To the Graduate Council:

I am submitting herewith a thesis written by Hisham Ramzi Durdunji entitled "A Descriptive Study of the Opinions of Classroom Teachers in North Alabama Regarding the Impact of the "New Mathematics." I recommend that it be accepted in partial fulfillment of the requirements for the degree of Specialist in Education, with a major in Curriculum and Instruction.

D. J. Dessart

D. J. Dessart, Major Professor

We have read this thesis and
recommend its acceptance:

W C Murphy

Anand Mathur

Accepted for the Council:

Hilton A. Smith

Vice Chancellor
Graduate Studies and Research

A DESCRIPTIVE STUDY OF THE OPINIONS OF CLASSROOM TEACHERS IN NORTH ALABAMA REGARDING THE IMPACT OF THE "NEW MATHEMATICS"

A Thesis

Presented for the

Specialist in Education

Degree

The University of Tennessee

Hisham Ramzi Durdunji

August 1975

1245912

ACKNOWLEDGEMENTS

The writer wishes to express sincere appreciation to his committee chairman, Dr. D. J. Dessart, for his interest, encouragement, and assistance in the completion of this study.

Special appreciation is also expressed to the other members of the research committee, Dr. A. Malik and Dr. W. C. Murphy, for their confidence, encouragement, and willingness to sacrifice their time and effort. Special appreciation is extended to Dr. H. Frandsen for his assistance and willingness to help.

Many thanks go to all participants for their willingness to respond to the opinionnaire and their prompt return of the questionnaire.

A sincere appreciation and a deeply felt gratitude goes to the writer's family: to his wife, Hilda, for her constant devotion, love and encouragement; and to his two children, Sami and Sara, for their love and sacrifices which made the completion of this manuscript possible.

ABSTRACT

The purpose of this study was to ascertain the opinion of elementary, middle, and secondary school teachers in North Alabama regarding the impact of the "new mathematics."

The study was made by means of a questionnaire and an opinionnaire. The questionnaire was designed to provide personal background variables, and the opinionnaire was composed of different opinions given by various publications, articles, and teachers of mathematics concerning the impact of the "new math" to be judged according to a given set of scales.

The questionnaire and the opinion survey scale were distributed to a population consisting of 987 elementary, middle, and secondary teachers of mathematics in 136 school systems in North Alabama. The addresses of these schools were randomly drawn from a list of all teachers employed in North Alabama. The teacher sample consisted of 442 elementary and kindergarten teachers, 367 middle and junior high school teachers, and 178 high school teachers.

The study sought to determine whether the sex, race, age, teaching experience, recency of college or university training, highest degree held, grade level taught, knowledge of the new math, institutions or workshops attendance, and the teaching preference of the teacher affected the teacher's opinion regarding the new curriculum of mathematics.

Sex: Female teachers tended to indicate a more negative attitude toward the impact of the new math than male teachers.

Race: Nonwhite teachers tended to indicate a more positive attitude toward the impact of the new math than white teachers.

Age: Younger teachers tended to indicate a more positive attitude toward the impact of the new math than teachers with older age. The older the age group, the higher the negative attitude toward the new math.

Teaching Experience: Teachers possessing more years of teaching experience tended to indicate a more negative attitude toward the new math than teachers with fewer years of teaching experience.

Recency of College or University Courses Taken: Teachers who attended colleges or universities more recently tended to indicate a more positive attitude toward the new math than teachers who attended ten years ago or longer.

Highest Degree Held: Teachers with master's degrees or above tended to indicate a more positive attitude toward the impact of the new math than teachers with the bachelor's degree or less.

Present Teaching Level: Kindergarten and middle school (grades 5-8) teachers tended to indicate a more negative attitude toward the impact of the new math than teachers of elementary grades or high school levels. High school teachers tended to indicate a more positive attitude toward the new math than any of the other three grade levels, and kindergarten teachers tended to indicate more negative attitudes than any of the other three grade levels.

Knowledge of the New Math: Teachers with thorough understanding of the new math tended to indicate a more positive attitude toward the impact of the new math than teachers with slight or no understanding of the new math.

New Math Institutions or Workshops Attended: Teachers who attended institutions or workshops implementing the new math tended to indicate a more positive attitude toward the impact of the new math than teachers with no attendance to any new math workshops or institutions.

Teaching Preference: Teachers who chose the traditional curriculum tended to indicate a more negative attitude toward the new math than those who indicate the modification of both the new math and the traditional curriculum. Furthermore, teachers who chose the new math curriculum as their teaching preference indicated a significantly positive attitude toward the opinion that boolian algebra and symbolic logic are specialties, useless to noncollege students, and should be reserved for specialists, and were undecided to whether or not there was any justification for teaching matrices at the twelfth grade level.

TABLE OF CONTENTS

CHAPTER		PAGE
I.	INTRODUCTION	1
	General Information	1
	Problem and Purpose of Study	2
	The problem	2
	The purpose of the study	2
	Importance of the study	2
	Limitations of the study	4
	Assumptions	4
	Hypotheses	4
	Definition of Terms	6
II.	REVIEW OF RELATED LITERATURE	7
	Historical Background of the New Math	7
	The Confluence of the New Math	9
	The Birth of the New Math	10
	Substance of the New Math	17
	Research and the New Math	23
	Public Perceptions of the New Math	24
III.	METHODS AND PROCEDURES	33
	The Population	33
	Description of the Instruments	34
	The teacher questionnaire	34

CHAPTER PAGE

The opinion scale 34
Administration of the Instruments 35
Treatment of the Data 35
Summary 38
IV. ANALYSIS AND PRESENTATION OF THE DATA 39
Data Presentation 40
Item 1 41
Item 2 44
Item 3 48
Item 4 53
Item 5 57
Item 6 62
Item 7 66
Item 8 71
Item 9 76
Item 10 80
Item 11 85
Item 12 89
Item 13 94
Item 14 98
Item 15 102
V. SUMMARY, CONCLUSION, AND RECOMMENDATIONS 107
Introduction 107
Summary 108

CHAPTER PAGE

Conclusions 118
Sex 118
Race 118
Age 119
Teaching experience 119
Recency of college or university courses taken 119
Highest degree held 119
Present teaching level 119
Knowledge of the new math 120
New math institutions or workshops attended 120
Teaching preference 120
Recommendations 121
BIBLIOGRAPHY 123
APPENDIX 129
VITA 144

LIST OF TABLES

TABLE		PAGE
1.	Developmental Mathematics Curriculum Projects	14
2.	Schematic Representation of a Two-Way Contingency Table with r Categories for A and k Categories for B	36
3.	Teachers' Responses to Opinion Survey Scale Item 1 by Sex, Race, Age, Teaching Experience, Recency of College or University Courses Taken, Highest Degree Held, Present Teaching Level, Knowledge of the New Math, Attendance at New Math Institutions or Workshops, and Teaching Preference	41
4.	Teachers' Responses to Opinion Survey Scale Item 2 by Sex, Race, Age, Teaching Experience, Recency of College or University Courses Taken, Highest Degree Held, Present Teaching Level, Knowledge of the New Math, Attendance at New Math Institutions or Workshops, and Teaching Preference	45
5.	Teachers' Responses to Opinion Survey Scale Item 3 by Sex, Race, Age, Teaching Experience, Recency of College or University Courses Taken, Highest Degree Held, Present Teaching Level, Knowledge of the New Math, Attendance at New Math Institutions or Workshops, and Teaching Preference	49

TABLE PAGE

6. Teachers' Responses to Opinion Survey Scale Item 4 by Sex, Race, Age, Teaching Experience, Recency of College or University Courses Taken, Highest Degree Held, Present Teaching Level, Knowledge of the New Math, Attendance at New Math Institutions or Workshops, and Teaching Preference 54

7. Teachers' Responses to Opinion Survey Scale Item 5 by Sex, Race, Age, Teaching Experience, Recency of College or University Courses Taken, Highest Degree Held, Present Teaching Level, Knowledge of the New Math, Attendance at New Math Institutions or Workshops, and Teaching Preference 58

8. Teachers' Responses to Opinion Survey Scale Item 6 by Sex, Race, Age, Teaching Experience, Recency of College or University Courses Taken, Highest Degree Held, Present Teaching Level, Knowledge of the New Math, Attendance at New Math Institutions or Workshops, and Teaching Preference 63

9. Teachers' Responses to Opinion Survey Scale Item 7 by Sex, Race, Age, Teaching Experience, Recency of College or University Courses Taken, Highest Degree Held, Present Teaching Level, Knowledge of the New Math, Attendance at New Math Institutions or Workshops, and Teaching Preference 67

TABLE PAGE

10. Teachers' Responses to Opinion Survey Scale Item 8 by Sex, Race, Age, Teaching Experience, Recency of College or University Courses Taken, Highest Degree Held, Present Teaching Level, Knowledge of the New Math, Attendance at New Math Institutions or Workshops, and Teaching Preference 72

11. Teachers' Responses to Opinion Survey Scale Item 9 by Sex, Race, Age, Teaching Experience, Recency of College or University Courses Taken, Highest Degree Held, Present Teaching Level, Knowledge of the New Math, Attendance at New Math Institutions or Workshops, and Teaching Preference 77

12. Teachers' Responses to Opinion Survey Scale Item 10 by Sex, Race, Age, Teaching Experience, Recency of College or University Courses Taken, Highest Degree Held, Present Teaching Level, Knowledge of the New Math, Attendance at New Math Institutions or Workshops, and Teaching Preference 81

13. Teachers' Responses to Opinion Survey Scale Item 11 by Sex, Race, Age, Teaching Experience, Recency of College or University Courses Taken, Highest Degree Held, Present Teaching Level, Knowledge of the New Math, Attendance at New Math Institutions or Workshops, and Teaching Preference 86

TABLE PAGE

14. Teachers' Responses to Opinion Survey Scale Item 12 by Sex, Race, Age, Teaching Experience, Recency of College or University Courses Taken, Highest Degree Held, Present Teaching Level, Knowledge of the New Math, Attendance at New Math Institutions or Workshops, and Teaching Preference 90

15. Teachers' Responses to Opinion Survey Scale Item 13 by Sex, Race, Age, Teaching Experience, Recency of College or University Courses Taken, Highest Degree Held, Present Teaching Level, Knowledge of the New Math, Attendance at New Math Institutions or Workshops, and Teaching Preference 95

16. Teachers' Responses to Opinion Survey Scale Item 14 by Sex, Race, Age, Teaching Experience, Recency of College or University Courses Taken, Highest Degree Held, Present Teaching Level, Knowledge of the New Math, Attendance at New Math Institutions or Workshops, and Teaching Preference 98

17. Teachers' Responses to Opinion Survey Scale Item 15 by Sex, Race, Age, Teaching Experience, Recency of College or University Courses Taken, Highest Degree Held, Present Teaching Level, Knowledge of the New Math, Attendance at New Math Institutions or Workshops, and Teaching Preference 103

CHAPTER I

INTRODUCTION

I. GENERAL INFORMATION

In the United States, a fixed mathematics curriculum was maintained for many generations at the elementary and secondary school levels. In the twenty years immediately preceding this study, new curriculums had been fashioned and recommended by mathematicians and professors of mathematics.

The public had previously assumed that the profession had spoken and indeed the "new" mathematics curriculum must be accepted. Yet when this study was made, the author observed that there were many people advocating the idea that the "new math" had not lived up to its potential and their expectations from it. Consequently, a spreading attitude of public questioning and uncertainty caused parents to become increasingly inquisitive, accusing the new math of being inadequate in responding to their needs.

This study was designed to survey the opinion of the teachers of mathematics as to the merits of the innovation and to the question of whether or not it had actually improved the teaching of mathematics and had made the subject more accessible to the students.

II. PROBLEM AND PURPOSE OF STUDY

The Problem

How do elementary and secondary mathematics teachers, in North Alabama, perceive various characteristics of the new math?

The Purpose of the Study

The purpose of the study was to survey the opinions of elementary and secondary mathematics teachers regarding the new mathematics. The study sought to determine whether the sex of the teacher, the race of the teacher, the grade level of teaching, the recency of college or university training, the number of years teaching experience, the age of the teacher, the highest college degree held by the teacher, and teacher's knowledge of the new mathematics affected the teacher's opinion regarding the new curriculum of mathematics.

Importance of the Study

In the early days of the 1950's, new math was assumed by the mathematicians and professors of mathematics to be a new era of enlightenment descended upon the public and their children to bring deepened understanding as well as enthusiasm to replace traditional rote-learning procedures.[1]

However, innovation creates problems. This is as true in education as it is in any other profession. Furthermore, what had been the

---

[1]Donovan A. Johnson and Robert Rahtz, The New Mathematics in Our Schools (New York: The Macmillan Company, 1966; London: Collier-Macmillan Limited, 1966), p. 6.

aftermath of ten years of the new math? This question was repeatedly stated with increased vehemence from many quarters in the ten years preceding this study. The book, Why Johnny Can't Add: The Failure of the New Math,[2] lent fuel to the critics, in the classroom as well as out, who claimed evidence to show that children knew less about simple computational skills at the time of this study than had been the case in the past. In his book, Kline also brought about the question of whether the new curriculum had actually improved the teaching of mathematics and had indeed made the subject more accessible to the students. Furthermore, he pointed out that sharp differences of opinion as to the merits of the new mathematics did exist among professional mathematicians and teachers.[3]

With no doubt, it is difficult for teachers who are unaccustomed to technology and change to accept innovations. Any hope of successfully reforming the curriculum to improve the teaching of mathematics depends solely on the teachers. They must be able not only to see, work, and understand the new innovation, but totally accept its usefulness and purpose.

It was imperative at this stage to focus this study on teachers' opinions regarding this public pressure, criticism, and accusations that the new mathematics thus far had constituted an entirely inadequate response to their need. Teachers were in a better position to determine, by observing students' attitudes and achievements, the validity of the

---

[2]Morris Kline, Why Johnny Can't Add: The Failure of the New Math (New York: Random House, 1973).

[3]Ibid., p. x.

new math and whether or not such imminent-avalanche flavor and public accusations were justifiable.

Limitations of the Study

There were three major limitations of this study. First, the study was concerned with only elementary, middle, and high school teachers of mathematics in regular graded classrooms (K-12) in city school systems in North Alabama. The second limitation was that responses to the statement on the questionnaires were valid only for the time period of the study. Third, the study was dependent on written correspondence with the participants in the study for the data obtained from randomly selected teachers.

Assumptions

It was assumed that the information provided in the questionnaire accurately reflected the teachers' opinions. In addition, it was assumed that the answers given on the questionnaire were expressions of the respondents' opinions.

III. HYPOTHESES

The following null hypotheses were established in order to subject the purposes of the study to statistical analysis. Each was tested at the .05 level of significance:

1. There is no significant relationship at the .05 level of significance between the sex of the teachers and the expressed opinions toward the new math.

2. There is no significant relationship at the .05 level of significance between the race of the teachers and the expressed opinions toward the new math.
3. There is no significant relationship at the .05 level of significance between the age of the teacher and the expressed opinions toward the new math.
4. There is no significant relationship at the .05 level of significance between the teaching experience and the expressed opinions toward the new math.
5. There is no significant relationship at the .05 level of significance between the recency of college or university training and the expressed opinions toward the new math.
6. There is no significant relationship at the .05 level of significance between the highest degree held and the expressed opinions toward the new math.
7. There is no significant relatioship at the .05 level of significance between the grade level of teaching and the expressed opinions toward the new math.
8. There is no significant relationship at the .05 level of significance between the degree of knowledge of the new mathematics and the expressed opinions toward the new math.
9. There is no significant relationship at the .05 level of significance between the attendance to new mathematics institutions or workshops and the expressed opinion toward the new math.

10. There is no significant relationship at the .05 level of significance between the teaching preference of mathematics and the expressed opinion toward the new math.

IV. DEFINITION OF TERMS

The terms used in this study are defined as follows:

Elementary school level comprises kindergarten through grade four.

Middle school level comprises grades five through eight.

Secondary school level comprises grades nine through twelve.

New math refers to a revised curriculum, innovated, fashioned and formulated since 1954 by the collaboration of research mathematicians, professors and teachers of mathematics, and representatives of industry.[4]

---

[4]The Revolution in School Mathematics (Washington, D.C.: National Council of Teachers of Mathematics, 1961), p. 86.

