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A Comparative Study of the Contents of Seventh Grade Modern Mathematics Texts and Their Effect on the Transfer Student

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A COMPARATIVE STUDY OF THE CONTENTS OF SEVENTH

GRADE MODERN MATHEMATICS TEXTS AND THEIR

EFFECT ON THE TRANSFER STUDENT

———

A Thesis

Presented to

the Graduate Faculty

Central Washington State College

———

In Partial Fulfillment

of the Requirements for the Degree

Master of Education

———

by

John E. Kerslake

August 1965

APPROVED FOR THE GRADUATE FACULTY

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Darwin J. Goodey

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CHAPTER I

THE PROBLEM AND DEFINITIONS OF TERMS USED

In the past few years many changes have been made in the contents of the mathematics textbooks. Much has been written about the advantages and effects of these changes. Although there is an abundance of literature on the general topic of modern mathematics, very little has been written about the effectiveness of these new texts in regard to the transfer student.

I. THE PROBLEM

Statement of the problem. It was the purpose of this study: (1) to examine the contents of the newly published modern mathematics textbooks for the seventh grade level; (2) to compare the contents of a representative selection of these texts in regard to the sequence and variety of the topics covered; and (3) to show the probability of the effect this would have on a transfer student.

Importance of the study. The mobility of the population of the United States has been a topic of increasing interest, and even concern, in recent years. The magnitude of this development is statistically expressed by George F. Kneller:

It seems almost incredible that we should have movements of people totaling nearly thirty-two million in one year's time. This is nearly twenty per cent of the total population of the United States. Although it is true that 21.5 million changed residence only within a county, there were over five million who changed from one county to another. The figure that really is notable is the five million people who moved from one state to another (11:300).

This study was made in an attempt to examine the situations with which a transfer student is confronted and to determine if more concern should be given this development.

II. DEFINITION OF TERM USED

Modern mathematics. Throughout this study the term "modern mathematics" shall be interpreted as meaning a study of mathematics involving to some extent, the following: the properties of numbers, the pattern of numbers, the structure of number systems, the operations with numbers, and the properties of geometric figures (3:3).

CHAPTER II

REVIEW OF THE LITERATURE

The relative importance of mathematics to man and
his civilization has been the subject of vast amounts of
literature. The origin of mathematics has been described
by various authors in many ways. Stanley J. Bezuszka,
author of Mathematics, states: "Mathematics was created
in the wonder of primitive man as he gazed in fascination
and excitement at his physical universe" (1:49).

The growth of mathematics throughout the recorded
history of man has been one of vacillation rather than
one of measured strides in an orderly fashion. Mr. Bezuszka
describes it as follows: "As the spirit of mathematical
inquiry and investigation waned or died in one civilization,
it waxed and flourished in another" (1:49).

This growth during the twentieth century has taken
on some new characteristics. Dan T. Dawson and William F.
McClintock, authors of The Revolution in Mathematics,
state: "The twentieth century has seen more mathematics
research and more new mathematics produced than all the
rest of history" (4:15).

In describing the same period of history, Veryl
Schult, author of A New Look At The Old Mathematics, wrote:

Many people are not aware of the fact that
mathematics is an active, growing subject.
Probably more new mathematics has been developed
since 1900 than in all of history up to this
century (18:12).

Despite the slight discrepancies, the above men-

tioned statements tend to substantiate the position that

our mathematics curriculum must be subjected to constant

evaluation. It is through the process of evaluation and

appraisal that needed changes can be made to keep our

educational progress adequate in the face of these new

discoveries.

Long before the current space exploration era, some

mathematicians were concerned with the stagnation of mathe-

matics in the public schools. This is in evidence in the

following quotation from Wagner G. Collins' book The What,

Why and How of Modern Arithmetic:

Contrary to popular opinion, the changes in
the teaching of mathematics at all levels were
not Sputnik-imposed. Long before Sputnik,
research had shown that many of our students
did not have much depth of understanding of
mathematics and that an even greater number
did not find mathematics very interesting (3:3).

With this same idea in mind, Stanley J. Bezuszka

wrote:

Yet, as early as 1902, E. H. Moore, then
president of the American Mathematical Society,
called for some basic reforms in the teaching
of elementary and secondary school mathematics (1:50).

In his book What Does Research Say About Arithmetic

Vincent J. Glemmer reported:

> The arithmetic programs of the past twenty-
> five years have been inadequate, chiefly at two
> points. First, these programs have given child-
> ren little chance to use ideas and skills already
> learned in solving their own personal problems.
> Second, these arithmetic programs have neglected
> the meanings and rational principles which make
> arithmetic a phase of mathematics (7:4).

Many other studies have shown obvious weaknesses to
our traditional program. These deficiencies were noted
not only in methods and content but also in the grade level
placement of many mathematical concepts. G. H. Miller,
author of Shall We Change Our Arithmetic Program, wrote:

> However, with new data on comparative educa-
> tion, it seems apparent that earlier instruction
> of arithmetic does produce greater learning at
> an earlier age, contrary to the predictions of the
> advocates of maturation (14:194).

With these facts in evidence and with the challenge
to our supremacy in the field of science, our modern
mathematics programs were formulated and put into practice.
One of the greatest contributions in a financial sense
to this accelerated program for curriculum improvement in
the area of mathematics came from the United States govern-
ment through the National Defense Education Act. During
the years 1959-1961, the federal government spent an
estimated $18,717,316.00 on 19,615 mathematics projects
in the schools of our country (10:143).

In addition to providing financial assistance to the
schools, the federal government is giving substantial funds
to the School Mathematics Study Group. The general objective

of this group is "the improvement of the teaching of mathematics in the schools of this country" (17:1).

Contributions to the changing curriculum in mathematics are also being made by many other experimental programs throughout the country. Some of these contributing programs are: University of Illinois Committee on School Mathematics, Ball State Teachers College, Boston College Mathematics Institute, University of Maryland Mathematics Project, Madison Project, The Greater Cleveland Mathematics Program and others (20:137).

These changes in the mathematics curriculum are being made in many different content areas. Kenneth Brown, in his article What Are the Changes, lists the areas of emphasis as follows: "Structure, measurement, graphical representation, system of numbers, set terminology, operation and their inverses, logical deductions and valid generalizations" (2:138).

In describing these changes, Veryl Schult wrote:

> The changes in mathematics curriculum are not the result of some experimentor's whim but represent a sincere and thoughtful effort to prepare today's students for the demands that will be made of tomorrow's teachers and citizens (18:15).

Along with the changes in content, there have been many new demands placed on the teachers in mathematics. The teacher, by the very nature of the new program, must know far more mathematics than he did under the traditional program. Much of this knowledge must be acquired through

additional courses taken after graduation. However, as a partial reward for this effort, it has been discovered that the new mathematics is a far more interesting and satisfying subject to teach (15:141).

Kenneth Brown wrote the following passage in his discussion of the teacher's place in the new mathematics:

> However, the key to any successful mathematics program is the teacher. It is he who with wisdom must select the program or parts of programs that will contribute most effectively to the mathematical development of the student (2:140).

The role of the teacher is described in another way by W. Eugene Ferguson:

> Teachers in every section of the United States have told me they never worked so hard in all their lives, but they also say they enjoy it more (2:140).

Through this past decade of rapid change and new innovations, the role of the publishing companies has been one of deliberation and careful consideration. This condition of extreme caution resulted from the knowledge that even though most of the experimental programs were proving successful, a few were proven failures.

> Some things were tried that did not work out and these have been discarded. So, failures have been experienced along the way, but these have only intensified the search for suitable treatments of the very difficult parts of the new program (6:143).

Realizing the immediate need for new textbooks, but aware of the consequences of publishing an inadequate or undesirable series, the publishing companies were faced

with a many-sided problem. The experts in the field of arithmetic who formulated the plans for many of the original experimental projects were hired as consultants or authors for the new texts. With this utilization of experienced personnel, the publishers hoped to increase the value and success of their publications.

An illustration of this utilization is given in the preface of one of the newer textbooks published by Silver Burdett Company titled Modern Mathematics Through Discovery:

> The authors have examined carefully, several exploratory programs in elementary mathematics. These include programs of the following: The School Mathematics Study Group, The Syracuse University Madison Project, The University of Maryland Mathematics Project, The Greater Cleveland Mathematics Program, and others. Each of these sources has supplied useful ideas (16:1).

Out of this review of literature a statement that seems to both summarize and amplify the major point is:

> At the present time the school mathematics curriculum is undergoing a change. Several study groups consisting of mathematicians and teachers are attempting to develop new programs of instruction in mathematics. These programs vary in content, language and symbolism (19:1).

CHAPTER III

PROCEDURES USED

I. SELECTING TEXTS

The first phase of this study involved the methodical perusal of the available, newly published, seventh grade mathematical texts. Because of the continuing developmental nature of the textbook industry, the selection of these texts was made as of December, 1964. This selection included texts published by the following companies: American Book Company, D. C. Heath and Company, Holt Rinehart and Winston, Inc., Laidlaw Brothers, Prentice-Hall, Inc., Scott Foresman and Company, and the Silver Burdett Company.

These texts were selected on the premise that they would provide an adequate representative sampling of the available mathematical texts for the seventh grade level. The omittance of other companies' textbooks does not indicate a rejection of their texts or their programs. It was felt by the writer that seven texts would provide sufficient material for the purpose of this study.

