. Van Engen, *The Elementary School Journal*, Bulletin, 1949, Number 69, The University of Chicago Press, Chicago, Illinois, p. 399.

2/Irene Sauble, *op. cit.*, p. 172.

CHAPTER II

PROCEDURE

This study constitutes an analysis of the treatment of fractions in three series of basal arithmetic textbooks from grades one through six. It includes common fractions, decimal fractions, and per cent. The purpose is to determine the amount of fractional material that each series presents for building a background for teaching seventh grade fractions.

The content of twelve books was analyzed, four in each of the three series covering grades three, four, five, and six. No work was presented below grade three in any of the series.

Operational Definitions--The following terms are defined as they are used in this study:

1. Fractions have two meanings: equal parts (partitioning) and ratio (comparison by division).1/
2. Numerator is that part of a fraction which denotes how many of the equal parts are taken.2/
3. Denominator is the number denoting the number of equal parts into which a whole or a group is divided.3/

1/John R. Clark and Laura K. Eads, *Guiding Arithmetic Learning*, World Book Company, Yonkers-on-Hudson, New York, 1954, p. 135.

2/Leo Brueckner and Foster Grossnickle, *Making Arithmetic Meaningful*, The John C. Winston Company, Philadelphia, 1953, p. 342.

3/*Ibid*.

4. Proper fractions are those fractions which have smaller numerators than denominators.1/

5. Improper fractions have numerators equal to or greater than the denominators.2/

6. Mixed numbers are numbers not integers but greater than one; thus they have integral parts and fractional parts.3/

7. Decimal fractions are those fractions whose denominators are a power of ten.4/

8. Ratio is a process by which two quantities are compared by dividing.5/

9. Vocabulary refers to the formal introduction of the word fraction and its parts, numerator and denominator. 6/

10. Per cent is a fraction which has 1/100 for its unit of measure or denominator.7/

1/E. T. McSwain and Ralph J. Cooke, Understanding Arithmetic in the Elementary School, Henry Holt and Company, New York, 1958, p. 139.

2/Leo J. Brueckner and Foster Grossnickle, op. cit., p. 307.

3/J. Houston Banks, Learning and Teaching Arithmetic, Allyn and Bacon, Inc., Boston, 1959, p. 64.

4/Herbert F. Spitzer, The Teaching of Arithmetic, Houghton Mifflin Company, Cambridge, 1954, p. 241.

5/Kenneth B. Henderson and Robert E. Pingry, Using Mathematics, McGraw-Hill Book Company, Inc., New York, 1955, p. 162.

6/Leo Brueckner and Foster Grossnickle, op. cit., p. 342.

7/Burdette R. Buckingham, Elementary Arithmetic, Its Meaning and Practice, Ginn and Company, Boston, 1949, p. 351.

1. Criteria for Selection of Series

In order to conduct the study it was necessary to select the series, to establish criteria to be used in the analysis, and to analyze page by page the books selected for amount and types of practice provided. All books were published in 1959.

Following is the list of series used in the study:

Brueckner, Leo J., Morton, Elda L., Grossnickle, Foster E., Winston Arithmetics, The John C. Winston Co., Philadelphia, 1959, Books Three, Four, Five and Six.

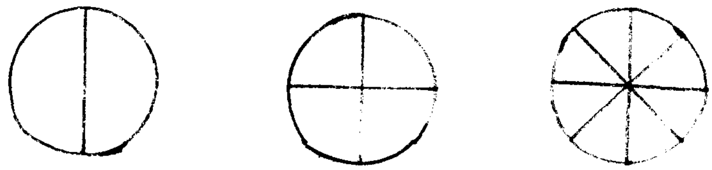
Wheat, Harry, Kauffman, Geraldine, and Douglas, Harl, Row Peterson Arithmetic, Row Peterson and Company, Evanston, Illinois, 1959, (Revised Editions), Books Three, Four, Five and Six.

Buswell, Guy T., Brownell, William, and Sauble, Irene, Arithmetic We Need, Ginn and Company, Boston, 1959, (Revised Editions), Books Three, Four, Five and Six.

The following objective criteria were drawn up for the basis of analyzing the series. These evaluative criteria were placed on charts for ease of tabulation. The numbers of pages and practices on fractional material were recorded in appropriate categories.