CHAPTER II

REVIEW OF RELATED LITERATURE

Never before the time of this study had a topic such as the new math been so seriously discussed by all segments of the mathematics education community. Not only had the previous twenty years produced many changes in the curriculum of mathematics, but these changes were not consistent with one another.

This chapter brings out many of the issues associated with these changes, discusses the substantive difference underlying the new math, and shows that, in spite of many agreements, these issues represent not merely disagreements between professional educators and professional mathematicians, but also differences of opinion within each of these groups.[1]

I. HISTORICAL BACKGROUND OF THE NEW MATH

> No man putteth a piece of new garment upon an old; if otherwise, then both, the new maketh a rent, and the piece that was taken out of the new agreeth not with the old.
>
> And no man putteth new wine into old skins; else the new wine will burst the skins, and be spilled, and the skins shall perish. But the new wine must be put into new skins; and both are preserved.
>
> No man also having drunk old wine straightway desireth new: for he saith: The old is better.[2]

---

[1] Donovan A. Johnson and Robert Rahtz, The New Mathematics in Our Schools (New York: The Macmillan Company, 1966; London: Collier-Macmillan Limited, 1966), p. 6.

[2] Luke 5:36-39.

Looking back over the panorama of educational change one can identify several highly significant events which dominated the course of subsequent reform. When this country entered World War II and the military discovered that the men were deficient in mathematics, they began to institute special courses to bring up the level of proficiency. The second of these events, and maybe the most dynamic force, was the news of the USSR launching of Sputnik I in 1957, which brought many Americans to the realization that our national efforts in science and mathematics had to become more strenuous.[3] And the third of these events has been dominated by the so-called "pursuit of excellence." Such pursuit began to take place in the curriculum of mathematics during the first half of the 1950's as a result of many forces. Some of the most important ones are:

1. The rapid growth of mathematics during the past one hundred and fifty years;
2. The revolutionary development of science and technology during this century;
3. A growing concern about the neglect of the superior student;
4. The historical tendency for college and university mathematics to move downward to lower grades;
5. A great increase in the collaboration among mathematics teachers at the college and high school levels;
6. An awareness of the great technological and mathematical progress of the USSR;
7. The huge financial support given by the federal government and large foundations to the improvement of mathematics education;

---

[3]Carl B. Allendoerfer, "The Second Revolution in Mathematics," The Mathematics Teacher (December, 1965), p. 690.

8. The emergence of vigorous and imaginative leadership in mathematics education in various universities and professional organizations.[4]

Though there are many factors that determine the outcome of excellence, the groups that undertook reform focused on curriculum and argued that if this component were improved the teaching of mathematics would be successful.

II. THE CONFLUENCE OF THE NEW MATH

On the basis of unified view of their common domain attained in the four centuries preceding this study, and in particular the last half of the twentieth century, mathematicians once interested in the school curriculum were naturally eager to see the nature, spirit, and excitement of their work conveyed to the children in the grades. The essence of their recommendations had been to modify the disproportionate emphasis on numeration systems and computational alogrithms in favor of increased attention to mathematical ideas. Hence, in order adequately to prepare the pupils in junior high school for rapid progress into significant mathematical activity, the former compartmentalization of mathematics into arithmetic, algebra, and geometry had been abandoned. In its place, the expansion of set theory and the subsequent exhaustive treatment of logic, real numbers, and geometry were being urged for implementation into a systematic program of premathematics instruction

---

[4]John J. Kinsella, Secondary School Mathematics (New York: The Center for Applied Research in Education, Inc., 1965), p. 15.

in the grades, to be followed by an axiomatic development at the junior and senior high school levels.[5]

As it turned out, the reform offered as much a new approach to the traditional curriculum as it did new contents, and some of the committees that were fashioned to influence such changes emphasized this fact. Nevertheless, the commission contended to drop the traditional subject matter in favor of such newer fields as abstract algebra, topology, symbolic logic, set theory, and Boolean algebra. The slogan of reform became new math.[6]

III. THE BIRTH OF THE NEW MATH

This section is devoted to brief descriptions of a number of projects contributing to the birth of the new math. There is not enough space here to do justice to all aspects of each project. This is merely a sampling which hopefully will enable the reader to perceive some trends and to recognize the complexity of the continued development of the new math.

The decade beginning in 1952 will be remembered as the one in which programs involving newer mathematics for the college-capable high school student blossomed.

---

[5]Robert B. Davis, "The Changing Curriculum: Mathematics," Association for Supervision and Curriculum Development, NEA (1967), pp. 1-4.

[6]Evelyn Sharp, "Progress Report on the Mathematics Revolution," Saturday Review (March 20, 1965), pp. 62-63.

The University of Illinois Committee on School Mathematics (UICSM), was a joint committee of the College of Education, the College of Engineering, and the College of Liberal Arts at the University of Illinois. It was developed in 1952 as an indirect result of the College of Engineering's dissatisfaction in the mathematical preparations of entering freshmen, the deficiencies in the computational facility, the insufficient conceptual background, the negligence of proofs and of mathematical structure outside geometry courses, the lack of contemporary applications of mathematics in natural science, social science, and technology, and the inadequate implementation of the knowledge of the learning process in the teaching of mathematics.[7]

In attacking the problem of preparing courses to reduce the weakness of the traditional curriculum, UICSM was guided by several hypotheses:

1. A consistent presentation of mathematics can be devised.
2. Students are greatly interested in ideas.
3. Manipulative tasks, while important, should be used mainly to give insight into basic concepts.
4. The language which the students read in the textbooks, or heard from the teacher, should be as unambiguous as possible.
5. The materials should be organized in such a fashion that the student would have abundant experiences in discovering generalizations.

---

[7]Max Beberman, An Emerging Program of Secondary School Mathematics (Cambridge, Mass.: Harvard University Press, 1958).

It was the hope of this committee that the implementation of such principles would promote students' understanding of mathematics and an enthusiasm for it.[8]

In 1955, aware that its mathematics tests were no longer fully adequate for the programs being initiated in some of the foremost public and private secondary schools, the College Entrance Examination Board appointed its Commission on Mathematics to make a comprehensive study of the secondary school mathematics curriculum and to make recommendations for its "modernization, modification, and improvement."[9] The main product of this commission was its report, Program for College Preparatory Mathematics, published in 1959.[10] It called for improvement of high school teachers, and argued for closer articulation of high school and college courses. The program called for:

1. Preparation for college mathematics at the level of calculus and analytic geometry;
2. Understanding of deductive reasoning not only in geometry but in other fields, such as algebra;
3. Appreciation of mathematical structure illustrated by properties of sets of numbers;
4. Judicious use of unifying ideas, such as sets, variables, functions, and relations;
5. Treatment of inequalities along with equations;
6. Insertion of some coordinate geometry and solid geometry into the plane geometry course;
7. Introduction of fundamental trigonometry centered on coordinates, vectors, and complex numbers;

---

[8]M. Eleanor, "A Secondary School Mathematics Program," The Bulletin of the National Association of Secondary School Principals (May, 1959), pp. 12-18.

[9]Commission on Mathematics, College Entrance Examination Board: Program for College Preparatory Mathematics and Appendices (Princeton, N.J.: Educational Testing Service, 1959), p. xi.

[10]Ibid.

8. Emphasis on elementary functions (polynomial, exponential, circular);
9. Recommendations of additional alternative units such as probability and statistical inference or modern algebra.[11]

Except for points (6) and (7), the nine-points program agreed with that of UICSM. (The latter did not introduce solid geometry into its geometry unit, nor introduce courses in probability and statistics as an introduction to modern algebra.)

These sets of recommendations by the Commission of Mathematics were published to guide the first steps elementary and secondary schools could take to come of new math age.

These suggestions were subsequently implemented by the School Mathematics Study Group in the form of experimental materials which were to serve as models for a new generation of textbooks.

Following the national humiliation in 1957 by the Russian launching of Sputnik, education was once again linked powerfully to the nation's destiny. Mathematics study groups and projects flourished at many universities and colleges. Some school districts also began to initiate new curricula.

Because this section is devoted to brief descriptions of these projects which contributed to the birth of the new math, and because of the limited space here to do justice to all aspects of each project, Table 1 provides a brief summary of the facts related to the most influential experimental projects which influenced curricular

---

[11] New Development in Secondary School Mathematics (Washington, D.C.: National Council of Teachers of Mathematics, May, 1959).

TABLE 1

DEVELOPMENTAL MATHEMATICS CURRICULUM PROJECTS

Name of Project	Director and Address	Began	Summary of Basic Purposes
School Mathematics Study Group (SMSG)	E. G. Begle Cedar Hall Stanford U. Stanford, Calif.	1959	1. To provide a curriculum based on mathematics rather than social applications. 2. To develop courses of study, teaching materials; to promote inservice education. 3. To emphasize precision of language, knowledge and appreciation of mathematical systems.
Greater Cleveland Mathematics Program	G. H. Baird Greater Cleveland Research Council 75 Public Square Cleveland, Ohio	1959	1. The logical and systematic presentation of arithmetic to all children that will enable them to understand basic mathematical concepts before being taught computational schemes.
University of Illinois Arithmetic Project (UIAP)	David Page 887 Commonwealth Avenue Newton, Mass.	1958	1. To devise materials to help children view work in mathematics as a fascinating adventure. 2. To stimulate curiosity, exploration, experimentation, and discovery.
Madison Project of Syracuse University and Webster College	R. B. Davis Smith Hall Syracuse University Syracuse, New York	1957	1. To revitalize the teacher education program in mathematics. 2. To develop, disseminate, and implement a supplementary program for nursery school through grade 12.

TABLE 1 (continued)

Name of Project	Director and Address	Began	Summary of Basic Purposes
Minnesota Mathematics and Science Teaching Project (MINNE MAST)	James H. Werntz, Jr. 720 Washington Avenue S.E. Minneapolis, Minnesota (Initially Prof. Paul Rosenbloom)	1961	1. To produce a curriculum based on what children can learn; prepare teachers to teach it. 2. Emphasis on mathematic structure for its own sake as well as strong emphasis on applications.
University of Maryland Mathematics Project (UMMaP)	John Mayor College of Education University of Maryland College Park Maryland	1959	1. To contribute to improved teaching of mathematics. 2. To produce experimental textbooks for elementary school teachers. 3. To develop inservice courses.
Stanford Project	Patrick Suppes Ventura Hall Stanford Univ. Stanford, Calif.	1959	1. To develop an elementary mathematics program from the notion of sets and operations on sets. 2. To develop a program of geometry for the primary and intermediate grades. 3. To assess an experimental project on logic for grades 5 and 6, designed for the academically gifted.
Computer-Based Mathematics Instruction	Patrick Suppes Ventura Hall Stanford Univ. Stanford, Calif.	1963	1. To provide a controlled environment for psychological and pedagogical studies of learning. 2. Drill and practice in elementary mathematics: mathematical logic for grades.

TABLE 1 (continued)

Name of Project	Director and Address	Began	Summary of Basic Purposes
Cambridge Conference on School Mathematics	Hugh P. Bradley Educational Services, Inc. 55 Chapel Street Newton, Mass.	1963	1. To explore curriculum reform needs in mathematics with a view to the long-range future.
Patterns in Arithmetic	Henry Van Engen R&D Center for Learning 1404 Regent Street Madison, Wisconsin	1964	1. The development of a self-contained mathematics program to be used in classr-om units for instruction and teacher training.
Project Mathematique de Sherbrooke	Zoltan P. Dienes 1382 rue Dominion Sherbrooke Province de Quebec Canada	1965	1. Emphasis on structure of the foundations of mathematics; laboratory work with classroom work; concrete experiences in varied situations; logic started as soon as the child comes to school.

change especially in the fifteen years immediately preceding this study.[12]

A glance at Table 1, especially the section labeled "Summary of Basic Purposes," indicates a sample of the wide variety of experimental approaches used in an attempt to update school mathematics programs. The questions of where these innovations were leading and how they should be instituted were a matter of great concern to educators who had the responsibility for developing local school mathematics programs which were ~~of~~ in constant need ~~for~~ of evaluation, revision, and strengthening in the light of the new social and intellectual development.[13]

IV. SUBSTANCE OF THE NEW MATH

What is the new math? An obvious informative answer is that new mathematics is mathematics that is new.[14] It is, however, more appropriate to speak of the new program in mathematics in our schools than to speak of the program in new mathematics.[15]

---

[12]David J. Lockard, Report of the International Clearinghouse on Science and Mathematics Curricular Developments (College Park, Md.: American Association for the Advancement of Science and the Science Teaching Center, May, 1967).

[13]Davis, loc. cit.

[14]The Continuing Revolution in Mathematics (Washington, D.C.: National Council of Teachers of Mathematics, 1968), pp. 4-5.

[15]F. Lynwood Wren, "It's Not How New You Make It, But How You Make It New," The Arithmetic Teacher (January, 1971), p. 7.

For the purpose of this study, the following articles will attempt to explain some important features that characterize many of the newer school mathematics programs.

The most emphasized topic in the new math which has attracted public attention is the set language. Although this topic was taught in graduate courses in mathematics prior to 1950, in 1975 the language of sets and a few of its simple properties and theories were taught from the kindergarten up.[16]

The objectives of teaching this basic concept of mathematics, set theory, were to clarify understanding and to unify various branches of mathematics.[17]

The important contribution of teaching sets is to be found in:

> . . . the simplicity of idea and precision of language that the concept brings to the curriculum and to classroom instruction. This simplicity enables the three-year-old to answer the question "Mary, how many cookies do you have on your plate?" by placing each of three fingers on each of the three cookies and then, without saying a word, holding up the three fingers for the interrogator to see, not hear, the answer to his question. In this simple performance the child not only answers the question in a universal language understood around the world, but also she exhibits the simplicity and power of the concept of one-to-one correspondence between the elements of two sets and of the concept of the cardinality of a set . . . The implication of set concepts and operations can be used also to advantage in algebra and geometry.[18]

---

[16]Morris Kline, Why Johnny Can't Add: The Failure of the New Math (New York: Random House, 1973), p. 101.

[17]Dorothy Geddes and Sally I. Lipsey, "Sets--Natural, Necessary, Knowledge?" The Arithmetic Teacher (April, 1968), p. 337; Norbert Lerner, "'Sets' and Elementary School Mathematics," The Arithmetic Teacher (November, 1958), p. 239.

[18]Wren, op. cit., pp. 7-8.

However, as things stood at the time of this study, it is important to notethat no major publisher would have been so foolhardy as to bring out a textbook for school mathematics in which the concepts of sets were not discussed at some length.[19]

The second change which the new math brought about was the topics of bases. These topics were introduced to aid the children to a better understanding of base ten and the operations of arithmetic.[20]

The third common topic in the new math was the study of congruences. This subject was frequently introduced by what is called clock arithmetic. The purpose of such a topic was to promote interest in numbers arithmetic and develop new addition and multiplication tables. For example, modula 6 will interpret the fact of 4 X 3 = 12 to 4 X 3 = 0.[21]

The new math replaced memorization of meaningless number facts to reasoning, by the study of principles, postulate, and the fundamental concepts of symbolic logic. It also recognized the commutative principle and recommended it as being useful to children studying addition and multiplication.[22]

---

[19] Continuing Revolution in Mathematics, p. 9.

[20] Kline, op. cit., pp. 103-104.

[21] Helen L. Garstens, "University of Maryland Mathematics Project," The Arithmetic Teacher (February, 1960), pp. 61-65.

[22] Clyde G. Corle, "The New Mathematics," The Arithmetic Teacher (April, 1964), p. 244.

> Principles involving the commutative, associative, and distributive laws of mathematics are a fundamental part of the newer experimental program. Through the application and understanding of these principles, children are assisted in developing not only skill, but also concepts of the flexibility which is possible in mathematics, and understandings underlying the algorithms or forms of recording mathematics.[23]

Before introducing students to the rather intricate problems of logical proof, the new math exposed them at an early stage to the "intuitive and perceptual basis of geometry."

> Now being taught in the elementary school are such highly intuitive concepts as these: Convex and concave figures; the symmetry properties of squares, triangles, and circles, as well as the symmetry properties of familiar objects such as plates, glasses, tables, and chairs; and simple constructions with straightedge and compass; such as bisecting an angle or finding the midpoint of a line segment.[24]

> Concepts of linear measure, area measure, and measures of capacity are also introduced. Topics that were part of traditional high school mathematics are now placed in earlier grades because educators believe young children are capable of learning much more than was previously assumed.[25]

The new math strove to be as mathematically correct as possible. The number-numeral distinction was another characteristic of the new math.