II. SURVEY OF TEXTS

Following the selection of the texts, a careful survey of the contents of each text was completed. These

contents are listed under the chapter headings for each of the texts. In the texts which have an adequate topic description in the Table of Contents, this will be used verbatim. In those texts which do not list the topics in a table of contents, the topics will be listed in the order in which they appear in the text. Features of the textbooks and a comparison of the sequence in which the topics occur is also discussed in this section.

In order to provide the reader with a reasonably easy access to the materials being discussed the complete contents of each text are included in Chapter IV. In addition to this, the contents covered by the student during both the first and the second semester are included in each example. This arrangement necessitates the duplication of the textbook content information, but it was felt by the writer to be worthwhile in that it contributes to the clarity of the study.

III. EXAMPLE

The next phase of the study involves the setting up of hypothetical transfer situations in an attempt to predict the possible effects these texts might have on the mathematical progress of a transfer student. To attain some degree of consistency to these examples, certain basic assumptions are made. The assumptions are described in detail in Chapter IV.

Under the conditions of the examples, the use of seven textbooks provided the possibility of forty-two different transfer situations. However, it was felt by the writer that seven examples would provide sufficient evidence upon which to base the conclusions.

IV. SUMMARY

The final portion of this study will relate the findings to the stated problem.

CHAPTER IV

MATERIALS USED AND EXAMPLES

The first portion of this chapter contains a
detailed description of the contents of the seven modern
mathematics texts used in this study. Table I lists the
titles and other information about these texts. Follow-
ing the section on contents, some of the features of the
texts are explained and a comparison of the topics covered
and the sequence in which they are introduced is made.
Table II is used to graphically clarify these comparisons.
The final portion of this chapter describes the applica-
tion of the contents of these texts to hypothetical trans-
fer situations.

I.   CONTENTS OF THE TEXTS

Structuring Mathematics - American Book Company

        Chapter 1, Counting and Numeration Systems. Sets;
1-to-1 correspondence; Elements; Equivalent and equal
sets; Digits; Numbers and numerals; Place value; Positional
system; Natural numbers; Cardinal and ordinal sense; Whole
numbers; Base ten; Exponents; Hindu-Arabic notation system;
Egyptian numerals; Polynomial form; Base six; Number bases;
Counting on different bases.

        Chapter 2, Addition and Subtraction. Meaning of
addition; Estimating answers; Meaning of subtraction; In-
verse operations; Take-away method using decomposition;
Additive method; Sentences and equations; Closure; Commuta-
tive and associative properties; Zero, the additive iden-
tity element; Problem solving; Adding and subtracting in
base six.

TABLE I

DATA ON TEXTS USED IN THIS STUDY

Title	Publisher	Number of Chapters	Number of Pages	Publishing Date
1. Structuring Mathematics	American Book Co.	12	387	1963
2. Introduction to Secondary Mathematics	D. C. Heath and Co.	8	300	1964
3. Exploring Modern Math	Holt, Rinehart and Winston, Inc.	9	438	1963
4. Contemporary Mathematics	Prentice-Hall, Inc.	14	388	1964
5. Mathematics	Laidlaw Brothers	17	384	1963
6. Seeing Through Mathematics	Scott Foresman and Company	8	508	1962
7. Modern Mathematics Through Discovery	Silver Burdett Co.	10	402	1964

Chapter 3, Multiplication and Division. Generalizations on 100 multiplication facts; Multiplication by zero; Number one, the identity element for multiplication; Commutative, associative, and distributive properties; Division by zero undefined; Meaning of division; Practice; Factoring; Prime, composite, odd, and even numbers; Divisors, factors, and divisibility; Multiplication and division on base six.

Chapter 4, Points, Lines, Planes, and Space. Geometry and basic ideas of points, lines, planes and space; Sets and intersection; Empty sets; Intersecting lines; Parallel and skew lines; Intersection of a line and a plane; Intersection of two planes; Union of sets; Rays and angles.

Chapter 5, Rational Numbers. Meaning; Fractions; Changing terms of fractions; Simplifying Fractions; Ratios; Ordered pairs of numbers; Proportions; Using ratios and proportions; Addition of rational numbers; Common denominators; Least common denominator; Least common multiple; Closure, commutative, associative, and distributive properties; Subtraction of rational numbers; The number line; Less than or greater than; Rational numbers greater than 1; Multiplying, dividing, adding, and subtracting rational numbers greater than 1; Reciprocals.

Chapter 6, Measurement. Counting or measuring; Unit of measure; Standard units of measure; Greatest possible error; True length; Measured length; Error of measurement; Recording measurements; Metric units of length; Measuring angles; Using protractors; Kinds of angles; Fractional parts of the degree.

Chapter 7, Decimal Numerals. Using exponents; Decimal fractions; Decimal numerals; Addition and subtraction; Rational numbers represented by decimal numbers; Multiplication; Multiplying by powers of ten; Repeating and terminating decimal numerals; Rounding numbers; Division of rational numbers; Problem solving.

Chapter 8, The Language of Percent. Meaning; Expressing numbers as percents; Percents representing numbers less than 1%, greater than 100%; Solution sets for simple equations; Percentage, base, and rate; Using percents in problem solving; Number properties and percent; Discounts; Percent of increase or decrease; Interest; Applications.

Chapter 9, Polygons and Prisms. Description and kinds; Rectangles; Squares; Parallelograms; Rhombuses; Perimeters; Formula; Areas; Lateral areas; Areas of triangles; Kinds of triangles; Sum of the measures of angles of triangles; Regular polygons and their perimeters; Right prisms; Cubes.

Chapter 10, Numeration Systems. Counting on other bases; Systems of numeration--Roman, Egyptian, and Hindu-Arabic; Changing numerals to base ten; Changing to other bases; Addition and subtraction on base six; Multiplication on base six; Division on base six; Properties of numbers.

Chapter 11, Circles and Right Circular Cylinders. Description of the circle; Measuring circles; Diameter, circumference, and pi; Area of a circle; Description of right circular cylinder; Lateral, total surface area, and volume of right circular cylinders.

Chapter 12, Integers. Directed distance; Directed numbers; Integers; Addition of integers; Whole numbers and non-negative integers; Additive inverse; Closure; Uniqueness; Property of zero; Commutative and associative properties of addition; Subtraction; Multiplication; Division.

Introduction to Secondary Mathematics - D. C. Heath and
                                           Company, 1964

Chapter 1, Probability. Probability of an event; The difference between "or" and "and"; Counting the number of outcomes; More probability.

Chapter 2, Mathematics of Whole Numbers. The counting process; Operating on whole numbers; Properties of the operations; The associative property; Special properties of zero and one; The distributive property; Properties of subtraction and division; The number line.

Chapter 3, The symbols we use for numbers. Various kinds of number symbols; Decimal numerals; Numerals with a base other than ten; Changing bases.

Chapter <u>4</u>, <u>More</u> <u>About</u> <u>Whole</u> <u>Numbers</u>: <u>Primes</u>.
Factors and multiples; Prime numbers; Some tests for
divisability; Some uses of multiples.

Chapter <u>5</u>, <u>Mathematics</u> <u>of</u> <u>Sets</u> <u>of</u> <u>Points</u>: <u>Non-</u>
<u>Metric</u> <u>Geometry</u>. Points and lines in space; Planes in space;
Representing lines and planes; Intersection of lines and
planes; Segments of lines; Separating lines, planes, and
space; What is an angle?; Simple closed curves.

Chapter <u>6</u>, <u>Mathematics</u> <u>of</u> <u>Rational</u> <u>Numbers</u>. Clos-
ure; Rational numbers; Operations on rational numbers;
Names for rational numbers; Division in terms of multipli-
cation; Subtraction in terms of addition.

Chapter <u>7</u>, <u>More</u> <u>About</u> <u>Rational</u> <u>Numbers</u>: <u>Decimals</u>,
<u>Ratio</u>. Reciprocals of non-zero rational numbers; Compar-
ing rational numbers; Rational numbers expressed as deci-
mal numerals; Operations, using decimal numerals; Every
rational number has a decimal expression; Rational numbers
as ratios; Percent and decimals; Uses of percent.

Chapter <u>8</u>, <u>Measuring</u> <u>with</u> <u>Rational</u> <u>Numbers</u>. How
does measuring differ from counting; Measuring continuous
quantities; Linear units of measure; Precision of measure-
ment; Measuring angles; Measuring interiors of closed
curves; Measuring interiors of space figures; Measuring
non-geometric quantities.

<u>Exploring</u> <u>Modern</u> <u>Mathematics</u> - Holt, Rinehart & Winston

Chapter <u>1</u>, <u>Numeration</u> <u>Systems</u>. Distinction between
number and numeral; Egyptian numeration; Roman numeration;
Babylonian numeration; Hindu-Arabic numeration; Expanded
numerals; Place-value; Exponential notation; The numbers
1 and 0 as exponents; Bases other than 10.

Chapter <u>2</u>, <u>Properties</u> <u>of</u> <u>Whole</u> <u>Numbers</u>. Natural
numbers and whole numbers; Names for natural numbers;
The symbol %; The number zero; Operations with zero; The
number one; Operations with one; Sentences about numbers;
The verb =; Equations; Parentheses; Properties of whole
numbers; The verb $\neq$; Multiplying by ten; Opposite operations;
Dividing by zero; The number line; Solution sets and graphs;
Cardinal and ordinal numbers; Estimating.

Chapter 3, Points, Lines, Curves and Planes.
Points; Geometric figures; Segments; Rays; Lines; Half-
lines; Intersection of sets; Lines on a point; Planes;
Planes on a line; Separations; Curves; Angles; Polygons;
Diagonals of a polygon; Convex and concave polygons.