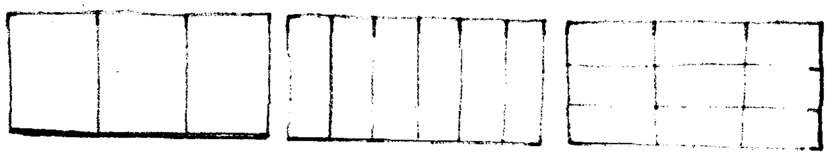
<u>Illustrative pictures</u> on fractions:

Examples: a. Circles showing equal parts.[1]



Halves Fourths Eighths

b. Squares and rectangles showing equal parts.



Thirds Sixths Ninths

<u>Proper fractions</u>

Examples: 1/2, 1/4, 5/6, 3/8[2]

<u>Improper fractions</u>

Examples: 3/2, 9/4, 7/6, 4/4[3]

1/John R. Clark and Laura K. Eads, <u>Guiding Arithmetic Learning</u>, World Book Company, New York, 1954, pp. 135, 139.

2/Irene Sauble, <u>Teaching Fractions, Decimals and Per cents: Practical Applications</u>, <u>Arithmetic 1947</u>, Supplementary Educational Monographs, Number 63, University of Chicago Press, Chicago, Illinois, p. 33.

3/<u>Ibid</u>., p. 33.

Material on mixed numbers

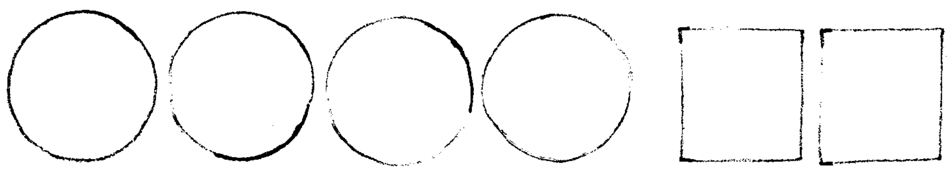
Examples: Counting by halves -- 1/2, 1, 1 1/2, 2, 2 1/2, 3, 3 1/2[1]

Decimals

Examples: .5, 1.8, .25, .028[2]

Ratio

Examples:



Compare: Number of squares 2/4 = ?/?

Compare with Number of circles

Answer a. There are 1/2 as many squares as circles.

b. There is 1 square for every 2 circles.[3]

1/Harold Moser, "Current Trends in Teaching Common Fractions," *Notes for the Arithmetic Teacher*, World Book Company, Yonkers-on-Hudson, New York, p. 2.

2/J. T. Johnson, *The Case of Decimals Versus Common Fractions*, *Arithmetic 1946*, National Council of Teachers of Mathematics, Monograph Number 39, New York City, p. 222.

3/*Ibid.*, p. 377.

<u>Vocabulary</u> or terms of "fraction"

Examples:

a. A <u>fraction</u> tells the part of a whole that is being talked about, e.g., 3/5 1/

b. The number above the line in a fraction is the <u>numerator</u>. This number, <u>3</u> tells you the 3 equal parts of a whole that are being used.

c. The number below the line in a fraction is the <u>denominator</u>. The denominator, <u>5</u> tells that the whole object was divided into 5 equal parts. The name and size of each part is a fifth.

<u>Per cents</u>

Examples:

20% = out of 100 or 20/100 2/

2. Extent of Treatment of Each Series

Each of the four textbooks in the three series was thoroughly examined for its fractional content and the findings were designated by capital letters; e.g., "A" represents the <u>Winston Arithmetic</u> Series, "B" represents the <u>Row Peterson Arithmetic</u> Series, "C" represents the <u>Arithmetic We Need</u> Series.

The information concerning each series is presented in the following chapter.

1/Leo Brueckner and Foster Grossnickle, <u>Making Arithmetic Meaningful</u>, The J. C. Winston Company, Philadelphia, 1953, p. 342.

2/Sauble, <u>op. cit</u>., p. 172.

CHAPTER III

ANALYSIS OF DATA

The data were analyzed to discover:

1. Frequency of each of the items by grades in each series.

2. The frequency of items for each grade for all series.

3. The totals for each item for all grades and all series.

Table 1 shows the number of pages and practices on each item for each grade for the Winston Series.