> The numeration system devised by early man is used by most new programs to enhance children's understanding of the Hindu-Arabic numeration system. Pupils are enthralled by a survey

---

[23]Edwina Deans, Elementary School Mathematics: New Directions (Washington, D.C.: U.S. Department of Health, Education and Welfare, 1963), p. 8.

[24]Patrick Suppes, "Adding Up the New Math," PTA Magazine (October, 1965), p. 9.

[25]Irwin K. Feinstein, "Mastering Modern Math," PTA Magazine (September, 1964), pp. 21-22.

> of Egyptian, Roman, Mayan, Babylonian, and Japanese numeration systems and realize that the Hindu-Arabic system took ages to develop.[26]

An emphasis on mathematical structure was a means that the new math used to help pupils understand the mathematics they were learning.

> It emphasizes the structure of mathematics, rather than isolated topics. For example, algebra and geometry had been treated as though they were disjoint disciplines. Separated by a long summer and taught by different teachers who had become specialists only within their own subjects. "Theorems" were unique to geometry, whereas "equations" were unique to algebra. Now students are led to understand that these two subjects have their counterparts in each other . . .[27]

Thus, rather than learning individual mathematical facts in a disconnected manner, the child was expected to get a feeling for the entire system.

Another innovation in the new math was the early introduction and use of equations.

> Children are encouraged to think of problems as stories, visualize the action going on in the story, translate this action into an arithmetic sentence, and then perform the necessary computation to find the answer.[28]

In keeping with the emphasis on abstraction and structure, the new math introduced Boolean algebra, to aid in reasoning and to be used as an alternative to the use of truth tables, the notions of group and field, relation and function, inequalities, and matrices.[29]

---

[26] Ibid.

[27] Allen F. Strehler, "What's New About the New Math?" Saturday Review (March 21, 1964), p. 69.

[28] Sister Mary Petronia, "A Letter to Parents about the New Mathematics,'" The Arithmetic Teacher (October, 1966), p. 471.

[29] Kline, op. cit., pp. 104-107.

There is also a great deal more involved in the new math than just new subject matter. Different ways of looking at mathematics and different ways of communicating with pupils have also been involved in changes in the mathematics program.[30] The new math is for the purpose of fresh emphasis in instruction and learning.

> The basic design of the contribution of newness is to place as much emphasis on the resources of understanding and appreciation as on the mechanics of manipulation. To keep abreast of current recommendations for an effective program in school mathematics, one should keep in mind three fundamental criteria as guides in determining what program of content selection and what procedure in instructional techniques to follow.
>
> 1. There must be emphasis on the "what" and "why" of understanding and interpretation, as well as the "how" of operation.
> 2. It's now how new you make it. It's how you make it new.[31]

The new math as a whole introduced subject matter to the students earlier than was previously thought possible. An attempt was made in 1963 at the Cambridge Conference in the report entitled Goals for School Mathematics by 1990.

> A student who has worked through the full thirteen years of mathematics in K-12 should have a level of training comparable to three years of top-level college training today; that is, we shall expect him to have the equivalent of two years of calculus, and one semester each of modern algebra and probability theory.[32]

---

[30] Nuffield Mathematics Project, I Do, and I Understand (New York: John Wiley and Sons, Inc., 1967), pp. 3-5.

[31] Wren, op. cit., p. 9.

[32] Cambridge Conference on School Mathematics, Goals for School Mathematics (Boston: Houghton Mifflin Co., 1963), p. 24.

It also prepared a first draft of the proposed new organization of the mathematics curriculum, outlining it grade by grade.

V. RESEARCH AND THE NEW MATH

A research report on the New Math developed at St. Joseph School, Milwaukee, Wisconsin, and other Catholic Schools in the United States concluded that:

> . . . learning elementary mathematics by means of a new curriculum which is entirely different from the conventional textbook curriculum previously used in St. Joseph School before 1957, shows gain in achievement as measured by scores on the California Arithmetic Achievement Test and Science Research Associates Arithmetic Test, administ ered during the school year 1957-1958 and 1958-1959, which are enough magnitude to indicate that the new curriculum is a great improvement over the conventional curriculum and textbook materials previously used in the school.[33]

A study conducted by the SMSG materials for grades 4, 5, and 6, revealed that the norms for higher grades were higher than the norms for lower grades.[34]

E. G. Begle proclaimed that the evidence for such findings was the result of the new mathematics educational system. Begle supported his finding with the result given by the National Longitudinal Study of Mathematical Abilities.

---

[33]Andrew F. Schott (Consultant to Education, Inc.), "The Fifth Study in the Improvement of Elementary Mathematics Education" (1960), p. 52.

[34]William D. Grafft, "Cognitive Outcomes of the SMSG Mathematics Program in Grades 4, 5, and 6" (Unpublished Doctoral dissertation, University of California, 1966).

> . . . two geometry scales were administered at the end of grade six. It turned out that those students who had used, from the beginning of grade four, texts that include geometry scored higher on these scales than students whose texts did not include geometry.[35]

He also concluded that the new curriculum of mathematics clearly influenced what the student learned and demonstrated that the loation of specific topics in the curriculum should be based not on the age of the student, but rather, on the overall structure of mathematics.[36]

The research staff of National Assessment, under the direction of Thomas Knapp, conducted a mathematics study in the winter of 1967-68. The primary objectives were to compare the version using the accepted formal language in a mathematics exercise with the version using parallel exercises that were revised to be less formal. The study revealed no essential differences in using the formal versus informal language.[37]

VI. PUBLIC PERCEPTIONS OF THE NEW MATH

Writing about the new math in the mid-seventies was a safe and popular venture. As a consequence, the subject was a perfectly acceptable conversation piece at just about any kind of social

---

[35]E. G. Begle, "Some Lessons Learned by SMSG," Mathematics Teacher (March, 1973), p. 207.

[36]Ibid., p. 210.

[37]Dale I. Foreman and William A. Mehrens, "National Assessment in Mathematics," The Arithmetic Teacher (March, 1971), pp. 141-142.

gathering, from fashionable cocktail parties to sessions around the office water cooler.[38]

To reflect this general and widespread interest, this section will include a review of articles with the following criteria:

1. The article was published in a magazine indexed by the Readers' Guide.

2. The article said something about school mathematics, i.e., at the below-college level.

3. The article was published in a magazine whose readership would not contain a disproportionate number of professional educators and/or mathematicians. Magazines such as the NEA Journal, School and Society, Scientific American, Mathematics Teacher, etc., which the nonprofessional is less likely to read and in which more penetrating discussions of new math were likely to appear, were excluded.

Previously there had been articles on the subject, but at no time before was there such an accumulation of articles as occurred immediately after the mathematics revolution. In 1956, three of these articles appeared with clearly negative titles and stories to match: "Why Johnny Can't Add,"[39] "Least Popular Subject,"[40] and "Digits and Dunces."[41] A fourth article in Fortune, entitled "Path to Math,"[42] was

---

[38]Strehler, op. cit., pp. 68-69.

[39]R. Dunbar, "Why Johnny Can't Add," Saturday Review (September 8, 1956), p. 28.

[40]"Least Popular Subject," Time (June 18, 1956), p. 74.

[41]"Digits and Dunces," Newsweek (April 9, 1956), p. 78.

[42]"Path to Math," Fortune (April, 1956), p. 110.

equally negative in viewpoint. In this article the editor lamented the fact that while we cry for the more and better mathematically trained people, the proportion of high school students who take college preparatory mathematics is seriously declining.

A fifth article that year, "Math Demonstrates It Still Appeals to Youngsters,"[43] described a mathematics contest in Toledo. Both the title ("Still") and the story suggest that what happened in that city represented an exception to the general rule that most youngsters detest mathematics.

In retrospect, an article appeared in Time under the title, "Math and Ticktacktoe,"[44] marking the beginning of a perceptible trend among subsequent authors of popular magazine articles on new math to differ almost blindly to the potential magic of the new math and the new curricular innovators in mathematics. As it turned out, for nearly a decade to follow, this buoyant, brighter outlook was to be the prevailing tenor of just about every popular magazine article on new math to appear. Not until the final year of the decade, 1965, did authors appear in these magazines to question the validity and appropriateness of the innovators' handiwork with one possible exception: A Newsweek article which appeared in 1959 reported on a publication by the Council for Basic Education in which the ability of U.S. children in arithmetic was compared unfavorably with that of European children.

---

[43]"Math Demonstrates It Still Appeals to Youngsters," Business World (March 31, 1956), pp. 24-25.

[44]"Math and Ticktacktoe," Time (July 23, 1956), pp. 78-80.

The middle eight years of the 1956-65 decade were the happy years for the new math--insofar as public image was reflected in these m magazines. During that period articles appeared with such upbeat titles as these: "The Wonderful World of Why,"[45] "Math Made Easy,"[46] "Captivating Key to Math,"[47] and "She Turns Figures into Fun."[48]

While there was not any noticeable outcropping of doubt about the worth of new math until the very recent years before this study, there did appear throughout the first decade of the new math a fair amount of discussion about parental inadequacies in trying to understand the mathematics children were being taught. For example, Peter Drucker reflected this early viewpoint very well in his article "Math Every Parent Can Understand."[49] In it he remarked that parents bought books that explained the new math to them to help them cope with Junior's mathematics.

In later years of the first decade, there appeared a growing tendency for articles to take greater pains in trying to explain to the uninitiated details of content. Such articles as "Spare Me the

---

[45]Helen Rowan, "The Wonderful World of Why," Saturday Review (November 2, 1957), pp. 42-45.

[46]"Math Made Easy," Newsweek (February 8, 1960), p. 91.

[47]"Captivating Key to Math," Life (February 10, 1961), p. 47.

[48]James Gordon Stewart, "She Turns Figures into Fun," Reader's Digest (June, 1961), pp. 211-212.

[49]Peter F. Drucker, "Math Every Parent Can Understand," Harper's (April, 1958), pp. 73-75.

Rods,"[50] "New Math: You Don't Count on Your Fingers Anymore,"[51] and "How to Check with Arithmetic,"[52] appeared to provide explanation to parents for such subjects as sets, nondecimal systems, and the like. Other articles such as "Mastering Modern Math,"[53] and "Inside Numbers,"[54] in addition to their contribution in teaching parents the new math and promoting floods of mathematics books for them, were projecting a highly favorable attitude toward new math.

In these later years, there was in evidence a general tendency toward moderation of hopes and claims. Such moderation is well illustrated in three articles, "Adding Up the New Math,"[55] "Progress Report on Mathematical Revision,"[56] and "New Math Your Children May Be Learning."[57] In them the reader is given an overview of the "new math movement." The advantages were cited and continued to prevail in these

---

[50]Aloise B. Heath, "Spare Me the Rods," National Review (December 31, 1963), pp. 562-566.

[51]Evelyn Sharp, "New Math: You Don't Count on Your Fingers Anymore," Saturday Review (January 19, 1963), pp. 65-67.

[52]R. R. Denny, "How to Check with Arithmetic," Better Homes and Gardens (January, 1963), pp. 76-78.

[53]Irwin Feinstein, "Mastering Modern Math," PTA Magazine (September, 1964), pp. 19-22.

[54]"Inside Numbers," Time (January 31, 1964), pp. 34-35.

[55]Suppes, op. cit., pp. 8-10.

[56]Evelyn Sharp, "Progress Report on Mathematical Revision," Saturday Review (March 20, 1965), pp. 62-63.

[57]"New Math Your Children May Be Learning," Good Housekeeping (January, 1965), pp. 132-133

articles, but at least the suggestion of some possible shortcomings achieved mention.

Of greater importance with respect to trends, perhaps, was the appearance of two other articles in 1965 in the popular magazines. It may well be that some future researcher will note them to be as equally pivoted as the 1956 Time article in marking a change in public mood. The first of the two appeared again in Time under the title "Trials of New Math."[58] It discussed the possibility that we may have gone too far with new math in the elementary grades, at the cost of ability to compute.

The second article appeared in the Newsweek magazine under the title "New Math--Does It Really Add Up?"[59] Here, for the first time in the history of the new math an article on balance suggested "no" as the answer to the question in its title.

The article concluded with: "The new mathmen . . . seem willing to go along with a hunch," the hunch being (according to Newsweek), Professor Jerome Bruner's statement that "Any subject can be taught in some intellectually honest form to any child at any stage of development."

At the beginning of 1967, an article under the title "Poor Marks in Math for U.S. Pupils, But--" appeared in the U.S. News and World Report, indicating that the U.S. Office of Education pointed out that although America had a more comprehensive system of education than other

---

[58]"Trials of New Math," Time (January 22, 1965), p. 38.

[59]"New Math--Does It Really Add Up?," Newsweek (May 10, 1965), pp. 112-118.

countries, U.S. school children really lagged behind foreign students in the study of mathematics. The article concluded that some educators were questioning this finding.[60] Furthermore, John L. Creswell in an article under the title, "Are American Children Behind in Math?," published by the Parents Magazine, objected to the outcome of an international math test, IMT, and advocated that this test was neither a reasonable measure of what our children were learning from the new math nor a good instrument to gauge their potential mathematical skill.[61]

Within the ten-year period 1964-1974, as as a result of the early public cynicism toward the new math and of the many articles that were written to describe the characteristics and values of the mathematics revolution, two had clearly described why certain changes were made and what improvement could be expected from these changes. The first article under the title "What is the New Mathematics?[62] appeared in the Education Digest to characterize the innovation of the new math, and the second article published by the American Education, "New Math Roadshow: Madison Project" advocated that the new math could be comprehended by creative learning, experience, and activity packages.[63]

---

[60]"Poor Marks in Math for U.S. Pupils, But--," U.S. News and World Report (March 20, 1967), p. 12.

[61]John L. Creswell, "Are American Children Behind in Math?" Parents Magazine (March, 1968), pp. 58-59.

[62]Stephen S. Willoughby, "What is the New Mathematics?" Education Digest (September, 1968), pp. 47-50.

[63]Patricia Pine, "New Math Road Show: Madison Project Workshop for Teachers," American Education (July, 1968), pp. 27-29.

In response to an article published by the Reader's Digest in 1966 under the title "Why Parents Can't Add"[64] advocating that the reason why Johnny can't add is because his parents can't do his homework, a series of articles began to appear in behalf of those parents who were confronting the new math problem. For example, articles under titles: "Who is Afraid of the New Math?,"[65] "Mom and Dad Study the New Math; Course Sponsored by PTA of Beanmont, Texas,"[66] "How They're Teaching Math to Your Kids; New Math,"[67] and "Mathematics for the Very Young,"[68] attempted to provide a parents' guide to the new math, enlighten those who had been puzzled and, in many cases, disturbed by the so-called new math being taught to their grade school level children, and explain what was happening in the comic strip "Peanuts" in relation to the basic methods of math reasoning.

To overcome these difficulties, the RCA Victor, in an article, published by the Saturday Review, under the title "The New Math at 33-1/3,"[69] came out with a set of eight albums (LPM 8501/8, mono only)

---

[64]Art Buchwald, "Why Parents Can't Add," Reader's Digest (October, 1966), pp. 151-152.

[65]Alan Van Dine, "Who's Afraid of the New Math?" Parents Magazine (September, 1967), pp. 62-63.

[66]J. L. Creswell, "Mom and Dad Study the New Math," Parents Magazine (September, 1966), pp. 58-59.

[67]"How They're Teaching Math to Your Kids," Changing Times: The Kiplinger Magazine (November, 1969), pp. 19-22.

[68]Louis Ellison, "Mathematics for the Very Young," Parents Magazine (July, 1969), pp. 88-89.

[69]Nathan Cohn, "The New Math at 33-1/3," Saturday Review (March 16, 1968), p. 55.

In the early seventies, there appeared a growing tendency for articles to take greater pain in trying to strike out the new math and chronicle its growth in scathingly critical publications.

The major part of the controversy on new math was the parents' concern over the ssemingly falling behind of.computational skill. Articles appeared under the titles "Is the New Math Doing the Job?,"[70] "New Math Strikes Out,"[71] "Does New Math Add Up,"[72] "Reflections Mathematics and Creativity,"[73] and "New Math: Success/Failure."[74] Some of these articles tended to reduce the emphasis on rote (or memorized) knowledge, and added more emphasis to concepts and heuristic problem analysis, while other articles tended to emphasize rote knowledge by showing concern over the seemingly falling behind of computational skill.