Chapter 4, Factoring and Prime Numbers. Primes,
composites and the number 1; Sieve of Eratosthenes; Gold-
bach's Conjecture; Twin primes and prime triples; Prime
factorization; Unique factorization; Common factors;
Common multiples; Relatively prime numbers; Euclidean
algorithm; Tests of divisibility; Venn diagrams; Union
of sets; G.C.F.; L.C.M.

Chapter 5, Mathematical Systems. How to make and
study mathematical systems; What is an operation; What is
closure; Inverse elements; Inverses in clock arithmetic;
Subtraction and additive inverses; Multiplication in
clock arithmetic; Division in clock arithmetic; Multipli-
cative inverses; Reciprocals and division; Distributive
property; Factoring; Modular arithmetic.

Chapter 6, The Number System of Arithmetic. Using
fractional numerals; Using decimal numerals; Properties of
arithmetic numbers; Division and reciprocals; Repeating
decimals; Simplest fractional numeral; Square root; Order
for arithmetic numbers; Decimal and fractional equivalents;
Per cents.

Chapter 7, Figures on a Plane. One-dimensional
figures; Two-dimensional figures; Three-dimensional
figures; Measures of one-dimensional figures; Sentences
about measures; Sub-units; Standard measures; Using a
ruler; Least count; Perimeter; Measures of angles; Classi-
fication of angles; Special pairs of angles; Perpendicular
lines; Classification of triangles; Angles of a triangle;
Measures of the angles of a triangle; Measures of the
angles of a quadrilateral; Rectangles; Regular polygons.

Chapter 8, Measures. Systems of measures; British-
American units of length; Metric system; Errors in measure-
ment; Greatest possible error; Precision in measurement;
Relative error; Accuracy; Tolerances; Measures other than
length; Capacity; Weight; Mass; Measures of time; Computing
with measures; Speed; Indirect measurement; Handling unit
symbols in computations; Changing units; Changing metric
units to British-American units.

Chapter 9, Applying the Number System of Arithmetic.
Interest; Compound interest; Discount; Commission; Ratio;
Statistical graphs; Bar graphs; 100% bar graphs; Broken
line graphs; Pictograph.

Mathematics - Laidlaw Brothers

Chapter 1, Decimal Numeration Systems. Number and
numeral; Number symbols; Equations as mathematical sen-
tences; Our decimal numeration system; Reading and writing
numbers; Using exponents; Values less than one; Rounding
off numbers.

Chapter 2, Inverse Operations. Addition and sub-
traction; Multiplication and division; Special properties
of addition, multiplication, subtraction and division;
The distributive property; Equations.

Chapter 3, Equations and Problem Solving. Impor-
tance of problem solving; Symbols for grouping; Relation
symbols; Arithmetic sentences; Open sentences; Replacement
set; Solving equations; Properties of equations; Using
the properties of equations; Translating sentences; Trans-
lating problems into equations; Rejecting unnecessary
information; Estimating answers; Using the operations.

Chapter 4, Points, Lines, and Angles. The meaning
of geometry; Lines and line segments; Planes; Simple
closed curves; triangles and quadrilaterals; Circles and
arcs; Rays and angles; Angle measure; Kinds of triangles;
Parallelograms.

Chapter 5, Factoring and Primes. Writing whole
numbers as products; More about factored form; Smallest
factors; Prime numbers; Divisibility; Locating prime
numbers; Using power notation; More about prime numbers;
Greatest common factor; Least common multiple; Numbers
which are relatively prime; Problem solving.

Chapter 6, Fraction Numbers. The closure property;
Fractional notation; Product of two fractional numbers;
Zero in division; Different names for a fractional number;
Addition of fractional numbers; Comparing fractional numbers;

Subtraction of fractional numbers; Multiplication of
fractional numbers; More than two fractional factors;
Reciprocals; Division of fractional numbers; Using more
than one operation.

      Chapter 7, Decimals. Addition and subtraction with
decimals; Using a decimal as a factor; Multiplication with
decimals; Division with decimals; Rounding off numbers;
Estimating the quotient; Terminating decimals; Repeating
decimals; Changing decimals to fractions.

      Chapter 8, Measurement. Some new units of measure;
Units of measure; How we measure; Measurement is always
approximate; Precision in measurement; Relative error;
Addition and subtraction of measures; Multiplication of
measures; Other units of measure; Many names for the same
measurement.

      Chapter 9, Perimeter, Area, and Volume. Perimeter;
Perimeter of a rectangle, perimeter of a square; Circum-
ference of a circle; Diameter of a circle; Perimeters of
other closed figures; Units of area--measure; Area of the
interior of a rectangle, a square and a triangle; Area of
the interior of a parallelogram; Area of the interior of
a circle; Prisms; Area of a rectangular prism; Volume of
a rectangular prism; Measurement of a circular cylinder;
Finding area and volume.

      Chapter 10, Ratio and Proportion. Comparing the
size of sets; Writing ratios as fractions; Expressing ratios;
Proportion; Using proportion; Determining equivalent ratios;
Finding a missing term in a proportion; Fractions and
decimals in a proportion; Translating a problem into a
proportion; Proportional line segments.

      Chapter 11, Analyzing Percent. Renaming numbers
in fractional form as percent; Renaming numbers in decimal
form as percent; Converting percents to a decimal form;
Practice in using equivalents; Computing with equivalent
forms of the same number; Using proportions in problems
with percent; Rounding numbers in decimal form to percent;
Solving problems involving percent; Percent of increase;
Percent of decrease.

Chapter 12, Uses of Percent. Buying at reduced prices; Finding sale prices; Problems involving discounts; Commission; Interest; Computing interest per year; Using a formula in computing interest; Finding the rate or the principal; Installment buying; Taxes.

Chapter 13, Organizing Data. Data; Graphing; Bar graphs; Sector of a circle; Circle graphs; Coordinates on a line; Coordinates of a point; Line graphs; Measures of central tendency--mean, median, mode.

Chapter 14, Geometric Constructions. Congruent line segments; Bisecting a line segment; Errors from observation; Congruent angles; Bisecting an angle; Vertical angles; Lines and transversals; Parallel lines and corresponding angles; Parallel lines and pairs of angles; Angles of a triangle; Angles of a quadrilateral; Angles of a parallelogram; Parallel lines and perpendicular lines.

Chapter 15, Scientific Notation. Large numbers; Large numbers and scientific notation; Calculating with large numbers; Zero as an exponent; Small numbers and scientific notation; Small numbers as factors; Computations using scientific notation; Practice with exponent notation.

Chapter 16, The Metric System. Metric system of measures; Metric units of length; Comparing metric and English units; Metric units of area; Metric units of volume; Mass and weight; Temperature.

Chapter 17, Other Numeration Systems. Numeration systems; Base ten numerals; Base five numerals; Changing bases; Addition in base five; Multiplication in base five; Other numeration systems; Addition and multiplication in other bases; Base two; Addition and multiplication in base two.

Contemporary Mathematics - Prentice Hall

Chapter 1, Base and Place. The Egyptian Numerals; The Roman Numerals; The Hindu-Arabic Numerals; Exponents; Expressing Numbers Using Exponents; Using Exponents in Expressing Numbers in Expanded Form; Grouping by Fives; Changing a Numeral from Base Five to a Numeral in Base Ten; Numbers in Any Base; Base Twelve Numerals.

Chapter 2, Non-Metric Geometry. Intersection; Union; The Intersection of Lines and Planes; Separation; Simple Closed Curves.

Chapter 3, System of Whole Numbers. A One-to-One Correspondence; Counting Numbers; The Number Line; Whole Numbers; Properties of Whole Numbers; The Number Nine; Check by "Casting Out Nines"; Subtraction; Method I: The Take Away Process; Method II: The Additive Process; Casting Out Nines; Division; Estimating Quotients; Casting Out Nines; Finding an Average; The Number One; The Number Zero; Properties of Joining.

Chapter 4, Factors and Primes. Factors and Multiples; Prime and Composite Numbers; A Complete Factorization of a Number; Divisibility; Using Test of Divisibility; Greatest Common Factor; Least Common Multiple.

Chapter 5, Rational Numbers. Changing the Fractional Form of a Rational Number; Simplest Form of a Fraction Representing a Rational Number; Addition of Rational Numbers; Vertical Addition; Commutative and Associative Properties of Addition for Rational Numbers; Subtraction of Rational Numbers; Multiplication of Rational Numbers; Division of Rational Numbers; Reciprocals; The Distributive Property; Comparing Quantities Using Rational Numbers; Division of Rational Numbers; Reciprocals; The Distributive Property; Comparing Quantities Using Rational Numbers; Ratio; Practice Using Ratios; Proportion; Decimal Notation; Decimal Fractions; Addition and Subtraction of Rational Numbers Expressed as Decimals; Multiplication of Rational Numbers Expressed as Decimals; Multiplying by Powers of 10; Division of Rational Numbers Expressed as Decimals; Dividing by a Rational Number Written as a Decimal; Rounding Numbers; Practice in Dividing by Powers of 10; Changing Fractional Numerals to Decimal Numerals; Rational Numbers Expressed as Percents; Application of Percents; Practice with Percent Notation.

Chapter 6, Measurement. Length; Units of Measure; The Number Line and a Ruler; Inch and Metric Rulers; Measurement of Angles; Kinds of Angles; Drawing and Measuring Angles; Pairs of Angles.