Table 1. Number of Pages and Practices in Series A

GRADE	3		4		5		6	
CONTENT	No. of Pages	No. of Prac-tices	No. of Pages	No. of Prac-tices	No. of Pages	No. of Prac-tices	No. of Pages	No. of Prac-tices
Illus-trative Pictures.....	22	102	24	80	72	496	80	337
Proper Fractions....	29	113	37	220	106	1032	84	850
Improper Fractions....			2	3	29	332	30	151
Mixed Numbers......			2	3	120	1424	152	2024
Decimals.....					39	771	45	598
Ratio........	4	13	4	26	6	69	5	36
Vocabulary								
1.Fractions..	1							
2.Numerator..					1			
3.Denominator					1			
Per cent.....								
TOTAL........	56	228	69	332	374	4624	396	3996

From grades three through six there were practices for illustrative pictures, proper fractions, and ratio. Improper fractions and mixed numbers were introduced in grade four and continued through grade six with the most emphasis in grades five and six. Decimal practices were provided in grades five and six. The vocabulary of fraction was found in grades three and five. No practice with percent was given.

Table 2 shows the number of pages and practices on each item for each grade for the Row Peterson Series.

Table 2. Number of Pages and Practices in Series B

GRADE	3		4		5		6	
CONTENT	No. of Pages	No. of Prac- tices	No. of Pages	No. of Prac- tices	No. of Pages	No. of Prac- tices	No. of Pages	No. of Prac- tices
Illus- trative Pictures.....	16	75	10	46	72	317	81	305
Proper Fractions....	17	149	26	159	80	871	136	1355
Improper Fractions....					14	100	25	358
Mixed Numbers......			1	1	45	705	103	1473
Decimals.....					21	289	59	773
Ratio........			11	67	14	115	9	78
Vocabulary								
1.Fraction...	1							
2.Numerator..			1					
3.Denominator			1					
Per cent.....							10	55
TOTAL........	34	224	50	273	246	2397	423	4397

There were practices for illustrative pictures and proper fractions in grades three to six. Practices with improper fractions were provided in grades five and six. Mixed numbers and ratio were found in grades four, five, and six with emphasis on mixed numbers beginning at the fifth grade. The vocabulary of fractions was given in grades three and four. Practice in per cent was found only in grade six.

Table 3 shows the number of pages and practices on each item for each grade for the Ginn Series.

Table 3. Number of Pages and Practices in Series C

GRADE	3		4		5		6	
CONTENT	No. of Pages	No. of Practices	No. of Pages	No. of Practices	No. of Pages	No. of Practices	No. of Pages	No. of Practices
Illustrative Pictures.....	19	85	30	135	52	181	20	54
Proper Fractions....	33	147	72	485	96	781	116	1242
Improper Fractions....			11	42	27	87	21	135
Mixed Numbers......	1	1	1	1	83	689	93	937
Decimals.....					22	348	68	1209
Ratio........	1	9	4	39	7	48	10	82
Vocabulary								
1.Fraction...								
2.Numerator..	1		1					
3.Denominator			1					
Per cent.....								
TOTAL........	55	242	120	702	287	2134	328	3659

Practices were provided in illustrative pictures, proper fractions, mixed numbers, and ratio in grades three through six. Improper fractions were provided in grades four, five, and six. Decimal practices began in grade five and continued through grade six. Vocabulary of fraction was given in grades three and four. No practices were given with per cents.

Table 4 shows the pages and practices of each item for all grades in the three series.

Table 4. Frequency of Pages and Practices in the Three Series

GRADE		3		4		5		6		TOTAL	
CONTENT	SE-RIES	No. of Pg.	No. of Pr.	No. of Pg.	No. of Pr.	No. of Pg.	No. of Pr.	No. of Pg.	No. of Pr.	No. of Pages	No. of Prac.
Illus-trative Pictures	A	22	102	24	80	72	496	80	337	198	1015
	B	16	75	10	46	72	317	81	305	179	743
	C	19	85	30	135	52	181	20	54	121	455
Proper Fractions	A	29	113	37	220	106	1032	84	850	256	2215
	B	17	149	26	159	80	871	136	1355	259	2534
	C	33	147	72	485	96	781	116	1242	317	2655
Improper Fractions	A			2	3	29	322	30	151	61	476
	B					14	100	25	358	39	458
	C			11	42	27	87	21	135	59	264

(concluded on next page)

Table 4. (concluded)