> Since the fabric of the world is the most perfect, and was established by the wisest Creator, nothing happens in this world in which some reason of maximum or minimum would not come to light.
>
> Euler

---

[70] J. H. Lawson, "Is the New Math Doing the Job?" Education Digest (December, 1973), pp. 16-17.

[71] Richard Martin, "The New Math Strikes Out," Science Digest (October, 1973), pp. 65-69.

[72] F. Kendig, "Does New Math Add Up?" Time (January 6, 1974), pp. 14-15; (January 27, 1974), p. 4.

[73] Alfred Adler, "Reflections Mathematics and Creativity," New Yorker (February 19, 1972), pp. 39-45.

[74] R. B. Davis, "New Math: Success/Failure," Education Digest (March, 1974), pp. 10-12.

CHAPTER III

METHODS AND PROCEDURES

During the year 1960-1975 a new curriculum for the elementary and secondary schools had been fashioned by dozens or more groups of professional mathematicians, mathematics educators, and teachers. This new curriculum of mathematics permitted the introduction of new units with new vocabulary into the elementary and middle school curriculum and much of the collegiate mathematics into the high school curriculum.[1]

As it turned out, the reform offered as much a new approach to the traditional curriculum as it did new contents. Hence, the question of whether the new curriculum actually improved the teaching of mathematics and indeed made the subject more accessible to students is important.[2] Consequently, in this study, consideration was given, through descriptive research, to the opinion of mathematics teachers in elementary, middle, and secondary school levels in school systems in North Alabama.

I. THE POPULATION

The questionnaire and the opinion scale (see Appendix) were

---

[1]Monroe D. Cohen, "The Strange Case of the New Math," Childhood Education (February, 1974), p. 210.

[2]Morris Kline, "The New Math: A Passing Aberration," Learning (January, 1974), p. 18.

distributed to a population randomly chosen consisting of 987 teachers of mathematics, employed during the 1974-75 school year in 136 school systems in the following twelve counties in North Alabama: Colbert, Cullman, Franklin, Jackson, Lauderdale, Lawrence, Limestone, Madison, Marion, Marshall, Morgan, and Winston. The addresses of schools (see Appendix) were randomly drawn from the Educational Directory 1974-75 of the State of Alabama, Department of Education Bulletin 1975 No. 1.

II. DESCRIPTION OF THE INSTRUMENTS

The Teacher Questionnaire

The Teacher Questionnaire (see Appendix) was constructed to gather data about selected personnel, educational, and experimental characteristics of teachers surveyed. The specific information requested were: sex, race, present age, number of years of teaching experience, recency of formal college or university training, highest degree held, present teaching level, attendance to institutions or workshops implementing the new mathematics, degree of familiarity with the new mathematics, and preference of a mathematics curriculum.

The Opinion Scale

The Opinion Scale (see Appendix) was constructed to allow the mathematics teachers to strongly agree, agree, show indecision, disagree, or strongly disagree with each statement relating to the new math. This part of the questionnaire consisted of fifteen items all related to the various aspects of the new math. These items were assimilated from a total of eighty opinions (see Appendix) given by various teachers

and related literature reflecting their judgment to various aspects of the new mathematics.

III. ADMINISTRATION OF THE INSTRUMENTS

In an attempt to find out what attitudes toward the new mathematics were held by teachers of mathematics in kindergarten, elementary, middle, and secondary school levels, the questionnaire and the opinion scale were distributed by mail to 136 schools out of a total of 225 schools found in the selected counties (see Appendix) in North Alabama. Teachers were asked to return the questionnaire in an enclosed self-addressed, stamped envelope. The teacher sample consisted of 442 elementary and kindergarten teachers, 367 middle and junior high school teachers, and 178 high school teachers.

IV. TREATMENT OF THE DATA

Because the nature of the study dealt with observed number of observations falling in each of various categories, the observations of data were arranged in the form of contingency tables and each null hypothesis was tested by the χ^2 (Chi square) distributions.

For a general discussion of the treatment of data assuming two criteria of classification A and B, with r categories or classes for A, and k classes or categories for B, a two-way table (as shown by Table 2) may be set up. In terms of the notation of this table, the number of subjects in the i^{th} category of A and the j^{th} category of B is N_{ij}. The sum or total number of observations in the i^{th} category

TABLE 2

SCHEMATIC REPRESENTATION OF A TWO-WAY CONTINGENCY TABLE WITH r CATEGORIES FOR A AND k CATEGORIES FOR B

A Criterion	B Criterion							
	B_1	B_2	B_3	.	B_j	.	B_k	Σ
A_1	N_{11}	N_{12}	N_{13}	.	N_{1j}	.	N_{1k}	$N_{1\cdot}$
A_2	N_{21}	N_{22}	N_{23}	.	N_{2j}	.	N_{2k}	$N_{2\cdot}$
A_3	N_{31}	N_{32}	N_{33}	.	N_{3j}	.	N_{3k}	$N_{3\cdot}$
.	.	.	.	.	.	.	.	.
A_i	N_{i1}	N_{i2}	N_{i3}	.	N_{ij}	.	N_{ik}	$N_{i\cdot}$
.	.	.	.	.	.	.	.	.
A_r	N_{r1}	N_{r2}	N_{r3}	.	N_{rj}	.	N_{rk}	$N_{r\cdot}$
Σ	N.1	N.2	N.3	.	N.j	.	N.k	N

of A is obtained by summing the i^{th} row over the k columns, so that

$$N_{i.} = \sum_{j=1}^{k} N_{ij}$$

The sum or total number of observations in the j^{th} category of B is obtained by summing the j^{th} column of the table over the r rows, so that

$$N_{\cdot j} = \sum_{i=1}^{r} N_{ij}$$

If all of the cell entries are summed the total number of observations is obtained, and this total is represented by n. Then

$$N = \sum_{i=1}^{r} \sum_{j=1}^{k} N_{ij}$$

The expected number for a cell (N_{ij}') is obtained by multiplying the total sum of the observation in the i^{th} category of A, ($N_{i.}$) by the total number of observations in the j^{th} category of B, ($N_{i.j}$) and dividing the product by the total number of observation (n), so that

$$N_{ij}' = \frac{N_i \cdot N_{\cdot j}}{N}$$

In order to calculate the χ^2 the difference between each observed and expected number for each cell is taken, these discrepancies are squared,

each squared discrepancy is divided by the corresponding expected number, and summed. Thus

$$\chi^2 = \sum_{i=1}^{r} \sum_{j=1}^{k} \frac{(N_{ij} - N_{ij}')^2}{N_{ij}'}$$

In order to evaluate the χ^2 the table of χ^2 is entered with the number of degrees of freedom available. Since it is true that the sum of the expected numbers in any row of the table will be equal to the sum of the observed numbers, then for any given row only (K-1) of the discrepancies will be free to vary. Similarly, it is true that the sum of the expected numbers for any given column will be equal to the sum of the observed numbers, then for any given column, only (r-1) of the discrepancies will be free to vary. Thus for any r χ k contingency table, the number of degrees of freedom will be given by df = (r-1) (k-1).

V. SUMMARY

This chapter has discussed the approach taken toward this study of the opinion of classroom teachers in North Alabama regarding the impact of the new mathematics. A discussion of the background for the study, a description of the population, and a description of the instruments were also given. The treatment of the data and the Chi square were also discussed. In the next chapter a presentation of the data and analysis of the data will be given.

CHAPTER IV

ANALYSIS AND PRESENTATION OF THE DATA

This chapter will present the findings of the study and will discuss some possible interpretations of these findings. The data will be presented as it relates to each of the hypotheses and exploratory questions. The .05 level of significance was selected as criterion of significance. The Multinominal Distribution and Two-Way Contingency Tables were used by The University of Tennessee Knoxville Computing Center to process this data.

The following categories were used as factors to which data could be compared in an effort to ascertain the effect of personal or background variables as a function of attitude toward the new mathematics:

1. Sex
2. Racial differences
3. Age group
4. Number of years teaching experience
5. Recency of college or university courses taken
6. Highest college or university degree held
7. Grade level of teaching
8. Degree of knowledge of the new mathematics
9. Attendance at workshops or institutions implementing the new mathematics
10. The teaching preference of mathematics

I. DATA PRESENTATION

Item 1

The new math teaches new routines far more useless than the traditional routines.

Table 3 presents the distribution of teachers' responses for the opinion survey scale to the above item by the ten categories under consideration. The data indicate that there are significant relationships between the sex of the teachers and their expressed responses. Fifty-four and three-tenths percent of all female teachers have either agreed or strongly agreed to item 1, whereas, only 49.7 percent of all male teachers have agreed or strongly agreed. Furthermore, the data reveal that there are significant relationships between the race of the teachers and their expressed responses. Of all white teachers 55.2 percent have agreed, whereas only 42.9 percent of all nonwhites have agreed, to item 1.

Under the category of age group, the data reveal significant relationships between the age of the teachers and their expressed responses. Of those who are 50 years of age or older, 53 percent of them have agreed to item 1, and as the teacher's age decreased, the percentage of those who agreed to item 1 also decreased. Only 46.3 percent of those teachers between the ages of 20 to 30 indicated their agreement to item 1.

The data also reveal significant relationships between the number of years of teaching experience of teachers and their expressed responses. Of those with 15 or more years of teaching experience,

TABLE 3

TEACHERS' RESPONSES TO OPINION SURVEY SCALE ITEM 1[a] BY SEX, RACE, AGE, TEACHING EXPERIENCE, RECENCY OF COLLEGE OR UNIVERSITY COURSES TAKEN, HIGHEST DEGREE HELD, PRESENT TEACHING LEVEL, KNOWLEDGE OF THE NEW MATH, ATTENDANCE AT NEW MATH INSTITUTIONS OR WORKSHOPS, AND TEACHING PREFERENCE

Criterion	Percentage of All Respondents SD+D	U	SA+A	Σ	χ^2	Sig.
Sex						
Male	33.8	12.0	54.3	527	6.78*	0.034
Female	43.0	7.3	48.7	193		
Race						
White	34.7	10.1	55.2	594	6.41*	0.040
Nonwhite	43.7	13.5	42.9	126		
Age Group						
20-30 years	37.2	16.5	46.3	242	18.07*	0.006
30-40 years	38.0	8.4	53.6	166		
40-50 years	37.9	7.9	54.2	177		
50 or more years	30.4	6.7	63.0	135		
Teaching Experience						
0-4 years	33.2	17.1	49.7	187	19.04*	0.004
5-9 years	42.0	10.6	47.3	188		
10-14 years	40.3	6.7	52.9	119		
15 or more years	31.9	7.5	60.6	226		
Recency of College or University Courses Taken						
Now taking	34.8	14.8	50.3	155	10.44	0.235
Within 1-4 years	37.2	10.9	52.0	304		
Within 5-9 years	40.5	9.5	50.0	148		
10 years or longer	30.4	5.3	36.4	112		
Highest Degree Held						
Less than bachelor's	31.3	0.0	68.8	32	11.88	0.064
Bachelor's	31.5	9.5	58.9	241		
Bachelor's plus graduate work	39.4	12.0	48.6	251		
Master's or above	18.8	12.2	49.0	196		

TABLE 3 (continued)

Criterion	Percentage of All Respondents SD+D	U	SA+A	Σ	χ^2	Sig.
Present Teaching Level						
Kindergarten	41.7	2.8	55.6	36		
Grades 1-4	34.3	13.2	52.5	318	23.81*	0.001
Grades 5-8	30.6	8.3	61.2	242		
Grades 9-12	50.8	11.3	37.9	124		
Knowledge of the New Mathematics						
Thorough understanding	44.6	8.0	47.3	224		
Average understanding	37.0	10.7	54.4	412	28.12*	0.000
Slight understanding	17.5	23.8	58.7	63		
No understanding	28.6	0.0	71.4	21		
New Math Institution or Workshop Attended						
Yes	40.9	9.0	50.1	455	13.24*	0.010
No	28.1	13.7	58.3	263		
Teaching Preference						
The traditional curriculum	19.0	8.2	72.8	232		
The new math curriculum	90.4	1.9	7.7	52	109.30*	0.000
A modification of both	38.9	13.1	47.9	434		
None of these	50.0	0.0	50.0	2		
TOTAL	261	77	382	720		
	36.5%	10.7%	53.1%	100%		

[a]Item 1. The new math teaches new routines far more useless than the traditional routines.

*Significant at the .05 level of significance.

60.6 percent of them agreed to item 1; whereas, only 47.3 percent of those with 5-9 years of experience agreed to the above item.

An examination of Table 3 reveals that there were no significant relationships between the recency of college or university training and the expressed opinions to item 1. Also, the data reveal that there was no significant relationships between the highest degree held and the expressed opinion toward item 1.

Under the category of grade level, a significant relationship was revealed between the grade level of teaching and the responses to the item. Those who agreed to item 1 were 61.2 percent of the middle school teachers (grades 5-8), 55.6 percent of the kindergarten teachers, 52.5 percent of the elementary teachers (grades 1-4), and 37.9 percent of the high school teachers (grades 9-12).

Under the category of knowledge of the new math the data show significant relationships between teachers' knowledge of the new math and their expressed responses. Those who agreed to item 1 were 71.4 percent of those who had no knowledge of the new math and only 47.3 percent of those who had thorough knowledge of the new math.

There were also significant relationships between the attendance at workshops or institutions which dealt with the implementation of the new math and teachers' responses to item 1. Of those who attended such workshops, 50.1 percent indicated an agreement to item 1, whereas only 58.2 percent of those who did not attend workshops agreed.

A significant relationship between the teaching preference and the expressed reactions to item 1 is detected from the data of Table 3.

Only 7.7 percent of those who chose the new math curriculum as their teaching preference agreed to item 1 as compared to 72.8 percent of those teachers who indicated the traditional curriculum as their teaching preference. Furthermore, 47.9 percent of those teachers who chose the modification of the new math curriculum also indicated their agreement to item 1.

Item 2

The formalism of the new math leads to an erosion of the vitality of mathematics and to authoritarianism in teaching.

Table 4 presents the distribution of teachers' responses for the opinion survey scale to the above item by the ten categories under consideration. The data reveal that there were significant relationships between the sex of the teachers and their expressed responses. Forty-five and four-tenths percent of all male teachers either disagreed or strongly disagreed to item 2 in comparison to only 42 percent of all female teachers who also disagreed or strongly disagreed to the same opinion.

The data distributed teachers' responses according to the race of the teachers and the expressed opinions to item 2. There was, however, a significant relationship between the age of the teachers and their response to the stated item. Of those between the ages of 20 to 30, 48.8 percent indicated their disagreement to item 2, and, as the teacher's age increased, the percent of those who disagreed decreased. Only 38.5 percent of those teachers who were 50 years of age or older indicated their disagreement to item 2.