Seeing Through Mathematics - Scott, Foresman and Company

Chapter 1, Sets, Conditions, and Variables. Sentences and placeholders; Sets and subsets; Sentences, statements and conditions; Sets, conditions, and equations; Sets, conditions, and inequalities; Finite sets and infinite sets; Standard description of sets; Sets of points; Relating points, lines, and planes; Segments and congruent segments; Comparing segments; The circle; Number lines and graphs; Multiplication; Preparation for division; Division; Problems involving conditions for equality; Problems involving conditions for inequality; Solution sets of conditions for equality; Solution sets of conditions for inequality; Conditions for abstract problems.

Chapter 2, Intersection and Union of Sets. Intersection of sets; Union of sets; Compound conditions and their solution sets; Problems involving compound conditions; Intersection of lines and planes; Rays and angles; The triangle; Regions of the plane.

Chapter 3, Conditions in Two Variables. Ordered pairs; Sets of ordered pairs; Graphs of sets of ordered pairs; Conditions and graphs; The cartesian set N X N; Charts and solution sets; Compound conditions in two variables; Simple conditions for problems; Compound conditions for problems; Compound conditions for more complex problems; Conditions for abstract problems.

Chapter 4, Conditions Involving Rate Pairs. Equivalent ordered pairs; Rate pairs and ratios; Solution sets of conditions; Percent; Problems involving percent; Problems involving compound conditions about rate pairs; Abstract problems involving rate pairs.

Chapter 5, Numeration Systems. Tally, code, and grouping numeration systems; Numeration systems that have place value; Place value and digits in numeration systems; Egyptian, Roman, and Babylonian numeration systems; Factors, powers, and exponential notation; Converting numerals from one base to another; Computing in numeration systems other than the decimal system; Decimal numerals for numbers greater than one thousand.

Chapter 6, The Natural-Number System. Equivalent
sets; Natural numbers as properties of sets; Ordering of
the natural numbers; The closure property of addition;
The closure property of multiplication; The commutative
properties; The associative properties; The distributive
property; Simplifying expressions; The natural-number
system; A finite number system; Zero and one; Composite
and prime numbers; The unique factorization property.

Chapter 7, The Rational Numbers of Arithmetic.
Fractions and equivalent fractions; Rational numbers;
Ordering of the rational numbers; Multiplication of rational
numbers; Addition of rational numbers; Subtraction of
rational numbers; Common factors and common multiples;
The natural numbers related to certain rational numbers;
Mixed numerals used in computation; The commutative prop-
erties; The associative properties; The distributive
property and the system of rational numbers; The identity
elements; Reciprocals and the reciprocal property; Divi-
sion of rational numbers; Decimal numerals; Computing with
decimals; Repeating decimals; The density property; Solu-
tion sets of conditions in one variable; Conditions in one
variable for problems; Rational-number components of rate
pairs; Problems involving rate pairs and rational numbers;
Percents involving rational numbers; Problems involving
percents and rational numbers; Problems involving compari-
sons with one; Percents related to rate pairs with second
components of one.

Chapter 8, Geometry and Measurement. Measure of a
segment; Practical measurement; Problems involving standard
units of length; Measure of an angle; Angles formed by two
coplanar lines; Angles formed by three coplanar lines;
Measures associated with triangles; Congruent triangles;
The quadrilateral; Area of the rectangle; Area of the
parallelogram and area of the triangle.

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Chapter 1, Sets. Sets and subsets; Designating sets;
Empty set; Cardinal and ordinal numbers; Order; Number
sentences; Union and intersection of sets; Disjoint sets;
Number line.

Chapter 2, Number Systems. Place value; Decimal numerals; Exponents; Binary numerals; Inverse operations; Addition and subtraction; Commutative and associative principles of addition; Identity element for addition; Multiplication and division; Commutative and associative principles of multiplication; Identity element for multiplication; Distributive principle; Rounding numbers; Factors; Prime numbers; Multiples.

Chapter 3, Fractions. Unit space; Proper, improper, and mixed fractions; Comparing fractional numbers; Equivalent fractions; Simplest form; Like and unlike fractions; Least common denominator; Addition and subtraction; Substitution principle; Multiplication; Reciprocals; Division; Common denominator method; Complex fractions; Fractional numbers and the number line.

Chapter 4, Decimals. Decimal fractions; Decimal place value; Addition and subtraction; Decimals on the number line; Rounding; Multiplication; Division; Decimal equivalents; Repeating decimals; Terminating decimals.

Chapter 5, Ratio and Proportions. Comparing sets; Using quotients; Comparing numbers; Pairs of multiples; Ratio; Quotients and ratios; Equivalent ratios; Simplest form; Ratios and rates; Proportion; Solving proportions; Scale drawings; Applications of proportions; Fractions in proportions.

Chapter 6, Percent. Percent as a ratio; Understanding percent; Percents, ratios; and fractions; Percent of a number; Rate, base, and percentage; Percent of increase or decrease; Using the distributive principle; Discount; Annual interest; Interest formula.

Chapter 7, Measurement. Using a unit of measure; Using a scale; Measuring to the nearest unit; Greatest possible error; Using different units; Relative error; Metric system; Using the decimal pattern; Units; Precision and computing; Length; Weight; Metric weight; Liquid measure; Dry measure; Time; Time zones; Longitude and latitude; Estimating lengths; Reading scales; Generated units.

Chapter 8, Geometry. Points, lines, and line segments; Intersection of sets; Planes; Separation, ray, and angle; Separation in a plane; Interior and exterior of an angle; Measurement of angles; Using a protractor; Different sets of angles; Adjacent angles; Vertical angles and supplementary angles; Parallel and perpendicular lines; Intersection and union of sets of points; Simple closed figures; Polygons; Triangles; Properties of triangles; Perimeter; Circles; Working with a compass; Drawing angle bisectors; Bisecting a segment; Circumference of a circle; Circles and arcs; Central angles and arc-degree measure; Areas of regions; Formulas for areas; Prisms.

Chapter 9, Statistics. Data; Organizing data by rank; Frequency; Mode; Arithmetic mean; Median; Range; Intervals; Pictographs; Bar graphs; Circle graphs; Line graphs; Interpreting data.

Chapter 10, Number Line and Graphs. Thinking about the number line; Set of directed numbers; Addition on the number line; Principles of addition; Opposites and the identity element; Subtraction of directed numbers; A pattern for subtracting; Properties of subtraction; Ordering the set of directed numbers; Graphs on the number line; Open sentences and statements; Solution sets; Graphs of solution sets.

II. SUMMARY OF THE CONTENTS

This selection of texts represents the efforts of a total of twenty-five authors, who for various reasons are considered authorities in the field of modern mathematics. The number of pages in the texts varied from a minimum of three hundred to a maximum of five hundred eight. The number of chapters contained in the texts varied from a low of eight to a high of seventeen. The materials in the texts included some contributions from most of the more publicized experimental mathematics'

projects carried on in recent years; namely: School
Mathematics Study Group, University of Maryland Project,
University of Illinois Report, The Madison Project, and
the Greater Cleveland Project.

The comparison of the topics covered by these texts
showed a high degree of similarity. When compared on the
basis of fifteen topics, selected by the writer as some
of the more important topics to be covered at this level,
the results showed that ten of these topics were covered
by all seven of these texts. Two of the topics were
covered by six of the texts, one was covered by five of the
texts, one was covered by three of the texts and the remain-
ing topic was covered by two of the texts.

When the contents of the texts were compared on
the basis of the sequence in which they introduced the
topics, the results were considerably different. The
quarters of the school year in which the topics were intro-
duced were used as a basis for comparing the similarity of
the sequence. The results of this comparison showed that
not one of the topics was introduced during the same quar-
ter by all seven of the texts. The topic that came closest
to achieving uniformity in the sequence of presentation
was the topic dealing with the properties of whole numbers.
This topic was introduced during the first quarter by six
of the texts and during the third quarter by the other
text. The topic of rational numbers or fractions was

introduced during the first quarter by one of the texts, the second quarter by three of the texts, and during the third quarter by three of the texts. The topic of measurement was introduced by three texts during the second quarter, by one during the third quarter, and by three during the fourth quarter. Decimal numerals were introduced by three texts during the second quarter, by three texts during the third quarter, and by one text during the fourth quarter. A comparison of the time of introduction, for the topic of percent, showed that two of the texts introduced it during the second quarter, four during the third quarter, and one during the fourth. These and other topic comparisons are shown on Table II.

The comparison of the contents of these texts was made primarily in terms of topics covered and the sequences in which they were covered. However, in addition to these points, some of the following related features of interest were detected:

1. Only one of the texts included a chapter on probability, and that text gave this topic the distinction of being the first area of study for the year.

2. In the treatment of the topic of "fractions," four texts used the term rational numbers, while the other three used the term, fractional numbers.

3. Only one of the texts included an answer section for the students to utilize. This included answers for only a portion of the exercises.

4. Four of the texts included a glossary of terms near the end of the book.

5. Only one text defined and included a study of the integers, as such.

6. One of the texts utilized set notation and theory throughout its entirety; another completely avoided the use of sets.

7. One of the texts included a student handbook, with concise treatments of eleven mathematical topics, for review and quick reference.