GRADE		3		4		5		6		TOTAL	
CONTENT	SE-RIES	No. of Pg.	No. of Pr.	No. of Pg.	No. of Pr.	No. of Pg.	No. of Pr.	No. of Pg.	No. of Pr.	No. of Pages	No. of Prac.
Mixed Numbers	A			2	3	120	1424	152	2024	274	3451
	B			1	1	45	705	103	1473	149	2179
	C	1	1	1	1	83	689	93	937	178	1628
Decimals	A					39	771	45	598	84	1369
	B					21	289	59	773	80	1062
	C					22	348	68	1209	90	1557
Ratio	A	4	13	4	26	6	69	5	36	19	144
	B			11	67	14	115	9	78	34	260
	C	1	9	4	39	7	48	10	82	22	178
Vocabulary 1.Fractions	A	1				1				3	
2.Numerator						1					
3.Denomi-nator	B	1		1							
				1						3	
				1							
	C	1		1						3	
Per cent	A										
	B							10	55	10	55
	C										

<u>Illustrative pictures</u> and <u>proper fractions</u> were introduced in grade three of each series and were presented in each grade through the sixth grade. Series "A" provided the most practice in <u>Illustrative pictures</u> in grades three, five, and six. Series "C" provided the least practice with the exception of grade four. Series "C" gave the greatest number of practices with <u>proper fractions</u>.

<u>Improper fractions</u> were provided in Series "A" and "C" in the fourth grade and continued through grade six. Series "B" provided practices in grades five and six. The greatest amount of practices were provided in Series "A", and Series "C" provided the least practice.

Heavy practice with <u>mixed numbers</u> was provided in grades five and six of Series "A", "B", and "C". A little practice was provided in grade four in Series "A" and "B". Series "C" provided a little in grades three and four. The most practice was provided in Series "A" with the heaviest practice in grade six. Series "C" provided the least practice.

<u>Decimals</u> were introduced in grade five in all series with the most practice in Series "C", and the least practice in Series "B". <u>Ratio</u> was introduced in grade three of Series "A" and "C" and continued through grade six. Series "B" provided practices in grades four, five, and six. The most practice was provided in Series "B", and the least practice was given in Series "C".

Each series began the vocabulary of fractions in the third grade, and Series "B" and "C" continued it in grade four. Series "A" continued it in grade five.

Series "B" provided practices in per cent in the sixth grade. Series "A" and "C" provided no practice in per cent.

Table 5 shows the total number of pages and practices on each item for each series.

Table 5. Summary of Practices Presented by Series

	SERIES A		SERIES B		SERIES C	
CONTENT	No. of Pages	No. of Practices	No. of Pages	No. of Practices	No. of Pages	No. of Practices
Illustrative Pictures.......	198	1015	179	743	121	455
Proper Fractions......	256	2215	259	2534	317	2655
Improper Fractions......	61	476	39	458	59	264
Mixed Numbers........	274	3451	149	2179	178	1628
Decimals.......	84	1369	80	1062	90	1557
Ratio..........	19	144	34	260	22	178
Vocabulary..... 1.Fraction 2.Numerator 3.Denominator	3		3		3	
Per cent.......			10	55		
TOTAL..........	895	8670	753	7291	790	6737

Series "A" presented the greatest amount of practices in illustrative pictures, improper fractions, and mixed numbers, and Series "C" presented the least practices. Series "C" presented the most practices in proper fractions and decimals. Series "A" presented the least practices in proper fractions and ratio. Series "B" presented the least practices in decimals, and the most practice in ratio. Each series treated the vocabulary of fraction equally. Series "B" presented practices in per cent, Series "A" and "C" did not.

CHAPTER IV

SUMMARY AND CONCLUSIONS

The purpose of this study was to compare three series of arithmetic textbooks, Winston Arithmetics, Row Peterson Arithmetics, and Arithmetic We Need, in order to determine the extent of practice provided for fractional content. Twelve books for grades three, four, five, and six in three series published in 1959 were analyzed to discover amount of practice provided in eight areas: illustrative pictures, proper fractions, improper fractions, mixed numbers, decimals, ratio, vocabulary of fraction, and per cent.

The following conclusions may be drawn:

1. All systems utilize illustrative pictures, and proper fractions in all grades.
2. Improper fractions are not presented before grade four.
3. Mixed numbers are emphasized in grades five and six in each of the three systems.
4. Decimals are part of the program in grades five and six in each of the three systems.
5. Little practice in vocabulary is provided.
6. There is little work in per cent. It was introduced in grade six in only Series "B".

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