TABLE 4

TEACHERS' RESPONSES TO OPINION SURVEY SCALE ITEM 2[a] BY SEX, RACE, AGE, TEACHING EXPERIENCE, RECENCY OF COLLEGE OR UNIVERSITY COURSES TAKEN, HIGHEST DEGREE HELD, PRESENT TEACHING LEVEL, KNOWLEDGE OF THE NEW MATH, ATTENDANCE AT NEW MATH INSTITUTIONS OR WORKSHOPS, AND TEACHING PREFERENCE

Criterion	Percentage of All Respondents SD+D	U	SA+A	Σ	χ^2	Sig.
Sex						
Male	45.4	27.9	26.8	527	26.79*	0.100
Female	42.0	13.5	44.6	193		
Race						
White	45.3	23.6	31.1	594	0.99	0.607
Nonwhite	40.5	26.2	33.3	126		
Age Group						
20-30 years	48.8	32.2	18.0	242	40.98*	0.000
30-40 years	47.6	24.1	28.3	166		
40-50 years	40.1	18.1	41.8	177		
50 or more years	38.5	17.0	44.4	135		
Teaching Experience						
0-4 years	44.4	32.6	23.0	187	36.76*	0.000
5-9 years	51.6	26.1	22.3	188		
10-14 years	46.2	13.4	40.3	119		
15 or more years	37.6	20.8	41.6	226		
Recency of College or University Courses Taken						
Now taking	45.2	30.3	24.5	155	48.07*	0.000
Within 1-4 years	49.7	26.6	23.7	304		
Within 5-9 years	45.9	16.9	37.2	148		
10 years or longer	27.7	17.9	54.5	112		
Highest Degree Held						
Less than bachelor's	9.4	9.4	81.3	32	55.25*	0.000
Bachelor's	36.5	27.4	36.1	241		
Bachelor's plus graduate work	50.6	25.9	23.5	251		
Master's or above	52.0	19.9	28.1	196		

TABLE 4 (continued)

Criterion	Percentage of All Respondents SD+D	U	SA+A	Σ	χ^2	Sig.
Present Teaching Level						
Kindergarten	44.4	5.6	50.0	36		
Grades 1-4	44.0	28.6	27.4	318	20.44*	0.000
Grades 5-8	43.4	25.6	31.0	242		
Grades 9-12	47.6	14.5	37.9	124		
Knowledge of the New Mathematics						
Thorough understanding	56.3	17.0	26.8	224		
Average understanding	43.9	28.2	27.9	412	71.87*	0.000
Slight understanding	17.5	30.2	52.4	63		
No understanding	9.5	0.0	90.5	21		
New Math Institution or Workshop Attended						
Yes	50.1	22.6	27.3	455	18.62*	0.001
No	34.6	26.2	39.2	263		
Teaching Preference						
The traditional curriculum	24.1	24.6	51.3	232		
The new math curriculum	84.6	9.6	5.8	52	97.17*	0.000
A modification of both	50.5	25.6	24.0	434		
None of these	50.0	0.0	50.0	2		
TOTAL	320	173	227	720		
	44.4%	24.0%	31.5%	100%		

[a]Item 2. The formalism of the new math leads to an erosion of the vitality of mathematics and to authoritarianism in teaching.

*Significant at the .05 level of significance.

The data also reveal significant relationships between the teaching experience of teachers and their expressed responses. Of those with 15 or more years teaching experience, only 37.6 percent disagreed to item 2, in comparison to 51.6 percent of those with 5 to 9 years of experience who also disagreed.

Under the category of recency of college or university courses taken, significant relationships were revealed between the recency of college or university training and expressed opinion to item 2. Of those who attended college or a university within 1 to 4 years, 49.7 percent disagreed, whereas only 27.7 percent of those teachers who had attended college or a university within 10 years or longer disagreed.

The data also reveal significant relationships between the highest degree held by the teachers and their expressed responses. A larger percentage of teachers with a higher degree indicated their disagreement to item 2. While 52 percent of the teachers with master's or above disagreed, only 36.5 percent of those with bachelor's and 9.4 percent of those with less than bachelor's disagreed.

Under the category of grade level a significant relationship was revealed between the grade level of teaching and the expressed responses. Those who disagreed to item 2 were 44.4 percent of the kindergarten teachers, 44 percent of grades 1-4, 43.4 percent of grades 5-8, and 47.6 percent of grades 9-12.

Under the category of knowledge of the new math, the data show significant relationship between teacher's knowledge of the new math,

and their expressed responses. Those who disagreed to item 2 were 56.3 percent of those who had thorough knowledge of the new math, 43.9 percent of those who had average understanding, 17.5 percent of those with slight understanding, and only 9.5 percent of those who indicated no understanding of the new math.

There was also significant relationship between the attendance at workshops or institutions which dealt with the implementation of the new math and teachers' responses to item 2. Of those who attended such workshops 50.1 percent indicated their disagreement to item 2, whereas only 34.6 percent of those who did not attend workshops disagreed.

A significant relationship between the teaching preference and the expressed reactions to item 2 is detected from the data of Table 4. Only 24.1 percent of those who chose the traditional curriculum as their teaching preference disagreed to item 2 in comparison to 84.6 percent of those teachers who indicated the new math curriculum as their teaching preference and responded with similar disagreement. Furthermore, 50.5 percent of those teachers who indicated the modification of the new math curriculum also disagreed to item 2.

Item 3

The subject of sets in the new math is of no use in understanding the elementary mathematics.

The data in Table 5 present the distribution of teachers' responses for the opinion survey scale to the above item by the ten categories

TABLE 5

TEACHERS' RESPONSES TO OPINION SURVEY SCALE ITEM 3[a] BY SEX, RACE, AGE, TEACHING EXPERIENCE, RECENCY OF COLLEGE OR UNIVERSITY COURSES TAKEN, HIGHEST DEGREE HELD, PRESENT TEACHING LEVEL, KNOWLEDGE OF THE NEW MATH, ATTENDANCE AT NEW MATH INSTITUTIONS OR WORKSHOPS, AND TEACHING PREFERENCE

Criterion	Percentage of All Respondents SD+D	U	SA+A	Σ	χ^2	Sig.
Sex						
Male	76.1	8.2	15.7	527	14.07*	0.001
Female	63.7	8.3	28.0	193		
Race						
White	71.0	8.2	20.7	594	6.44*	0.039
Nonwhite	81.0	7.9	11.1	126		
Age Group						
20-30 years	76.4	9.9	13.6	242	9.79	0.133
30-40 years	70.5	7.2	22.3	166		
40-50 years	74.0	7.3	18.6	177		
50 or more years	67.4	7.4	25.2	135		
Teaching Experience						
0-4 years	69.5	12.8	17.6	187	13.75*	0.032
5-9 years	76.1	5.9	18.1	188		
10-14 years	80.7	5.0	14.3	119		
15 or more years	68.6	8.0	23.5	226		
Recency of College or University Courses Taken						
Now taking	72.9	7.1	20.0	155	22.91*	0.004
Within 1-4 years	74.3	10.9	14.8	304		
Within 5-9 years	77.0	6.1	16.9	147		
10 years or longer	63.4	5.4	31.3	112		
Highest Degree Held						
Less than bachelor's	56.3	3.1	40.6	32	16.52*	0.011
Bachelor's	71.0	8.7	20.3	241		
Bachelor's plus graduate work	76.9	9.6	13.5	251		
Master's or above	77.4	6.6	15.9	196		

TABLE 5 (continued)

Criterion	Percentage of All Respondents SD+D	U	SA+A	Σ	χ^2	Sig.
Present Teaching Level						
Kindergarten	86.1	0.0	13.9	36		
Grades 1-4	81.1	7.9	11.0	318	38.47*	0.000
Grades 5-8	66.9	9.9	23.1	242		
Grades 9-12	58.9	8.1	33.1	124		
Knowledge of the New Mathematics						
Thorough understanding	77.7	7.1	15.2	224		
Average understanding	72.8	7.8	19.4	412	13.07*	0.042
Slight understanding	67.1	5.9	27.0	63		
No understanding	66.7	4.8	28.6	21		
New Math Institution or Workshop Attended						
Yes	77.4	7.0	15.6	455	14.20*	0.007
No	55.0	10.3	24.7	263		
Teaching Preference						
The traditional curriculum	58.6	10.3	31.0	232		
The new math curriculum	90.4	5.8	3.8	52	46.02*	0.000
A modification of both	78.3	7.1	14.5	434		
None of these	50.0	50.0	0.0	2		
TOTAL	524	59	137	720		
	72.8%	8.2%	19.0%	100%		

[a]Item 3. The subject of sets in the new math is of no use in understanding the elementary mathematics.

*Significant at the .05 level of significance.

under consideration. The data indicate that there were significant relationships between the sex of the teachers and their expressed responses. Seventy-six and one-tenth percent of all male teachers either disagreed or strongly disagreed to item 3, whereas only 63.7 percent of all female teachers disagreed. Furthermore, the data reveal that there were significant relationships between the race of the teachers and their expressed responses. Of all white teachers, 71 percent disagreed, and 81 percent of all nonwhite also disagreed to item 3.

An examination of Table 5 reveals that there was no significant relationship between the age of the teachers and their expressed responses to item 3. However, the data reveal significant relationships between the teaching experience of teachers and their expressed responses. Of those with 15 or more years of teaching experience, 68.6 percent disagreed to item 3, 80.7 percent of those with 10 to 14 years of teaching experience disagreed, and 76.1 percent of those with 5 to 9 years of teaching experience also indicated disagreement.

Under the category of recency of college or university courses taken, a significant relationship was revealed between the recency of college or university training and the expressed opinion to item 3. Those who disagreed were 72.9 percent of teachers taking courses in colleges or universities, 74.3 percent who had taken courses in colleges or universities, 74.3 percent who had taken courses within 1 to 4 years, 77 percent of those teachers who had taken courses within 5 to 9 years, and only 63.4 percent of those who took courses 10 years before this study or more.

The data also reveal significant relationships between the highest degree held by the teachers and their expressed responses. Data show a larger percentage of teachers with a higher degree indicating disagreement to item 3. The data show that those who disagreed were 56.3 percent of teachers with less than the bachelor's degree, 71 percent of the teachers with bachelor's, 76.9 percent of those with bachelor's plus graduate work, and 77.4 percent of those teachers holding master's or above.

Under the category of grade level, significant relationships can be detected between the grade level of teaching and the expressed responses. There was a smaller percentage of teachers of higher grade level of teaching who disagreed to item 3. Those who disagreed were 86.1 percent of the kindergarten teachers, 81.1 percent of the elementary teachers (grades 1-4), 66.9 percent of the middle school teachers, and only 58.9 percent of the high school teachers (grades 9-12).

Under the category of knowledge of the new math the data show significant relationships between the teachers' knowledge of the new math and their expressed responses. Knowledge of the new math tended to increase the percentage of those who disagreed to item 3. Those who disagreed were 77.7 percent of teachers with thorough understanding, 72.8 percent of those with average understanding, 67.1 percent with slight understanding of the new math, and only 66.7 percent of those with no understanding of the new math.

There were also significant relationships between the attendance at workshops or institutions which dealt with the implementation of the

new math and teachers' responses to item 3. Of those who attended such workshops, 77.4 percent disagreed, whereas only 65 percent of those who did not attend workshops disagreed.

A significant relationship between the teaching preference and the expressed reactions to item 3 can be detected from the data of Table 5, page 50. Only 58.6 percent of those who chose the traditional curriculum as their teaching preference disagreed as compared to 90.4 percent of those teachers who indicated the new math curriculum as their teaching preference and responded with similar disagreement. Furthermore, 78.3 percent of those teachers who indicated the modification of the new math also disagreed to item 3.

Item 4

The subject of bases in the new math is confusing and has no significance in aiding the understanding of base ten.

The data in Table 6 present the distribution of teachers' responses for the opinion survey scale to the above item by the ten categories under consideration. The data indicate that there were no significant relationships between the sex of the teachers, the race of the teachers, the age group of the teachers, or the teaching experience of the teachers, and their expressed response to item 4.

Under the category of recency of college or university courses taken, a significant relationship was revealed between the recency of college or university training and the expressed opinion to item 4. Of those who attended college or a university within 1 to 4 years, 48.4 percent disagreed, whereas only 40.5 percent of those teachers

TABLE 6

TEACHERS' RESPONSES TO OPINION SURVEY SCALE ITEM 4[a] BY SEX, RACE, AGE, TEACHING EXPERIENCE, RECENCY OF COLLEGE OR UNIVERSITY COURSES TAKEN, HIGHEST DEGREE HELD, PRESENT TEACHING LEVEL, KNOWLEDGE OF THE NEW MATH, ATTENDANCE AT NEW MATH INSTITUTIONS OR WORKSHOPS, AND TEACHING PREFERENCE

Criterion	Percentage of All Respondents SD+D	U	SA+A	Σ	χ^2	Sig.
Sex						
Male	42.5	14.6	42.9	527	4.03	0.133
Female	40.9	20.7	38.3	193		
Race						
White	40.6	16.5	42.9	594	3.26	0,195
Nonwhite	49.2	15.1	35.9	126		
Age Group						
20-30 years	44.2	19.0	36.8	242	8.32	0.215
30-40 years	44.0	15.7	40.4	166		
40-50 years	42.9	14.7	42.4	177		
50 or more years	34.8	14.1	51.1	135		
Teaching Experience						
0-4 years	41.2	17.6	41.2	187	18.73	0.068
5-9 years	51.6	12.2	36.2	188		
10-14 years	37.8	20.2	42.0	119		
15 or more years	37.2	16.4	46.5	226		
Recency of College or University Courses Taken						
Now taking	43.2	21.3	35.5	155	23.59*	0.003
Within 1-4 years	48.4	12.5	39.1	304		
Within 5-9 years	40.5	15.5	43.9	148		
10 years or longer	25.9	20.5	53.6	112		
Highest Degree Held						
Less than bachelor's	18.8	28.1	53.1	32	23.45*	0.001
Bachelor's	34.9	16.2	49.0	241		
Bachelor's plus graduate work	46.6	18.3	35.1	251		
Master's or above	49.0	11.7	39.3	196		

TABLE 6 (continued)

Criterion	Percentage of All Respondents SD+D	U	SA+A	Σ	χ^2	Sig.
Present Teaching Level						
Kindergarten	55.6	2.8	41.7	36		
Grades 1-4	40.6	16.0	43.4	318	34.88*	0.000
Grades 5-8	43.0	10.7	46.3	242		
Grades 9-12	40.3	31.5	28.2	124		
Knowledge of the New Mathematics						
Thorough understanding	50.9	13.4	35.7	224		
Average understanding	41.7	16.7	41.5	412	28.50*	0.000
Slight understanding	27.0	9.0	54.0	63		
No understanding	0.0	28.6	71.4	21		
New Math Institution or Workshop Attended						
Yes	46.8	15.6	37.6	455	14.42*	0.006
No	33.8	17.1	49.0	263		
Teaching Preference						
The traditional curriculum	28.0	13.8	58.2	232		
The new math curriculum	63.5	32.7	3.8	52	46.05*	0.000
A modification of both	47.0	15.7	37.3	434		
None of these	50.0	0.0	50.0	2		
TOTAL	303	117	300	720		
	42.1%	16.3%	49.7%	100%		

[a]Item 4. The subject of bases in the new math is confusing and has no significance in aiding the understanding of base ten.

*Significant at the .05 level of significance.

who attended colleges within 5 to 9 years and even lesser percentage of those who attended colleges or universities 10 years or more before disagreed.

The data also reveal significant relationships between the highest degree held by teachers and their expressed responses to item 4. Data show a larger percentage of teachers with a higher degree indicating disagreement to item 4. The data show that those who disagreed were 18.8 percent of teachers with less than the bachelor's degree, 34.9 percent of the teachers with bachelor's, 46.4 percent of those with bachelor's plus graduate work, and 49 percent of those teachers holding master's or above.

Under the category of grade level, a significant relationship was revealed under the teachers' grade level of teaching and their expressed responses. There was a lesser percentage of teachers of higher grade level of teaching who disagreed to item 4. Those who disagreed were 55.6 percent of the kindergarten teachers, 40.6 percent of the elementary teachers (grades 1-4), 43 percent of the middle school teachers (grades 5-8), and only 40.3 percent of the high school teachers (grades 9-12).

Under the category of knowledge of the new math, the data show significant relationships between teachers' knowledge of the new math, and their expressed responses. There was a higher percentage of those with better understanding of the new math who disagreed. Twenty-seven percent of those with slight understanding indicated their disagreement to item 4 in comparison to 50.9 percent of those with thorough understanding of the new math who also disagreed.

There were also significant relationships between the attendance at workshops or institutions which dealt with the implementation of the new math and teachers' responses to item 4. Of those who attended such workshops 46.8 percent disagreed, whereas only 33.8 percent of those who did not attend workshops disagreed.

The data also indicate a significant relationship between the teaching preference and the expressed reactions to item 4. Only 28 percent of those who chose the traditional curriculum as their teaching preference disagreed in comparison to 63.5 percent of those teachers who indicated the new math curriculum as their teaching preference and responded with similar disagreement. Furthermore, 47 percent of those teachers who indicated the modification also disagreed to item 4.

Item 5

There seems to be nothing to recommend the study of arithmetic modulo for the elementary level except its pointless novelty.

Table 7 presents the distribution of teachers' responses for the opinion survey scale to the above item by the ten categories under consideration. The data reveal that there were significant relationships between the sex of the teachers and their expressed responses. Twenty-nine percent of all male teachers agreed or strongly agreed to item 5 in comparison to 40.4 percent of all female teachers who also disagreed or strongly disagreed to the same option.