III. EXAMPLES

This section of the chapter applies the information from parts I and II to specific transfer situations. In each example one text was used for the first semester and another text for the second semester. To provide an equitable basis for comparison, the seven examples allowed the use of each text once during the first semester, and once during the second semester. The progress in the mathematical development of each student in each example was summarized on the basis of the following four points: (1) Topics covered the first semester, (2) Topics covered the second semester, (3) Topics not covered by this student

TABLE II

FREQUENCY OF TOPIC OCCURRENCE AND THE QUARTER DURING THE
SCHOOL YEAR IN WHICH THEY OCCUR

| Topics | Textbooks | | | | | | |
	A	B	C	D	E	F	G
Numeration Systems	x1	x2	x1	x4	x4	x2	x1
Rational Number or Fractions	x2	x3,4	x3	x2	x2	x3	x1
Measurement	x2	x4	x4	x2	x2	x4	x3
Decimal Numerals	x3	x4	x3	x2	x2	x3	x2
Percent	x3	x4	x3	x3	x2	x2	x3
Geometry	x2,3	x2	x2,4	x1,3	x2	x4	x4
Properties of Whole Numbers	x1	x1	x1	x1	x1	x3	x1
Factoring & Prime	x1	x2	x2	x1	x1	x3	x1
Graphs	--	--	x4	x3	x3	x2	x4
Equations	x1,3	--	x1	x1	x3	x1	x4
Statistics	--	--	--	x3	x4	--	x4
Scientific Notation	--	--	--	x4	--	x3	--
Metric System	x2	x4	x4	x4	x2	x4	x3
Sets	x2	x2	x1,2	--	x1	x1,2,3,4	x1,4
Bases Other Than Ten	x1	x1	x1	x4	x1	x2	x1

The letter x indicates the inclusion of the topic. The number indicates the quarter of the school year in which the topics occur.

that were covered by his second semester class, and (4)
Topics repeated this year.

These examples are based on the following assumptions:

1. The topics were covered in the same sequence
    as they appeared in the texts.

2. The student transferred at the end of the first
    semester and then completed the second semester
    in the new mathematical environment.

3. Only the topics covered in the basic texts were
    used in evaluating the student's progress.

4. The examples are hypothetical and are not meant
    to be considered case histories.

5. Topics covered prior to the seventh grade and
    topics covered following the seventh grade were
    not considered in this study.

6. In situations where the text was not divided
    into first and second semester work, the divi-
    sion was arbitrarily set at the approximate
    halfway point in the text.

7. In an attempt to avoid placing any given text in
    an advantageous position, each text was used in
    an example once during the first semester and
    once during the second.

EXAMPLE I

This example was based on the student having com-
pleted the first semester of the seventh grade in a class
using, as the basic text, a book titled "Exploring Modern
Mathematics." At the close of the first semester the
student transferred to another school to complete the aca-
demic year in a class which is using as a basic text the
book titled "Modern Mathematics Through Discovery."

Topics Covered During the First Semester:

Numeration systems. Distinction between number
and numeral; Egyptian numeration; Roman numeration;
Babylonian numeration; Hindu-Arabic numeration; Expanded
numerals; Plane value; Exponential notation; The numbers
1 and 0 as exponents; Bases other than ten.

Properties of whole numbers. Natural numbers and
whole numbers; Names for natural numbers; The symbol %; The
number zero; Operations with zero; The number one; Opera-
tions with one; Sentences about numbers; The verb $=$; Equa-
tions; Parenthesis; Properties of whole numbers; The verb
$\neq$; Multiplying by ten; Opposite operations; Dividing by
zero; The number line; Solution sets and graphs; Cardinal
and ordinal numbers; Estimating.

Points, lines, curves and planes. Points; Geometric
figures; Segments; Rays; Lines; Half lines; Intersections
of sets; Lines on a point; Planes; Planes on a line; Sep-
arations; Curves; Angles; Polygons; Diagonals of a poly-
gon; Convex and concave polygons.

Factoring and prime numbers. Primes; Composites
and the number one; Sieve of Eratesthenes; Goldbach's
conjecture; Twin primes and prime triples; Prime factori-
zation; Unique factorization; Common factors; Common mul-
tiples; Relatively prime numbers; Euclidean algorithm;

tests of divisibility; Venn diagrams; union of sets; greatest common factor; least common multiple.

Topics Covered During the Second Semester:

Percent. Percent as a ratio; understanding percent; percents, ratios and fractions; percent of a number; rate, base and percentages; percent of increase or decrease; using the distributive principle; discount; annual interest; interest formula.

Measurement. Using a unit of measure; using a scale; measuring to the nearest unit; greatest possible error; using different units; relative error; metric system; using the decimal pattern; units; precision and computing; length; weight; metric weight; liquid measure; dry measure; time; time zones; longitude and latitude; estimating lengths; reading scales of generated units.

Points, lines, and line segments. Intersection of sets; planes; separation, ray, and angle; separation in a plane; interior and exterior of an angle; measurement of angles; using a protractor; different sets of angles; adjacent angles; vertical angles and supplementary angles; parallel and perpendicular lines; intersection and union of sets of points; simple closed figures; polygons; triangles; properties of triangles; perimeter; circles; working with a compass; drawing angle bisectors; bisecting a segment; circumference of a circle; circles and arcs; central angles and arc-degree measure; areas of regions; formulas for areas; prisms.

Data. Organizing data by rank; frequency; mode; arithmetic mean; median; range; intervals; pictographs; bar graphs; circle graphs; line graphs; interpreting data.

Thinking about the number line. Set of directed numbers; addition on the number line; principles of addition; opposites and the identity element; subtraction of directed numbers; a pattern for subtracting; properties of subtraction; ordering the set of directed numbers; graphs on the number line; open sentences and statements; solution sets; graphs of solution sets.

Topics Not Covered By This Student This Year That Were
Covered By His Second Semester Class:

Fractions. Proper, improper and mixed fractions;
comparing fractional numbers; equivalent fractions;
simplest form; like and unlike fractions; least common
denominator; addition and subtraction of fractions; substitution principle; multiplication; reciprocals; division;
common denominator method; complex fractions; fractional
numbers; the number line.

Decimals. Decimal fractions; decimal place value;
addition and subtraction; decimals on the number line;
rounding; multiplication; division; decimal equivalents;
repeating decimals; terminating decimals.

Topics Repeated By This Student This Year:

Geometry. Points; geometric figures, segments;
rays; lines; half lines; lines on a point; planes; separation; angles; polygons.

SUMMARY OF EXAMPLE I

In many ways the compatability of the two texts in
this example seem to be quite satisfactory. The similarity
of the topics covered and the sequence of the topics led
to a reasonably smooth transfer from one book to the other.
The repeating of some of the geometric topics would not
seem to constitute a major loss of progress. It may, in
fact, be an asset in terms of extension and reinforcement.
However, the omission, in this student's mathematical
itinerary, of the two basic topics of fractions and decimals
could prove to be a handicap in many problem solving

situations. Although both of these texts devoted a substantial number of pages to the treatment of these topics, this transfer student missed out on the coverage because of their sequential arrangement.

<div align="center">EXAMPLE II</div>

This second example was based on the student having completed the first semester of the seventh grade in a class using as the basic text a book entitled "Mathematics" which is published by Laidlaw Brothers. At the close of the first semester the student transferred to another school to complete the academic year in a class which was using as a basic text the book titled "Introduction to Secondary Mathematics" which is published by D. C. Heath and Company.

Topics Covered During the First Semester:

Decimal numeration systems. Number and numeral; number symbols; equations as mathematical sentences; our decimal numeration system; reading and writing numbers; using exponents; values less than one; rounding off numbers.

Inverse operations. Addition and subtraction; multiplication and division; special properties of addition, multiplication, subtraction and division; the distributive property; equations.

Equations and problem solving. Importance of problem solving; symbols for grouping; relation symbols; arithmetic sentences; open sentences; replacement set; solving equations; properties of equations; using the properties of equations; translating sentences; translating problems into equations; rejecting unnecessary information; estimating answers; using the operations.

Points, lines, and angles. The meaning of geometry;
lines and line segments; planes; simple closed curves;
triangles and quadrilaterals; circles and arcs; rays and
angles; angle measure; kinds of triangles; parallelograms.

Factoring and primes. Writing whole numbers as
products; more about factored form; smallest factors; prime
numbers; divisibility; locating prime numbers; using power
notation; more about prime numbers; greatest common factor;
least common multiple; numbers which are relatively prime;
problem solving.

Fraction numbers. The closure property; fractional
notation; product of two fractional numbers; zero in divi-
sion; different names for a fractional number; addition of
fractional numbers; comparing fractional numbers; subtrac-
tion of fractional numbers; multiplication of fractional
numbers; more than two fractional factors; reciprocals;
division of fractional numbers; using more than one opera-
tion.

Decimals. Addition and subtraction with decimals;
using a decimal as a factor; multiplication with decimals;
division with decimals; rounding off numbers; estimating
the quotient; terminating decimals; repeating decimals;
changing decimals to fractions.

Measurement. Some new units of measure; units of
measure; how we measure; measurement is always approximate;
precision in measurement; relative error; addition and
subtraction of measure; multiplication of measures; other
units of measure; many names for the same measurement.

Perimeter, area, and volume. Perimeter; perimeter
of a rectangle; perimeter of a square; circumference of a
circle; diameter of a circle; perimeters of other closed
figures; units of area--measure; area of the interior of
a rectangle, a square and a triangle; area of the interior
of a parallelogram; area of the interior of a circle;
prisms; area of a rectangular prism; volume of a rectang-
ular prism; measurement of a circular cylinder; finding
area and volume.