The data from the distribution of teacher responses according to the race of the teachers reveal that there was significant relationship

TABLE 7

TEACHERS' RESPONSES TO OPINION SURVEY SCALE ITEM 5[a] BY SEX, RACE, AGE, TEACHING EXPERIENCE, RECENCY OF COLLEGE OR UNIVERSITY COURSES TAKEN, HIGHEST DEGREE HELD, PRESENT TEACHING LEVEL, KNOWLEDGE OF THE NEW MATH, ATTENDANCE AT NEW MATH INSTITUTIONS OR WORKSHOPS, AND TEACHING PREFERENCE

Criterion	Percentage of All Respondents SD+D	U	SA+A	Σ	χ^2	Sig.
Sex						
Male	29.2	41.7	29.0	527	8.93*	0.012
Female	26.9	32.6	40.4	193		
Race						
White	26.1	41.8	32.2	594	12.68*	0.002
Nonwhite	40.5	27.8	31.7	126		
Age Group						
20-30 years	25.4	50.4	24.2	242	36.19*	0.000
30-40 years	34.3	41.0	24.7	166		
40-50 years	32.2	29.9	37.9	177		
50 or more years	24.4	29.5	45.9	135		
Teaching Experience						
0-4 years	26.7	48.1	25.1	187	16.56*	0.011
5-9 years	34.6	35.6	29.8	188		
10-14 years	25.2	42.0	32.8	199		
15 or more years	27.0	33.6	39.4	226		
Recency of College or University Courses Taken						
Now taking	29.0	47.1	23.9	155	34.05*	0.000
Within 1-4 years	31.9	40.8	27.3	304		
Within 5-9 years	32.4	29.1	38.5	148		
10 years or longer	14.3	38.4	47.3	112		
Highest Degree Held						
Less than bachelor's	3.1	37.5	59.4	32	32.29*	0.000
Bachelor's	23.7	38.2	38.2	241		
Bachelor's plus graduate work	33.1	44.2	22.7	251		
Master's or above	33.2	34.7	32.1	196		

TABLE 7 (continued)

Criterion	Percentage of All Respondents SD+D	U	SA+A	Σ	χ^2	Sig.
Present Teaching Level						
Kindergarten	38.9	5.6	55.6	36		
Grades 1-4	29.6	42.5	28.0	318	24.87*	0.000
Grades 5-8	28.5	36.4	35.1	242		
Grades 9-12	23.4	46.8	29.8	124		
Knowledge of the New Mathematics						
Thorough understanding	38.8	28.6	32.6	224		
Average understanding	26.2	46.1	27.7	412	48.75*	0.000
Slight understanding	17.5	38.1	44.4	63		
No understanding	0.0	23.8	76.2	21		
New Math Institution or Workshop Attended						
Yes	34.7	36.5	28.8	455	25.55*	0.000
No	18.3	43.7	38.0	263		
Teaching Preference						
The traditional curriculum	19.8	29.7	50.4	232		
The new math curriculum	57.7	34.6	7.7	52	74.01*	0.000
A modification of both	30.0	44.7	25.3	434		
None of these	0.0	100.0	0.0	2		
TOTAL	206	283	231	720		
	28.6%	39.3%	32.1%	100%		

[a]Item 5. There seems to be nothing to recommend the study of arithmetic modulo for the elementary level except its pointless novelty.

*Significant at the .05 level of significance.

between the race of the teachers and the expressed opinion to item 5. Thirty-two and two-tenths percent of the white teachers agreed or strongly agreed while 41.8 percent of them were undecided, in comparison to 31.7 percent of the nonwhite who agreed or strongly agreed to item 5 and only 27.8 percent who were undecided.

A significant relationship between the age of the teachers and their responses to item 5 was also revealed. A higher percentage of the older teachers indicated their agreement to item 5, while a higher percentage of the younger teachers were undecided. Of those between 20 and 30 years of age, 24.2 percent agreed and 50.4 percent were undecided in comparison to 45.9 percent of those 50 years of age or older who agreed and 29.6 percent who were undecided on item 5.

The data also reveal significant relationships between the teaching experience of teachers and their expressed responses. There was a higher percentage of those with more years of teaching experience who agreed to item 5 and a higher percentage of those with lesser teaching experience who were undecided on item 5. Of those with 15 or more years teaching experience, 39.4 percent agreed while 33.6 percent were undecided, as compared to 25.1 percent of those with 4 years or less teaching experience who agreed and 48.1 percent who were undecided.

Under the category of recency of college or university courses taken, a significant relationship was revealed between the recency of college or university training and the expressed opinion to item 5.

The percentage was lower for those who attended college more recently and who agreed to item 5. Only 23.9 percent of those teachers who were taking courses agreed to item 5 while 47.3 percent of those teachers who attended colleges or universities 10 years before or more also agreed.

An examination of Table 7, page 59, also reveals that there was significant relationship between the highest degree held by teachers and their expressed responses to item 5. Those who agreed were 59.4 percent of the teachers with less than bachelor's, 38.2 percent of those with bachelor's, 22.7 percent of those with bachelor's plus graduate work, and 32.1 percent of those teachers with master's or above.

Under the category of grade level, a significant relationship was revealed between teachers' grade level of teaching and their expressed response to item 5. Those who agreed were 55.6 percent of the kindergarten teachers, 28 percent of the elementary teachers, 35.1 percent of the middle school teachers (grades 5-8), and 29.8 percent of the high school teachers.

The data also reveal significant relationships between teachers' knowledge of the new math and their expressed responses. Seventy-six and two-tenths percent of those with no understanding of the new math agreed to item 5, whereas only 32.6 percent of those who indicated thorough understanding indicated their agreement. There was a higher percentage of those with better understanding of the new math who disagreed.

There was also a significant relationship between the attendance at workshops or institutions which dealt with the implementation of the new math and teachers' responses to item 5. Of those who attended such workshops, 28.8 percent agreed and 34.7 percent disagreed, while of those who did not attend workshops 38 percent agreed and only 18.3 percent disagreed.

The data also indicate a significant relationship between the teaching preference and the expressed reactions to item 5. Only 7.7 percent of those who chose the new math curriculum as their teaching preference agreed, whereas 50.4 percent of those who chose the traditional curriculum as their teaching preference agreed. Furthermore, 25.3 percent of those teachers who indicated the modification of the new math also agreed to item 5.

Item 6

Boolean algebra and symbolic logic are specialties, useless to noncollege students, and should be reserved for specialists.

Table 8 presents the distribution of teacher responses for the opinion survey scale to the above item by the ten categories under consideration. The data reveal that there were significant relationships between the sex of the teachers and their expressed responses. Out of all male teachers 32.8 percent agreed, whereas 59.1 percent of all females indicated similar response.

The data also indicate that there were no significant relationships between the race of the teachers, the age group of the teachers, and the

TABLE 8

TEACHERS' RESPONSES TO OPINION SURVEY SCALE ITEM 6[a] BY SEX, RACE, AGE, TEACHING EXPERIENCE, RECENCY OF COLLEGE OR UNIVERSITY COURSES TAKEN, HIGHEST DEGREE HELD, PRESENT TEACHING LEVEL, KNOWLEDGE OF THE NEW MATH, ATTENDANCE AT NEW MATH INSTITUTIONS OR WORKSHOPS, AND TEACHING PREFERENCE

Criterion	Percentage of All Respondents SD+D	U	SA+A	Σ	χ^2	Sig.
Sex						
Male	18.4	48.8	32.8	527	40.57*	0.000
Female	11.4	29.5	59.1	193		
Race						
White	16.2	43.1	40.7	594	1.13	0.566
Nonwhite	18.3	46.0	35.7	126		
Age Group						
20-30 years	16.9	40.5	42.6	242	3.35	0.763
30-40 years	15.1	42.8	42.2	166		
40-50 years	17.5	47.5	35.0	177		
50 or more years	16.3	45.2	38.5	135		
Teaching Experience						
0-4 years	14.4	44.9	40.6	187	5.85	0.439
5-8 years	18.8	46.3	35.1	188		
10-14 years	15.1	37.0	47.9	119		
15 or more years	17.3	43.8	38.9	226		
Recency of College or University Courses Taken						
Now taking	20.6	45.2	34.2	155	19.49*	0.024
Within 1-4 years	20.7	39.8	39.5	304		
Within 5-9 years	9.5	49.3	41.2	148		
10 years or longer	8.9	44.6	46.4	112		
Highest Degree Held						
Less than bachelor's	6.2	25.0	68.8	32	26.97*	0.000
Bachelor's	11.2	48.5	40.2	241		
Bachelor's plus graduate work	17.5	47.0	35.5	251		
Master's or above	23.5	36.2	40.3	196		

TABLE 8 (continued)

Criterion	Percentage of All Respondents SD+D	U	SA+A	Σ	χ^2	Sig.
Present Teaching Level						
Kindergarten	2.8	91.7	5.6	36		
Grades 1-4	16.4	55.7	28.0	318	104.74*	0.000
Grades 5-8	15.3	34.7	50.0	242		
Grades 9-12	23.4	16.1	50.5	124		
Knowledge of the New Mathematics						
Thorough understanding	21.0	34.4	44.6	224		
Average understanding	16.0	46.8	37.1	412	18.54*	0.005
Slight understanding	7.9	47.6	44.4	63		
No understanding	4.8	66.7	28.6	21		
New Math Institution or Workshop Attended						
Yes	18.7	42.6	38.7	455	6.64	0.156
No	12.9	44.9	42.2	263		
Teaching Preference						
The traditional curriculum	12.5	43.5	44.0	232		
The new math curriculum	13.5	25.0	61.5	52	20.72*	0.002
A modification of both	18.9	46.1	35.0	434		
None of these	50.0	0.0	50.0	2		
TOTAL	119	314	287	720		
	16.5%	43.6%	39.9%	100%		

[a]Item 6. Boolean algebra and symbolic logic are specialties, useless to noncollege students, and should be reserved for specialists.

*Significant at the .05 level of significance.

teaching experience of the teachers and their expressed responses to item 6.

Under the category of recency of college or university courses taken a significant relationship was revealed between the recency of college or university training and the expressed opinion to item 6. The percentage was lower for those who attended college more recently and who agreed to item 6. Those who agreed were 46.4 percent of those teachers who attended college or universities 10 years before or more, 41.2 percent of those teachers who attended colleges or universities within 5 to 9 years, 39.5 percent of those teachers who attended college or universities within 1 to 4 years, and only 34.2 percent of those teachers who were taking courses at the time of this study.

The data also reveal significant relationships between the highest degree held by the teachers and their expressed responses to item 6. Data show a larger percentage of teachers with a higher degree indicating disagreement to item 6. Those who disagreed were 23.5 percent of teachers with master's or above, 17.5 percent of teachers with bachelor's plus graduate work, 11.2 percent of teachers with bachelor's, and only 6.2 percent of those teachers with less than the bachelor's degree.

A significant relationship can be detected between the grade level of teaching and the expressed responses of the teachers. There was a greater percentage of teachers of higher grade level of teaching who agreed to item 6. Those who agreed were 60.5 percent of the high school teachers, 50 percent of the middle school teachers (grades 5-8),

28 percent of the elementary teachers, and only 5.6 percent of the kindergarten teachers.

Under the category of knowledge of the new math the data show a significant relationship between teachers' knowledge of the new math and their expressed responses. Those who agreed were 44.6 percent of teachers with thorough understanding, 37.1 percent of teachers with average understanding, 44.4 percent of teachers with slight understanding, and only 28.6 percent of teachers with no understanding of the new math.

The data indicate no significant relationship between teachers' attendance at workshops or institutions which dealt with the implementation of the new math and their expressed responses to item 6.

A significant relationship between the teaching preference and the expressed reactions is detected from the data of Table 8, page 64. Only 44 percent of those who chose the traditional curriculum as their teaching preference agreed in comparison to 61.5 percent of those teachers who indicated the new math curriculum as their teaching preference and responded with similar agreement. Furthermore, only 35 percent of those teachers who indicated the modification of the new math agreed to item 6.

Item 7

There is no justification for teaching matrices at the twelfth grade level, as advocated by the new math movement.

The data in Table 9 present the distribution of teachers' responses for the opinion survey scale to the above item by the ten categories

TABLE 9

TEACHERS' RESPONSES TO OPINION SURVEY SCALE ITEM 7[a] BY SEX, RACE, AGE, TEACHING EXPERIENCE, RECENCY OF COLLEGE OR UNIVERSITY COURSES TAKEN, HIGHEST DEGREE HELD, PRESENT TEACHING LEVEL, KNOWLEDGE OF THE NEW MATH, ATTENDANCE AT NEW MATH INSTITUTIONS OR WORKSHOPS, AND TEACHING PREFERENCE

Criterion	Percentage of All Respondents SD+D	U	SA+A	Σ	χ^2	Sig.
Sex						
Male	27.5	63.0	9.3	527	33.82*	0.000
Female	25.4	48.7	25.9	193		
Race						
White	28.6	55.9	15.3	594	15.98*	0.001
Nonwhite	19.0	74.6	6.3	126		
Age Group						
20-30 years	33.1	53.3	13.6	242	11.85	0.244
30-40 years	25.3	61.4	13.3	166		
40-50 years	23.7	62.1	14.1	177		
50 or more years	22.2	63.0	14.1	135		
Teaching Experience						
0-4 years	30.5	59.9	9.6	187	20.27*	0.016
5-9 years	30.5	60.1	9.4	188		
10-14 years	17.6	59.7	22.7	119		
15 or more years	26.1	57.5	15.9	226		
Recency of College or University Courses Taken						
Now taking	32.3	56.8	11.0	155	32.30*	0.001
Within 1-4 years	32.9	54.9	12.2	304		
Within 5-9 years	18.2	68.2	13.5	148		
10 years or longer	15.2	61.6	22.3	112		
Highest Degree Held						
Less than bachelor's	9.4	50.0	40.6	32	40.12*	0.000
Bachelor's	20.7	64.7	14.5	241		
Bachelor's plus graduate work	27.5	51.8	10.8	251		
Master's or above	36.7	50.5	12.2	196		

TABLE 9 (continued)

Criterion	Percentage of All Respondents SD+D	U	SA+A	Σ	χ^2	Sig.
Present Teaching Level						
Kindergarten	2.8	86.1	11.1	36		
Grades 1-4	20.4	70.8	8.8	318		
Grades 5-8	28.5	59.1	12.4	242	107.86*	0.000
Grades 9-12	47.6	21.8	29.8	124		
Knowledge of the New Mathematics						
Thorough understanding	32.6	56.3	10.7	224		
Average understanding	27.4	58.7	13.8	412		
Slight understanding	11.1	69.8	19.0	63	22.48*	0.008
No understanding	4.8	66.7	28.6	21		
New Math Institution or Workshop Attended						
Yes	28.4	50.9	10.5	455		
No	24.3	56.3	19.4	263	12.35	0.054
Teaching Preference						
The traditional curriculum	20.3	62.1	17.7	232		
The new math curriculum	17.3	51.9	30.8	52		
A modification of both	31.6	58.8	9.4	434	33.42*	0.000
None of these	50.0	0.0	50.0	2		
TOTAL	194	426	99	720		
	26.9%	59.2%	13.8%	100%		

[a]Item 7. There is no justification for teaching matrices at the twelfth grade level, as advocated by the new math movement.

*Significant at the .05 level of significance.

under consideration. The data indicate that there were significant relationships between the sex of the teachers and their expressed responses. Although a larger percentage of the teachers responded undecided to item 7, 27.5 percent of the male teachers disagreed, and 25.4 percent of the female teachers also disagreed. The race category indicates a relationship between teachers' race and their responses to item 7. Although over half of the white and of the nonwhite teachers responded undecided, 28.6 percent of the white teachers disagreed and only 19 percent of the nonwhite teachers disagreed.

The data indicate that there were no significant relationships between the age group of the teachers and their expressed responses to item 7.

Under the category of teaching experience the data reveal significant relationships between the number of years teaching experience and the teachers' responses. Although the majority of the teachers responded undecided to item 7, 30.5 percent of those teachers with 9 or less years of teaching experience disagreed, 22.7 percent of those teachers with 10 to 14 years teaching experience agreed, and 15.9 percent of those teachers with 15 or more years teaching experience also agreed.

Under the category of recency of college or university courses taken, a significant relationship was revealed between the recency of college or university training and the expressed opinion to item 7. Although the majority responded undecided, the percentage was lower for those who attended college more recently and who agreed to item 7.

While 22.3 percent of those who attended colleges or universities 10 years before or more agreed, only 11 percent of those who were aking courses in colleges or universities also agreed to item 7.

The data also reveal significant relationships between the highest degree held by the teachers and their expressed responses. Although the majority of the teachers responded undecided to item 7, the data show a larger percentage of teachers with a higher degree indicating disagreement. Those who disagreed were 36.7 percent of teachers with master's or above, 27.5 percent of teachers with bachelor's plus graduate work, 20.7 percent of those with bachelor's degree, and only 9.4 percent of those teachers with less than a bachelor's degree.

A significant relationship can be detected between the grade level of teaching and the expressed responses of the teachers. There was a greater percentage of teachers of lower grade level of teaching who responded undecided on item 7 and a greater percentage of teachers of higher grade level who disagreed or strongly disagreed. While 47.6 percent of the high school teachers disagreed, only 28.5 percent of the middle school teachers (grades 5-8), and 20.4 percent of the elementary teachers also disagreed.

Under the category of knowledge of the new math the data show significant relationships between teachers' knowledge of the new math and their expressed responses. Although the majority responded undecided, there was a higher percentage of those with better understanding of the new math who disagreed to item 7. While 32.6 percent of

those who indicated thorough understanding disagreed, only 27.4 percent of those with average understanding, 11.1 percent of those with slight understanding, and 4.8 percent of those with no understanding of the new math also disagreed.

The data in Table 9, page 68, reveal no significant relationship between teachers' attendance at workshops or institutions which dealt with the implementation of the new math and their expressed response to item 7. However, a significant relationship was revealed between the teaching preference and the expressed responses of the teachers. While 30.8 percent of those who chose the new math curriculum as their teaching preference agreed, only 17.7 percent of those teachers who indicated the traditional as their teaching preference also agreed. Furthermore, only 9.4 percent of those teachers who indicated the modification of the new math agreed to item 7.

Item 8

The new math failed to present the relationship of mathematics to allied subjects and the real world.

Table 10 presents the distribution of teachers' responses for the opinion survey scale to the above item by the ten categories under consideration. The data indicate that there were significant relationships between the sex of the teachers and their expressed responses. Fifty-six and five-tenths percent of all female teachers either agreed or strongly agreed to item 8, whereas only 44 percent of all male teachers agreed or strongly agreed. Furthermore, the data reveal that there were significant relationships between the race of the

TABLE 10

TEACHERS' RESPONSES TO OPINION SURVEY SCALE ITEM 8[a] BY SEX, RACE, AGE, TEACHING EXPERIENCE, RECENCY OF COLLEGE OR UNIVERSITY COURSES TAKEN, HIGHEST DEGREE HELD, PRESENT TEACHING LEVEL, KNOWLEDGE OF THE NEW MATH, ATTENDANCE AT NEW MATH INSTITUTIONS OR WORKSHOPS, AND TEACHING PREFERENCE

Criterion	Percentage of All Respondents SD+D	U	SA+A	Σ	χ^2	Sig.
Sex						
Male	39.3	16.7	44.0	527	15.94*	0.003
Female	37.3	6.2	56.5	193		
Race						
White	38.6	15.8	45.6	594	11.35*	0.003
Nonwhite	39.7	4.8	55.6	126		
Age Group						
20-30 years	47.5	15.7	36.8	242	28.34*	0.000
30-40 years	42.8	12.0	45.2	166		
40-50 years	31.1	10.2	58.8	177		
50 or more years	28.1	17.8	54.1	135		
Teaching Experience						
0-4 years	46.5	15.5	38.0	187	22.17*	0.001
5-9 years	43.1	13.8	43.1	188		
10-14 years	40.3	9.2	50.4	119		
15 or more years	27.9	15.0	57.1	226		
Recency of College or University Courses Taken						
Now taking	41.9	10.3	47.7	155	34.16*	0.000
Within 1-4 years	43.4	17.4	39.1	304		
Within 5-9 years	39.2	14.2	46.6	148		
10 years or longer	21.4	8.9	69.6	112		
Highest Degree Held						
Less than bachelor's	12.5	3.1	84.4	32	31.69*	0.000
Bachelor's	35.7	12.0	52.3	241		
Bachelor's plus graduate work	47.4	15.1	37.5	251		
Master's or above	35.7	16.3	48.0	196		

TABLE 10 (continued)

Criterion	Percentage of All Respondents SD+D	U	SA+A	Σ	χ^2	Sig.
Present Teaching Level						
Kindergarten	41.7	5.6	52.8	36		
Grades 1-4	45.3	15.7	39.0	318	19.28*	0.004
Grades 5-8	34.3	13.6	52.1	242		
Grades 9-12	29.8	12.1	58.1	124		
Knowledge of the New Mathematics						
Thorough understanding	48.7	13.8	37.5	224		
Average understanding	39.6	13.3	47.1	412	52.62*	0.000
Slight understanding	9.5	22.2	68.3	63		
No understanding	4.8	0.0	95.2	21		
New Math Institution or Workshop Attended						
Yes	45.7	14.7	39.6	455	32.53*	0.000
No	26.6	12.5	60.8	263		
Teaching Preference						
The traditional curriculum	17.2	12.5	70.3	232		
The new math curriculum	88.5	1.9	9.6	52	120.54*	0.000
A modification of both	44.2	15.9	39.9	434		
None of these	50.0	50.0	0.0	2		
TOTAL	279	100	341	720		
	38.8%	13.9%	47.4%	100%		

[a]Item 8. The new math failed to present the relationship of mathematics to allied subjects and the real world.

*Significant at the .05 level of significance.

teachers and their expressed responses. While 55.6 percent of all nonwhite teachers agreed, only 45.6 percent of the white teachers agreed to item 8.

Under the category of age group, the data reveal significant relationships between the age of the teachers and their expressed responses. Of those who were 50 years of age or older, 54.1 percent of them agreed and only 36.8 percent of those teachers between the ages of 20 to 30 indicated their agreement to the same item.

The data also reveal significant relationships between the teaching experience of teachers and their expressed responses. A higher percentage of those with more years of teaching experience agreed to item 8, and a lower percentage disagreed. Those who agreed were 38 percent of the teachers with less than 4 years teaching experience, 43.1 percent of the teachers with 5 to 9 years teaching experience, 50.4 percent of those with 10 to 14 years of experience, and 47.1 percent of teachers with 15 or more years teaching experience.

Data, under the category of recency of college or university courses taken, reveal significant relationships between the recency of college or university training and the expressed opinion to item 8. Sixty-nine and six-tenths of those who attended college or a university 10 years before or more agreed as compared to 39.1 percent of those who attended colleges within 1 to 4 years and 47.7 percent of those who were attending college or a university and who also agreed.

The data also reveal significant relationships between the highest degree held by the teachers and their expressed responses. Those who

agreed were 84.4 percent of teachers with less than the bachelor's degree, 52.3 percent of the teachers with bachelor's, 37.5 percent of those with bachelor's plus graduate work, and 48 percent of those teachers holding master's or above. Data show a larger percentage of teachers with a higher degree responded undecided to item 8.

Under the category of grade level, significant relationships can be detected between the grade level of teaching and the expressed responses. Of the kindergarten teachers, 52.8 percent agreed, whereas only 39 percent of the elementary teachers, 52.1 percent of the middle school teachers (grades 5-8), and 58.1 percent of the high school teachers agreed.

Data reveal significant relationships between teachers' knowledge of the new math and their expressed responses. Knowledge of the new math tended to decrease the percentage of those who agreed and increase the percentage of those who disagreed. Thirty-seven and one-half percent of those with thorough understanding agreed and 48.7 percent disagreed as compared to 95.2 percent of those with no understanding who agreed and only 4.8 percent of whom disagreed to item 8.

There is also a significant relationship between the attendance at workshops or institutions which dealt with the implementation of the new math and teachers' responses to item 8. Thirty-nine and six-tenths percent of those who attended such workshops agreed, whereas 60.8 percent of those who did not attend workshops also agreed.

A significant relationship between the teaching preference and the expressed reactions to item 8 is detected from the data of Table 10,

page 72. Only 9.6 percent of those who chose the new math curriculum as their teaching preference agreed, as compared to 70.3 percent of those teachers who indiacated the traditional curriculum as their teaching preference and who responded with similar agreement. Furthermore, 39.9 percent of those teachers who indicated the modification of the new math also agreed to item 8.

Item 9

The new math offers an abstract and rigorous version that conceals the rich and fruitful essence of mathematics.

Table 11 presents the distribution of teachers' responses for the opinion survey scale to the above item by the ten categories under consideration. The data indicate that there were significant relationships between the sex of the teachers and their expressed responses. Forty and eight-tenths percent of all male teachers disagreed or strongly disagreed and 42.5 percent of all female teachers likewise disagreed to item 9. Furthermore, the data reveal no significant relationship between the race of the teachers and their expressed responses.

Under the category of age group, the data show significant relationships between the age of the teachers and their expressed responses. Forty-four and six-tenths percent of those teachers between the ages of 20 to 30 disagreed while only 30.4 percent of those who were 50 years of age or older also disagreed.

From the distribution of teachers' responses under the category of teaching experience, the data reveal no significant relationships

TABLE 11

TEACHERS' RESPONSES TO OPINION SURVEY SCALE ITEM 9[a] BY SEX, RACE, AGE, TEACHING EXPERIENCE, RECENCY OF COLLEGE OR UNIVERSITY COURSES TAKEN, HIGHEST DEGREE HELD, PRESENT TEACHING LEVEL, KNOWLEDGE OF THE NEW MATH, ATTENDANCE AT NEW MATH INSTITUTIONS OR WORKSHOPS, AND TEACHING PREFERENCE

Criterion	Percentage of All Respondents SD+D	U	SA+A	Σ	χ^2	Sig.
Sex						
Male	40.8	25.8	33.4	527	26.30*	0.000
Female	42.5	9.3	48.2	193		
Race						
White	39.9	22.6	37.5	594	3.70	0.157
Nonwhite	47.6	15.9	36.5	126		
Age Group						
20-30 years	44.6	25.2	30.2	242	24.21*	0.000
30-40 years	46.4	22.3	31.3	166		
40-50 years	40.1	13.6	46.3	177		
50 or more years	30.4	23.7	45.9	137		
Teaching Experience						
0-4 years	41.7	23.5	34.8	187	12.07	0.060
5-9 years	47.3	21.8	30.9	188		
10-14 years	44.5	16.0	39.5	119		
15 or more years	34.1	22.1	43.8	226		
Recency of College or University Courses Taken						
Now taking	39.4	21.3	39.4	155	29.30*	0.000
Within 1-4 years	45.7	23.0	31.3	304		
Within 5-9 years	47.3	20.3	32.4	148		
10 years or longer	24.1	18.8	57.1	112		
Highest Degree Held						
Less than bachelor's	12.5	9.4	78.1	32	39.17*	0.000
Bachelor's	36.9	18.3	44.8	241		
Bachelor's plus graduate work	46.2	25.5	28.3	251		
Master's or above	44.9	21.9	33.2	196		

TABLE 11 (continued)

Criterion	Percentage of All Respondents SD+D	U	SA+A	Σ	χ^2	Sig.
Present Teaching Level						
Kindergarten	41.7	2.8	55.6	36		
Grades 1-4	41.5	27.7	30.8	318	24.13*	0.000
Grades 5-8	40.1	19.8	40.1	242		
Grades 9-12	42.7	13.7	43.5	124		
Knowledge of the New Mathematics						
Thorough understanding	55.4	18.3	26.3	224		
Average understanding	39.1	21.4	39.6	412	66.55*	0.000
Slight understanding	19.0	38.1	42.9	63		
No understanding	0.0	4.8	95.2	21		
New Math Institution or Workshop Attended						
Yes	48.8	18.7	32.5	455	30.90*	0.000
No	28.1	25.9	46.0	263		
Teaching Preference						
The traditional curriculum	18.5	25.0	56.5	232		
The new math curriculum	88.5	5.8	5.8	52	112.27*	0.000
A modification of both	47.9	21.2	30.9	434		
None of these	0.0	50.0	50.0	2		
TOTAL	297	154	269	720		
	41.3%	21.4%	37.4%	100%		

[a]Item 9. The new math offers an abstract and rigorous version that conceals the rich and fruitful essence of mathematics.

[b]Significant at the .05 level of significance.

between the number of years of teaching experience of teachers and their expressed responses to item 9.

Data, under the category of recency of college or university courses taken, reveal significant relationships between the recency of college or university training and the expressed opinion to item 9. Teachers who disagreed were 39.4 percent of those who were taking courses, 45.7 percent of those who had taken courses within 1 to 4 years, and 47.3 percent of those who had attended college or a university within 5 to 9 years. Furthermore, only 24.1 percent of those who had attended college or a university ten years before or more also disagreed.

The table also reveals significant relationships between the highest degree held by the teachers and their expressed responses. Only 12.5 percent of those with less than the bachelor's degree disagreed as compared to 46.2 percent of those with bachelor's plus graduate work who also disagreed to item 9.

Under the category of grade level, signifcant relationships can be detected between the grade level taught and the responses to item 9. Those who disagreed were: 41.7 percent of the kindergarten teachers, 41.5 percent of the elementary teachers, 40.1 percent of the middle school teachers (grades 5-8), and 42.7 percent of the high school teachers. Furthermore, over half of the kindergarten teachers agreed or strongly agreed to item 9.

Under the category of knowledge of the new math, the data show significant relationships between teachers' knowledge of the new math

and their expressed responses. Lack of knowledge of the new math tended to decrease the percentage of those who disagreed. While 55.4 percent of those with thorough understanding of the new math disagreed, 39.1 percent of those with average understanding and 19 percent of those with slight understanding disagreed; furthermore, none of those with no understanding disagreed to item 9.

There were also significant relationships between the attendance at workshops or institutions which dealt with the implementation of the new math and teachers' responses. Of those who attended such workshops, 48.8 percent disagreed, whereas only 28.1 percent of those who did not attend such workshops disagreed.

A significant relationship between the teaching preference and the expressed reactions to item 9 is detected from the data of Table 11, page 78. While 88.5 percent of those who chose the new math curriculum as their teaching preference disagreed, only 18.5 percent of those who selected the traditional curriculum as their teaching preference disagreed. Furthermore, 47.9 percent of those teachers who indicated the modification of the new math curriculum also disagreed to item 9.

Item 10

The new math stresses final sophisticated versions of simple ideas while treating superficially the deeper ones.

Table 12 presents the distribution of teachers' responses for the opinion survey scale to the above item by the ten categories under consideration. The data show that there were significant relationships

TABLE 12

TEACHERS' RESPONSES TO OPINION SURVEY SCALE ITEM 10[a] BY SEX, RACE, AGE, TEACHING EXPERIENCE, RECENCY OF COLLEGE OR UNIVERSITY COURSES TAKEN, HIGHEST DEGREE HELD, PRESENT TEACHING LEVEL, KNOWLEDGE OF THE NEW MATH, ATTENDANCE AT NEW MATH INSTITUTIONS OR WORKSHOPS, AND TEACHING PREFERENCE

Criterion	Percentage of All Respondents SD+D	U	SA+A	Σ	χ^2	Sig.
Sex						
Male	24.9	21.1	54.1	527	14.43*	0.000
Female	32.6	9.3	58.0	193		
Race						
White	28.3	21.4	50.3	594	39.18*	0.000
Nonwhite	20.6	1.6	77.8	126		
Age Group						
20-30 years	27.3	24.8	47.9	242	28.99*	0.000
30-40 years	31.3	15.1	53.6	166		
40-50 years	29.4	7.9	62.7	177		
50 or more years	17.8	22.2	60.0	135		
Teaching Experience						
0-4 years	24.1	23.5	52.4	187	16.89*	0.001
5-8 years	31.9	18.6	49.5	188		
10-14 years	32.8	9.2	58.0	119		
15 or more years	22.1	17.3	60.6	226		
Recency of College or University Courses Taken						
Now taking	25.8	21.3	52.9	155	13.17	0.106
Within 1-4 years	29.3	18.4	52.3	304		
Within 5-9 years	31.1	16.2	52.7	148		
10 years or longer	17.0	14.3	68.8	112		
Highest Degree Held						
Less than bachelor's	3.1	6.3	90.6	32	37.91*	0.000
Bachelor's	20.3	14.5	65.1	241		
Bachelor's plus graduate work	31.1	21.1	47.8	251		
Master's or above	32.7	19.9	47.4	196		

TABLE 12 (continued)

Criterion	Percentage of All Respondents SD+D	U	SA+A	Σ	χ^2	Sig.
Present Teaching Level						
Kindergarten	38.9	2.8	58.3	36		
Grades 1-4	25.5	19.8	54.7	318	12.30	0.056
Grades 5-8	23.6	17.8	54.7	242		
Grades 9-12	33.9	17.7	48.4	124		
Knowledge of the New Mathematics						
Thorough understanding	38.8	16.5	44.6	224		
Average understanding	24.5	19.7	55.8	412	45.95*	0.000
Slight understanding	9.5	17.5	73.0	63		
No understanding	0.0	0.0	100.0	21		
New Math Institution or Workshop Attended						
Yes	32.3	17.8	49.9	455	20.45*	0.000
No	17.9	18.3	63.9	263		
Teaching Preference						
The traditional curriculum	10.3	18.1	71.6	232		
The new math curriculum	84.6	3.8	11.5	52	133.99*	0.000
A modification of both	29.0	19.1	51.8	434		
None of these	0.0	100.0	0.0	2		
TOTAL	194	129	397	720		
	26.9%	17.9%	55.1%	100%		

[a]Item 10. The new math stresses final sophisticated versions of simple ideas while treating superficially the deeper ones.