Topics Covered During the Second Semester:

Mathematics of rational numbers. Closure; rational
numbers; operations on rational numbers; names for rational
numbers; division in terms of multiplication; subtraction
in terms of addition.

More about rational numbers. Decimals, ratio--
reciprocals of non-zero rational numbers; comparing rational
numbers; rational numbers expressed as decimal numerals;
operations, using decimal numerals; every rational number
has a decimal expression; rational numbers as ratios; per-
cent and decimals; uses of percent.

Measuring with rational numbers. How does measuring
differ from counting; measuring continuous quantities;
linear units of measure; precision of measurement; measuring
angles; measuring interiors of closed curves; measuring
interiors of space figures; measuring non-geometric quanti-
ties.

Topics Not Covered By This Student This Year That Were
Covered By His Second Semester Class:

Probability. Probability of an event; the differ-
ence between "or" and "and"; counting the number of out-
comes; more probability.

Number systems. Numerals with a base other than
ten; changing bases.

Topics Repeated This Year By This Student:

Mathematics of rational numbers. Closure; func-
tional notation; operations on rational numbers; names
for rational numbers; division in terms of multiplica-
tion; subtraction in terms of addition.

More about rational numbers. Decimals; ration--
reciprocals of non-zero rational numbers; comparing
rational numbers; rational numbers expressed as decimal

numbers; operations using decimal numerals; every rational number has a decimal expression.

Measurement. How does measurement differ from counting; linear units of measure; precision of measurement; measuring angles.

SUMMARY OF EXAMPLE II

The transfer student in this example would seem to be spending a significant part of the second semester reviewing work that was introduced during the first semester. The sequence of the topics in the case of these texts does not seem to be beneficial to those students placed in a similar transfer situation. The fact that much of the three major areas of study covered during the second semester was material introduced during the first semester, to this student, might tend to dampen some of his enthusiasm for the subject. However, the increased scope given to some of these areas could seemingly help to offset this possibility.

The topics the transfer student did not have instruction in during the first semester that were covered by his second semester class would not apparently handicap the student to any great degree. The topic of probability, which had been covered by his class, is not a prerequisite for any of the other topics studied during the second semester. Also, the lack of coverage of the part on bases other than ten would not seem to constitute a major deficiency at this time.

EXAMPLE III

In this example the student has completed the first
semester of the seventh grade in a class using, as the
basic text, a book titled "Seeing Through Mathematics"
which is published by Scott Foresman and Company. At the
close of the first semester the student transferred to
another school to complete the academic year in a class
which is using, as a basic text, the book titled "Contem-
porary Mathematics" which is published by Prentice-Hall,
Inc.

Topics Covered During the First Semester:

Sets, conditions, and variables. Sentences and
placeholders; sets and subsets; sentences, statements and
conditions; sets, conditions, and equations; sets, condi-
tions, and inequalities; finite sets and infinite sets;
standard description of sets; sets of points; relating
points, lines and planes; segments and congruent segments;
comparing segments; the circle; number lines and graphs;
multiplication; preparation for division; division; prob-
lems involving conditions for equality; problems involving
conditions for inequality; solution sets of conditions
for equality; solution sets of conditions for inequality;
conditions for abstract problems.

Intersection and union of sets. Intersection of
sets; union of sets; compound conditions and their solu-
tion sets; problems involving compound conditions; inter-
section of lines and planes; rays and angles; the triangle;
regions of the plane.

Conditions in two variables. Ordered pairs; sets
of ordered pairs; graphs of sets of ordered pairs; condi-
tions and graphs; the cartesian set N X N; charts and
solution sets; compound conditions in two variables;

simple conditions for problems; compound conditions for
more complex problems; conditions for abstract problems.

<u>Conditions involving rate pairs</u>. Equivalent
ordered pairs; rate pairs and ratios; solution sets of
conditions; percent; problems involving percent; problems
involving compound conditions about rate pairs; abstract
problems involving rate pairs.

<u>Numeration systems</u>. Tally, code, and grouping
numeration systems; numeration systems that have place
value; place value and digits in numeration systems;
Egyptian, Roman and Babylonian numeration systems; factors,
powers, and exponential notation; converting numerals from
one base to another; computing in numeration systems other
than the decimal system; decimal numerals for numbers
greater than one thousand.

<u>Topics Covered During the Second Semester</u>:

<u>Perimeters, areas, and volumes</u>. Perimeters of
squares; perimeters of rectangles; perimeters of triangles;
measuring closed regions; area of rectangles; areas of
parallelograms; areas of triangles; areas of trapezoids;
other polygons; perimeters of regular polygons; a rec-
tangular prism; volume; right prisms.

<u>Equations</u>. Equations; finding the solution set;
two-step solutions; negative numbers in solution sets;
order on the number line; addition of negative and positive
numbers; negative numbers in equations.

<u>Coordinate geometry</u>. The number line; lines in a
plane; assigning numbers to points in the plane; sketching
algebraic equations; line graphs; broken-line graphs;
pictographs.

<u>Percents</u>. Percents; percents changed to fractional
and decimal notation; using percents in solving problems;
finding the percent of a quantity; other percents; percents
greater than 100 %; percents less than 1 %; other applica-
tions of percents; percents expressed to the nearest tenth
of a percent; finding the amount when a percent of it is
known; percent of increase or decrease; using percents in

sports; commission; discount; interest; finding the amount;
writing a formula for finding interest; finding interest
when time is given in days.

Circles. Circumference; the area of a circle;
circular surfaces.

Mathematical systems. Names of classes; properties
of an operation in the system; a system without numbers.

Statistics. Bar graphs; broken-line graphs; line
graphs; circle graphs; making circle graphs; measures of
central tendency and deviation.

Topics Not Covered By This Student This Year That Were
Covered By His Second Semester Class:

Factors and primes. Factors and multiples; prime
and composite numbers; complete factorization of a number;
divisibility; using test of divisibility; greatest common
factor; least common multiple.

Rational numbers. Changing the fractional form of
a rational number; simplest form of a fraction representing
a rational number; addition of rational numbers; vertical
addition; commutative and associative properties of addi-
tion for rational numbers; subtraction of rational numbers;
multiplication of rational numbers; division of rational
numbers; reciprocals; the distributive property; comparing
quantities using rational numbers; ratio; practice using
ratios; proportion; decimal notation; decimal fractions;
addition and subtraction of rational numbers expressed as
decimals; multiplication of rational numbers expressed as
decimals; multiplying by powers of ten; division of rational
numbers expressed as decimals; dividing by a rational
number written as a decimal; rounding numbers; practice in
dividing by powers of ten; changing fractional numerals
to decimal numerals; rational numbers expressed as percents;
application of percents; practice with percent notation.

Measurement. Length; units of measure; the number
line and a ruler; inch and metric rulers; measurement of
angles; kinds of angles; drawing and measuring angles;
pairs of angles.

Topics Repeated This Year By This Student:

   Equations. Finding the solution set; two-step
solutions; order on the number line.

   Coordinate geometry. The number line; lines in a
plane; line graphs.

   Circles. Circumference.

SUMMARY OF EXAMPLE III

   The effect of this transfer situation on the stu-
dent would present several seemingly important problems.
Due to the sequence of the topics in the texts, this stu-
dent would have missed out on the presentation of factors
and primes, rational numbers, and measurement. Had the
student remained with his first semester class, all of
these topics would have been covered, but under the con-
dition of the transfer they would not be covered under the
basic program. Considering the importance of the topics and
the scope which they are given in most texts at this level,
this student would be placed in an unenviable position in
regard to his orderly progress in the field of mathematics.

   The topics repeated, in the case of this transfer
student, would not seem to be detrimental to his over-all
program. The additional reinforcement and the variation
in the presentation would contribute substantially to his
opportunity for understanding the topics.

EXAMPLE IV

This fourth example was based on the student having completed the first semester of the seventh grade in a class using, as the basic text, a book titled "Structuring Mathematics" which is published by the American Book Company. At the close of the first semester the student transferred to another school to complete the academic year in a class which used, as a basic text, the book titled "Exploring Modern Mathematics" which is published by Holt, Rinehart and Winston, Inc.

Topics Covered During the First Semester:

Counting and numeration systems. Sets; 1-to-1 correspondence; elements; equivalent and equal sets; digits; numbers and numerals; place value; positional system; natural numbers; cardinal and ordinal sense; whole numbers; base ten; exponents; Hindu-Arabic notation system; Egyptian numerals; polynomial form; base six; number bases; counting on different bases.

Addition and subtraction. Meaning of addition; estimating answers; meaning of subtraction; inverse operations; take-away method using decomposition; additive method; sentences and equations; closure; commutative and associative properties; zero, the additive identity element; problem solving; adding and subtracting on base six.

Multiplication and division. Generalizations on 100 multiplication facts; multiplication by zero; number one, the identity element for multiplication; commutative, associative, and distributive properties; division by zero undefined; meaning of division; practice; factoring; prime; composite, odd, and even numbers; divisors, factors, and divisibility; multiplication and division on base six.

Points, lines, planes, and space. Geometry and basic ideas of points, lines, planes and space; sets and

intersection; empty sets; intersecting lines; parallel and skew lines; intersection of a line and a plane; intersection of two planes; union of sets; rays and angles.

Rational numbers. Meaning; fractions; changing terms of fractions; simplifying fractions; ratios; ordered pairs of numbers; proportions; using ratios and proportions; addition of rational numbers; closure, commutative, associative, and distributive properties; subtraction of rational numbers; the number line; less than or greater than; rational numbers greater than one; multiplying, dividing, adding, and subtracting rational numbers greater than one; reciprocals.

Measurement. Counting or measuring; unit of measure; standard units of measure; greatest possible error; true length; measured length; error of measurement; recording measurements; metric units of length; measuring angles; using protractors; kinds of angles; fractional parts of the degree.

Topics Covered During the Second Semester:

Mathematical systems. How to make and study mathematical systems; what is an operation; what is closure; inverse elements; inverses in clock arithmetic; subtraction and additive inverses; multiplication in clock arithmetic; division in clock arithmetic; multiplicative inverses; reciprocals and division; distributive property; factoring; modular arithmetic.

The number system of arithmetic. Using fractional numerals; using decimal numerals; properties of arithmetic numbers; division and reciprocals; repeating decimals simplest fractional numeral; square root; order for arithmetic numbers; decimal and fractional equivalents; percents.

Figures on a plane. One-dimensional figures; two-dimensional figures; three-dimensional figures; measures of one-dimensional figures; sentences about measures; subunits; standard measures; using a ruler; least count; perimeter; measures of angles; classification of angles; special pairs of angles; perpendicular lines; classification of triangles; angles of a triangle; measures of the angles

of a quadrilateral; rectangles; regular polygons.

   Measures. Systems of measures; British-American units of length; metric system; errors in measurement; greatest possible error; precision in measurement; relative error; accuracy; tolerances; measures other than length; capacity; weight; mass; measures of time; computing with measures; speed; indirect measurement; handling unit symbols in computations; changing units; changing metric units to British-American units.

   Applying the number system of arithmetic. Interest; compound interest; discount; commission; ratio; statistical graphs; bar graphs; 100% bar graphs; broken line graphs; pictograph.

Topics Not Covered By This Student This Year That Were Covered By His Second Semester Class:

   In this example the student has covered all of the general topics covered by the second semester class.

Topics Repeated This Year By This Student:

   Fractions. Using fractional numbers; division and reciprocals; simplest fractional numeral.

   Measurement. Errors in measurement; greatest possible error; measures of angles; using protractors; kinds of angles.

SUMMARY OF EXAMPLE IV

   In this case, the sequence and variety of the topics covered during the first semester would dovetail very nicely with those covered the second semester. The transfer student would enter the second semester class with an exposure to all of the topics covered by that class during

the first semester. In addition to this, there would be only minor duplication of study during the second semester. In the area of measurement there is considerably more diversification of application the second semester and much of this would not be in the category of duplication. This transfer example would seemingly present the possibility of a relatively smooth transition from one learning environment to another as far as the textbooks are concerned.

EXAMPLE V

In this example the student has completed the first semester of the seventh grade in a class using, as the basic text, a book titled "Modern Mathematics Through Discovery" which is published by the Silver Burdett Company. At the close of the first semester the student transferred to another school to complete the academic year in a class which used, as a basic text, the book entitled "Mathematics" which is published by Laidlaw Brothers.

Topics Covered During The First Semester:

Sets. Sets and subsets; designating sets; empty set; cardinal and ordinal numbers; order; number sentences; union and intersection of sets; disjoint sets; number line.

Number systems. Place value; decimal numerals; exponents; binary numerals; inverse operations; addition

and subtraction; commutative and associative principles of addition; identity element for addition; multiplication and division; commutative and associative principles of multiplication; identity element for multiplication; distributive principle; rounding numbers; factors; prime numbers; multiples.

Fractions. Unit space; proper, improper, and mixed fractions; comparing fractional numbers; equivalent fractions; simplest form; like and unlike fractions; least common denominator; addition and subtraction; substitution principle; multiplication; reciprocals; division; common denominator method; complex fractions; fractional numbers and the number line.

Decimals. Decimal fractions; decimal place value; addition and subtraction; decimals on the number line; rounding; multiplication; division; decimal equivalents; repeating decimals; terminating decimals.

Ratio and proportions. Comparing sets; using quotients; comparing numbers; pairs of multiples; ratio; quotients and ratios; equivalent ratios; simplest form; ratios and rates; proportion; solving proportions; scale drawings; applications of proportions; fractions in proportions.

Topics Covered During The Second Semester:

Decimal numeration systems. Number and numeral; number symbols; equations as mathematical sentences; our decimal numeration system; reading and writing numbers; using exponents; values less than one; rounding off numbers.

Inverse operations. Addition and subtraction; multiplication and division; special properties of addition, multiplication, subtraction and division; the distributive property; equations.

Equations and problem solving. Importance of problem solving; symbols for grouping; relation symbols; arithmetic sentences; open sentences; replacement set; solving equations; properties of equations; using the properties of

equations; translating sentences; translating problems into equations; rejecting unnecessary information; estimating answers; using the operations.

Points, lines, and angles. The meaning of geometry; lines and line segments; planes; simple closed curves; triangles and quadrilaterals; circles and arcs; rays and angles; angle measure; kinds of triangles; parallelograms.

Factoring and primes. Writing whole numbers as products; more about factored form; smallest factors; prime numbers; divisibility; locating prime numbers; using power notation; more about prime numbers; greatest common factor; least common multiple; numbers which are relatively prime; problem solving.

Fraction numbers. The closure property; fractional notation; product of two fractional numbers; zero in division; different names for a fractional number; addition of fractional numbers; comparing fractional numbers; subtraction of fractional numbers; multiplication of fractional numbers; more than two fractional factors; reciprocals; division of fractional numbers; using more than one operation.

Decimals. Addition and subtraction with decimals; using a decimal as a factor; multiplication with decimals; division with decimals; rounding off numbers; estimating the quotient; terminating decimals; repeating decimals; changing decimals to fractions.

Measurement. Some new units of measure; units of measure; how we measure; measurement is always approximate; precision in measurement; relative error; addition and subtraction of measures; multiplication of measures; other units of measure; many names for the same measurement.

Perimeter, area, and volume. Perimeter; perimeter of a rectangle; perimeter of a square; circumference of a circle; diameter of a circle; perimeters of other closed figures; units of area--measure; area of the interior of a rectangle, a square and a triangle; area of the interior of a parallelogram; area of the interior of a circle; prisms; area of a rectangular prism; volume of a rectangular

prism; measurement of a circular cylinder; finding area
and volume.

Topics Not Covered By This Student This Year That Were
Covered By His Second Semester Class:

     Equations and problem solving. Importance of prob-
lem solving; symbols for grouping; solving equations;
properties of equations; translating sentences; translating
problems into equations; rejecting unnecessary information;
estimating answers; using the operations.

     Points, lines, and angles. The meaning of geometry;
lines and line segments; planes; simple closed curves;
triangles and quadrilaterals; circles and arcs; rays and
angles; angle measure; kinds of triangles; parallelograms.

     Measurement. Some new units of measure; units of
measure; how we measure; measurement is always approximate;
precision in measurement; relative error; addition and
subtraction of measures; multiplication of measures; other
units of measure; many names for the same measurement.

     Perimeter, area, and volume. Perimeter; perimeter
of a rectangle; perimeter of a square; circumference of a
circle; diameter of a circle; perimeter of other closed
figures; units of area-measure; area of the interior of a
rectangle, a square and a triangle; area of the interior
of a parallelogram; area of the interior of a circle;
prisms; area of a rectangular prism; volume of a rectangular
prism; measurement of a circular cylinder; finding area
and volume.

Topics Repeated This Year By This Student:

     Ratio and proportion. Comparing the size of sets;
writing ratios as fractions; expressing ratios; proportion;
using proportion; determining equivalent ratios; finding a
missing term in a proportion; fractions in a proportion;
translating a problem into a proportion.

SUMMARY FOR EXAMPLE V

In this example of the effects of transferring, the student would definitely be handicapped by the relative sequential arrangement of the topics in these texts. Unless compensated for by special arrangements, this student would suffer during this year on instructional voids in such important areas as: introduction to geometry, use of measurement, measurements of geometric shapes, and equations. Although the variety of the topics covered by these texts varies to some degree, the major portion of the topics missed can be directly traced to the difference in the sequential arrangement.

The area of repeated instruction, in this example, would seem to be within the range of the expected amount under the circumstances. The additional time spent on ratio and proportion, along with the difference in the presentation, could feasibly be an asset to the mathematical growth of this student.

EXAMPLE VI

This sixth example was based on the student having completed the first semester of the seventh grade in a class using as the basic text a book titled "Introduction to Secondary Mathematics" which is published by D. C. Heath and Company. At the close of the first semester the student

transferred to another school to complete the academic year in a class which used, as a basic text, the book titled "Seeing Through Mathematics" which is published by Scott, Foresman and Company.

Topics Covered During the First Semester:

Probability. Probability of an event; the difference between "or" and "and"; counting the number of outcomes; more probability.

Mathematics of whole numbers. The counting process; operating on whole numbers; properties of the operations; the associative property; special properties of zero and one; the distributive property; properties of subtraction and division; the number line.

The symbols we use for numbers. Various kinds of number symbols; decimal numerals; numerals with a base other than ten; changing bases.

Whole numbers: primes. Factors and multiples; prime numbers; some tests for divisability; some uses of multiples.

Non-metric geometry. Points and lines in space; planes in space; representing lines and planes; intersection of lines and planes; segments of lines; separating lines, planes, and space; what is an angle?; simple closed curves.

Topics Covered During the Second Semester:

The natural-number system. Equivalent sets; natural numbers as properties of sets; ordering of the natural numbers; the closure property of addition; the closure property of multiplication; the commutative properties; the associative properties; the distributive property; simplifying expressions; the natural-number system; a finite

number system; zero and one; composite and prime numbers; the unique factorization property.

The rational numbers of arithmetic. Fractions and equivalent fractions; rational numbers; ordering of the rational numbers; multiplication of rational numbers; addition of rational numbers; subtraction of rational numbers; common factors and common multiples; the natural numbers related to certain rational numbers; mixed numerals used in computation; the commutative properties; the associative properties; the distributive property and the system of rational numbers; the identity elements; reciprocals and the reciprocal property; division of rational numbers; decimal numerals; computing with decimals; repeating decimals; the density property; solution sets of conditions in one variable; conditions in one variable for problems; rational-number components of rate pairs; problems involving rate pairs and rational numbers; percents involving rational numbers; problems involving percents and rational numbers; problems involving comparisons with one; percents related to rate pairs with second components of one.

Geometry and measurement. Measure of a segment; practical measurements; problems involving standard units of length; measure of an angle; angles formed by three coplanar lines; measures associated with triangles; congruent triangles; the quadrilateral; area of the rectangle; area of the parallelogram and area of the triangle.

Topics Not Covered By This Student This Year That Were Covered By His Second Semester Class:

Sets, conditions, and variables. Sentences and placeholders; sentences, statements and conditions; sets, conditions, and inequalities; finite sets and infinite sets; standard description of sets; sets at points; segments and congruent segments; the circle; graphs; problems involving conditions for equality and inequality; solution sets of conditions for equality and inequality; conditions for abstract problems.

Conditions in two variables. Ordered pairs, sets of ordered pairs; graphs of sets of ordered pairs; conditions and graphs; the cartesian set N X N; charts and

solution sets; compound conditions for problems; compound conditions for more complex problems; conditions for abstract problems.

<u>Conditions</u> <u>involving</u> <u>rate</u> <u>pairs</u>. Equivalent ordered pairs; rate pairs and ratios; solution sets of conditions; percent; problems involving percent; problems involving compound conditions about rate pairs; abstract problems involving rate pairs.

<u>Topics</u> <u>Repeated</u> <u>This</u> <u>Year</u> <u>By</u> <u>This</u> <u>Student</u>:

<u>The</u> <u>natural</u> <u>number</u> <u>system</u>. The commutative properties; the associative properties; the distributive property; the natural number system; zero and one; composite and primes.

SUMMARY OF EXAMPLE VI

This example depicts one of the more frustrating situations in which the transfer student can find himself placed. The differences in the vocabulary and the form of presentation found within these texts would tend to contribute to a very difficult adjustment for the student. The student, having completed the first semester with only the slightest exposure to set terminology, would find himself, at mid-year, in a mathematical environment based primarily on set notation and set terminology. This, along with the topics not covered during the first semester, would make for a seemingly insurmountable learning obstacle for all but the most versatile of students.

The authors of the text used during the second

semester seemed to anticipate this situation and fore-
warned the users with the following statement: "No
section can properly be viewed in isolation from the
preceding sections."

EXAMPLE VII

This final example was based on the student having
completed the first semester of the seventh grade in a
class using as the basic text a book titled "Contemporary
Mathematics" which is published by Prentice-Hall, Inc.
At the close of the first semester the student transferred
to another school to complete the academic year in a class
which used, as a basic text, the book titled "Structuring
Mathematics" which is published by the American Book
Company.

Topics Covered During the First Semester:

Base and place. The Egyptian numerals; the Roman
numerals; the Hindu-Arabic numerals; exponents; expressing
numbers using exponents; using exponents in expressing
numbers in expanded form; grouping by fives; changing a
numeral from base five to a numeral in base ten; numbers
in any base; base twelve numerals.

Non-metric geometry. Intersection; union; the
intersection of lines and planes; separation; simple
closed curves.

System of whole numbers. A one-to-one correspondence;
counting numbers; the number line; whole numbers; properties
of whole numbers; the number nine; check by "casting out

nines"; subtraction; method I: the take away process; method II: the additive process; casting out nines; division; estimating quotients; finding an average; the number one; the number zero; properties of joining.

Rational numbers. Changing the fractional form of a rational number; simplest form of a fraction representing a rational number; addition of rational numbers; vertical addition; commutative and associative properties of addition for rational numbers; subtraction of rational numbers; multiplication of rational numbers; division of rational numbers; reciprocals; the distributive property; comparing quantities using rational numbers; ratio; practice using ratios; proportion; decimal notation; decimal fractions; addition and subtraction of rational numbers expressed as decimals; multiplication of rational numbers expressed as decimals; multiplying by powers of ten; division of rational numbers expressed as decimals; dividing by a rational number written as a decimal; rounding numbers; practice in dividing by powers of ten; changing fractional numerals to decimal numerals; rational numbers expressed as percents; application of percents; practice with percent notation.

Measurement. Length; units of measure; the number line and a ruler; inch and metric rulers; measurement of angles; kinds of angles; drawing and measuring angles; pairs of angles.

Geometric figures. Triangles; kinds of triangles; sum of the measures of the angles of a triangle; angles and intersecting lines; parallel lines and transversals; quadrilaterals; perpendicular lines.

Topics Covered During the Second Semester:

Decimal numerals. Using exponents; decimal fractions; decimal numerals; addition and subtraction; rational numbers represented by decimal numbers; multiplication; multiplying by powers of ten; repeating and terminating decimal numerals; rounding numbers; division of rational numbers; problem solving.

The language of percent. Meaning; expressing numbers as percents; percents representing numbers less than 1%, greater than 100%; solution sets for simple equations;

percentage, base, and rate; using percents in problem
solving; number properties and percent; discounts; percent
of increase or decrease; interest; applications.

Polygons and prisms. Description and kinds; rec-
tangles; squares; parallelograms; rhombuses; perimeters;
formula; areas; lateral areas; areas of triangles; kinds
of triangles; sum of the measures of angles of triangles;
regular polygons and their perimeters; right prisms; cubes.

Numeration systems. Counting on other bases;
systems of numeration--Roman, Egyptian, and Hindu-Arabic;
changing numerals to base ten; changing to other bases;
addition and subtraction on base six; multiplication on
base six; division on base six; properties of numbers.

Circles and right circular cylinders. Description
of the circle; measuring circles; diameter, circumference,
and pi; area of a circle; description of right circular
cylinder; lateral, total surface area, and volume of right
circular cylinders.

Integers. Directed distance; directed numbers;
integers; addition of integers; whole numbers and non-
negative integers; additive inverse; closure; uniqueness;
property of zero; commutative and associative properties
of addition; subtraction; multiplication; division.

Topics Not Covered By This Student This Year That Were
Covered By His Second Semester Class:

The student, in this example, covered all of the
topics that were covered by his second semester class.

Topics Repeated This Year By This Student:

Decimal numerals. Using exponents; decimal frac-
tions; addition and subtraction; rational numbers repre-
sented by decimal numbers; multiplication; multiplying by
powers of ten; rounding numbers; division of rational
numbers; problem solving.

SUMMARY OF EXAMPLE VII

This example presented the minimum in conflicts as far as the transfer student was concerned. The sequence of the topics covered during the first semester was so similar in the two texts that the student did not miss out on instruction in the major areas covered by his second semester class. In addition to this advantageous condition, the student also benefited from having only a reasonable amount of repetitious work during the second semester. Of the examples studied, this one would seem to present the fewest obvious obstacles and would give the transfer student at least an even chance for success in his new environment.

CHAPTER V

SUMMARY AND CONCLUSIONS

The problem. The purpose of this study was to (1)
examine the contents of the newly published modern mathe-
matics textbooks for the seventh grade level, (2) to com-
pare the contents of a representative selection of these
texts in regard to the sequence and variety of the topics
covered, (3) to show the probability of the effect this
would have on a transfer student.

The importance of considering the transfer student
in the school curriculum was established by the fact that
in a recent year nearly twenty percent of the population
of the United States changed their place of residency.

Approach to the problem. The history and develop-
ments in mathematics leading up to the recent changes in
the textbooks were used to instigate this study. It was
established that the textbooks were influence by the many
recent experimental programs and that these programs were
not necessarily similar in all respects.

The available newly-published mathematics textbooks
for the seventh grade level were examined and a representa-
tive group of seven were selected for this study. A com-
plete listing of each text's contents was made along with
a comparison of topic similarity. This comparison was

based on a list of fifteen topics considered by the writer to be of importance at this level. This comparison showed that ten of these topics were included in all seven of the texts and that two of the topics were included in six of the texts. The remaining three topics were included in five, three, and two texts, respectively.

The contents of these texts were then compared on the basis of the sequence in which they were introduced. A comparison was also made of the school quarter in which each text introduced the fifteen selected topics. Table II was used to tabulate these comparisons.

Seven examples of mid-year transfer situations were used to provide additional information concerning the effects of the sequence of topics on the transfer students. Each of these examples was summarized in Chapter IV.

Conclusions. This study led to the conclusions that the contents of the seventh grade modern mathematics texts were basically quite similar, but the sequential arrangement of these topics varied considerably. Therefore, the transfer student may have an easy transition from one book to another or he may run into seemingly insurmountable obstacles that would definitely have an adverse effect on his orderly mathematical progress.

The nature of this study was limited in scope and was based on several assumptions described in Chapters

III and IV. Further studies at this and at other grade levels are needed to ascertain the seriousness of this problem. The use of case histories should prove to be extremely interesting and worthwhile.

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