*Significant at the .05 level of significance.

between the sex of the teachers and their expressed responses. While 58 percent of all female teachers agreed, only 54.1 percent of the male teachers also agreed. Furthermore, the data reveal significant relationships between the race of the teachers and their expressed responses. While only 50.3 percent of all white teachers agreed, 77.8 percent of all nonwhites also agreed to item 10.

Under the category of age group, the data reveal significant relationships between the age of the teachers and their expressed responses. As the teacher's age decreased, the percentage of those who agreed also decreased. Sixty percent of those teachers who were 50 years of age or older agreed, and only 47.9 percent of those between the ages of 20 to 30 also agreed.

The data also reveal significant relationships between the teaching experience of teachers and their expressed responses. Of those with 15 or more years teaching experience, 60.6 percent disagreed, whereas only 52.4 percent of those with 4 years or less teaching experience also agreed.

The data reveal no significant relationships between the recency of college or university courses taken and the expressed opinion of the teachers.

The data also reveal significant relationships between the highest degree held by the teachers and their expressed responses. A smaller percentage of teachers with a higher degree indicated their agreement to item 10. While 90.6 percent of the teachers with less than the

bachelor's degree agreed, only 65.1 percent with bachelor's degree, 47.8 percent with bachelor's plus graduate work, and 47.4 percent with master's or above also agreed.

Under the category of grade level, the data reveal no significant relationships between the grade level taught and the responses to item 10.

The data under the category of knowledge of the new math show significant relationships between teachers' knowledge of the new math and their expressed responses. Lack of knowledge of the new math tended to increase the percentage of those who agreed to item 10. While only 44.6 percent of those with thorough understanding agreed, 55.8 percent of those with average understanding, 73 percent with slight understanding, and 100 percent of those with no understanding agreed to the same item.

There were also significant relationships between the attendance at workshops or institutions which dealt with the implementation of the new math and teachers' responses. Of those who attended such workshops 49.9 percent agreed as compared to 63.9 percent of those who did not attend such workshops and who also agreed to item 10.

A significant relationship between the teaching preference and the expressed reactions to item 10 is detected from the data of Table 12, page 82. While 71.6 percent of those who selected the traditional curriculum agreed, only 11.5 percent of those who chose the new math curriculum as their teaching preference likewise agreed. Furthermore, 51.8 percent of those teachers who indicated the modification of the new math curriculum also indicated their agreement to item 10.

Item 11

The new math is ideal for the students who will ultimately enter into the full variety of professional careers and trades.

Table 13 presents the distribution of teachers' responses for the opinion survey scale to the above item by the ten categories under consideration. The data show that there were significant relationships between the sex of the teachers and their expressed responses. While 42.3 percent of all male teachers agreed, only 38.3 percent of all the female teachers also agreed. Furthermore, the data show no significant relationships between the race of the teachers and their expressed responses.

Under the category of age groups, the data reveal significant relationships between the age of the teachers and their expressed responses. The percentage of the younger teachers who agreed was higher than the percentage of the older teachers who also agreed to item 11. Thirty-seven percent of those teachers who were 50 years of age or older agreed and 48.8 percent of those between the ages of 20 to 30 also agreed. Furthermore, the data indicate no significant relationships between the teaching experience of teachers and their expressed responses.

The data also reveal significant relationships between the recency of college or university courses taken and the expressed opinion of the teachers. Of those who attended college or a university 10 years before or more, 26.8 percent agreed as compared to 39.9 percent of those

TABLE 13

TEACHERS' RESPONSES TO OPINION SURVEY SCALE ITEM 11[a] BY SEX, RACE, AGE, TEACHING EXPERIENCE, RECENCY OF COLLEGE OR UNIVERSITY COURSES TAKEN, HIGHEST DEGREE HELD, PRESENT TEACHING LEVEL, KNOWLEDGE OF THE NEW MATH, ATTENDANCE AT NEW MATH INSTITUTIONS OR WORKSHOPS, AND TEACHING PREFERENCE

Criterion	Percentage of All Respondents SD+D	U	SA+A	Σ	χ^2	Sig.
Sex						
Male	34.3	23.3	42.3	527	13.08*	0.001
Female	47.7	14.0	38.3	193		
Race						
White	37.5	21.2	41.2	594	0.35	0.836
Nonwhite	39.7	19.0	41.3	126		
Age Group						
20-30 years	33.1	18.2	48.8	242	18.54*	0.005
30-40 years	35.5	25.3	39.2	166		
40-50 years	48.0	15.8	36.2	177		
50 or more years	36.3	26.7	37.0	135		
Teaching Experience						
0-4 years	30.5	21.9	47.6	187	11.37	0.077
5-9 years	36.2	21.3	45.6	188		
10-14 years	40.3	16.8	42.9	119		
15 or more years	44.2	21.7	34.1	226		
Recency of College or University Courses Taken						
Now taking	34.2	23.9	41.9	155	27.32*	0.001
Within 1-4 years	34.5	18.4	47.0	304		
Within 5-9 years	35.1	25.0	39.9	148		
10 years or longer	56.3	17.0	26.8	112		
Highest Degree Held						
Less than bachelor's	84.4	0.0	15.6	32	45.53*	0.000
Bachelor's	40.7	18.7	40.7	241		
Bachelor's plus graduate work	29.5	20.7	49.8	251		
Master's or above	37.8	27.0	35.2	196		

TABLE 13 (continued)

Criterion	Percentage of All Respondents SD+D	U	SA+A	Σ	χ^2	Sig.
Present Teaching Level						
Kindergarten	52.8	2.8	44.4	36		
Grades 1-4	34.9	23.9	41.2	318	12.63*	0.049
Grades 5-8	37.2	19.0	43.8	242		
Grades 9-12	42.7	21.8	35.5	124		
Knowledge of the New Mathematics						
Thorough understanding	27.7	17.9	54.5	224		
Average understanding	39.3	22.1	38.6	412	55.57*	0.000
Slight understanding	46.0	30.2	23.8	63		
No understanding	95.2	0.0	4.8	21		
New Math Institution or Workshop Attended						
Yes	31.2	20.4	48.4	455	30.53*	0.000
No	49.4	21.7	28.9	263		
Teaching Preference						
The traditional curriculum	52.2	18.5	29.3	232		
The new math curriculum	9.6	3.8	86.5	52	72.17*	0.000
A modification of both	33.9	24.2	41.9	434		
None of these	0.0	0.0	100.0	2		
TOTAL	273	150	297	720		
	37.9%	20.8%	41.3%	100%		

[a]Item 11. The new math is ideal for the students who will ultimately enter into the full variety of professional careers and trades.

*Significant at the .05 level of significance.

who attended school within 5 to 9 years, 47 percent of those who attended school within 1 to 4 years, and 41.9 percent of those who were attending colleges or universities and who also agreed.

The data also reveal significant relationships between the highest degree held by teachers and their expressed responses to item 11. Those who agreed were 15.6 percent of teachers with less than the bachelor's degree, 40.7 percent of the teachers with bachelor's, 49.8 percent of those with bachelor's plus graduate work, and 35.2 percent of those teachers holding master's or above. A larger percentage of teachers iwth a higher degree indicated their indecision to item 11.

Under the category of grade level, significant relationships can be detected between the grade level taught and the responses to the above item. While 44.4 percent of the kindergarten teachers agreed, 41.2 percent of the elementary teachers, 43.8 percent of the middle school teachers (grades 5-8), and only 35.5 percent of the high school teachers also agreed.

Under the category of knowledge of the new math, the data show significant relationships between the teachers' knowledge of the new math and their expressed responses. Lack of knowledge of the new math tended to decrease the percentage of those who agreed to item 11. While 54.5 percent of those with thorough understanding of the new math agreed, 38.6 percent of those with average understanding, 23.8 percent of those with slight understanding, and only 4.8 percent of those with no understanding also agreed. There were also significant

relationships between the attendance at workshops or institutions which dealt with the implementation of the new math and teachers' responses. Of those who attended such workshops 48.4 percent agreed and 31.2 percent disagreed, while 28.9 percent of those who did not attend such workshops agreed and 49.4 percent disagreed.

A significant relationship between the teaching preference and the expressed reactions to item 11 is revealed from the data of Table 13, page 87. While 86.5 percent of those who chose the new math curriculum as their teaching preference agreed, 52.2 percent disagreed. Furthermore, 41.9 percent of those teachers who indicated the modification of the new math curriculum agreed and 33.9 percent disagreed to item 11.

Item 12

The new math is appealing and inviting to the students and provides for superior understanding.

Table 14 presents the distribution of teachers' responses for the opinion survey scale to the above item by the ten categories under consideration. The data show that there are no significant relationships between the sex of the teachers and their expressed responses to item 12. Furthermore, the data show significant relationships between the race of the teachers and their expressed responses. Fifty-one and eight-tenths percent of the white teachers disagreed and 15.2 percent indicated their indecision as compared to 70.6 percent of the nonwhites who disagreed and none of whom responded as undecided to item 12.

Under the category of age group, the data reveal significant relationships between the age of the teachers and their expressed

TABLE 14

TEACHERS' RESPONSES TO OPINION SURVEY SCALE ITEM 12[a] BY SEX, RACE, AGE, TEACHING EXPERIENCE, RECENCY OF COLLEGE OR UNIVERSITY COURSES TAKEN, HIGHEST DEGREE HELD, PRESENT TEACHING LEVEL, KNOWLEDGE OF THE NEW MATH, ATTENDANCE AT NEW MATH INSTITUTIONS OR WORKSHOPS, AND TEACHING PREFERENCE

Criterion	Percentage of All Respondents SD+D	U	SA+A	Σ	χ^2	Sig.
Sex						
Male	55.8	41.0	30.2	427	4.29	0.117
Female	60.1	8.3	31.6	193		
Race						
White	54.0	15.2	30.8	594	24.18*	0.000
Nonwhite	70.6	0.0	29.4	126		
Age Group						
20-30 years	47.1	18.6	34.3	242	19.13*	0.004
30-40 years	60.8	9.0	30.1	166		
40-50 years	61.6	9.6	28.8	177		
50 or more years	63.7	9.6	26.7	135		
Teaching Experience						
0-4 years	49.2	17.6	33.2	187	18.06*	0.006
5-9 years	51.6	14.9	33.5	188		
10-14 years	62.2	7.6	30.3	119		
15 or more years	65.0	8.8	26.1	226		
Recency of College or University Courses Taken						
Now taking	56.8	12.9	30.3	155	20.33	0.009
Within 1-4 years	51.3	14.8	33.9	304		
Within 5-9 years	54.7	12.2	33.1	148		
10 years or longer	75.0	6.3	18.8	112		
Highest Degree Held						
Less than bachelor's	87.5	3.1	9.4	32	16.86	0.010
Bachelor's	57.7	13.3	29.0	249		
Bachelor's plus graduate work	53.0	11.2	35.9	251		
Master's or above	56.1	14.8	29.1	196		

TABLE 14 (continued)

Criterion	Percentage of All Respondents SD+D	U	SA+A	Σ	χ^2	Sig.
Present Teaching Level						
Kindergarten	61.1	2.8	36.1	36		
Grades 1-4	56.9	12.9	30.2	318	4.23	0.645
Grades 5-8	59.0	12.0	31.0	242		
Grades 9-12	55.6	15.3	29.0	124		
Knowledge of the New Mathematics						
Thorough understanding	44.2	14.7	41.1	224		
Average understanding	59.5	11.7	28.9	412	37.61*	0.000
Slight understanding	73.0	12.7	14.3	63		
No understanding	95.2	4.8	0.0	21		
New Math Institution or Workshop Attended						
Yes	47.7	12.7	39.6	455	52.09*	0.000
No	72.6	12.2	15.2	263		
Teaching Preference						
The traditional curriculum	80.6	6.9	12.5	232		
The new math curriculum	9.6	1.9	88.5	52	147.20	0.000
A modification of both	50.0	16.8	33.2	434		
None of these	50.0	0.0	50.0	2		
TOTAL	410	90	220	720		
	56.9%	12.5%	30.6%	100%		

[a]Item 12. The new math is appealing and inviting to the students, and provides for superior understanding.

*Significant at the .05 level of significance.

responses. As the teacher's age increased, the percentage of those who disagreed also increased. Those who disagreed were 47.1 percent of those between the ages of 20 to 30, 60.8 percent of those between the ages of 30 and 40, 61.6 percent of those between the ages of 40 and 50, and 63.7 percent of those 50 years or older.

The data also reveal significant relationships between the number of years of teaching experience and the teachers' expressed responses. There was a higher percentage of those with more years of teaching experience who disagreed to item 12. Those who agreed were 49.2 percent of teachers with less than 4 years of teaching experience, 51.6 percent of those with 5 to 9 years of teaching experience, 62.2 percent of those with 10 to 14 years of teaching experience, and 65 percent of those with 15 or more years of teaching experience.

The data also reveal significant relationships between the recency of college or university training and the expressed opinions of the teachers. While 56.8 percent of those who were taking courses in colleges or universities disagreed to item 12, 51.3 percent who attended schools within 1 to 4 years, 54.7 percent of those within 5 to 9 years, and 75 percent of those who attended colleges or universities 10 years before or more also disagreed.

Under the category of the highest degree held, the data show significant relationships between the highest degree held by the teachers and their expressed responses. Those who disagreed were 87.5 percent of teachers with less than the bachelor's degree, 57.7 percent of the teachers with bachelor's, 53 percent of those

with bachelor's plus graduate work, and 56.1 percent of those teachers holding master's or above.

Furthermore, the data show no significant relationships between the grade level taught and the responses to item 12.

Under the category of knowledge of the new math, the data reveal significant relationships between the teachers' knowledge of the new math and their expressed responses. Lack of knowledge of the new math tended to increase the percentage of those who disagreed. While only 44.2 percent of those with thorough understanding of the new math disagreed, 54.5 percent with average understanding, 73 percent of those with slight understanding, and 95.2 percent with no understanding of the new math also disagreed.

There were also significant relationships between the attendance at workshops or institutions which dealt with the implementation of the new math and the teachers' responses. Of those who attended such workshops, 47.7 percent disagreed, whereas 72.6 percent of those who did not attend such workshops also disagreed.

A significant relationship between the teaching preference and the expressed reactions to item 12 is detected from the data of Table 14, page 91. While 80.6 percent of those who chose the traditional curriculum as their teaching preference disagreed, only 9.6 percent of those who selected the new math curriculum as their teaching preference responded with similar disagreement. Furthermore, 50 percent of those teachers who indicated the modification of the new math as their teaching preference disagreed to item 12.

Item 13

The introduction of such axioms as commutative and associative properties eliminate difficulties in learning mathematics.

Table 15 presents the distribution of teachers' responses for the opinion survey scale to the above item by the ten categories under consideration. The data indicate that there were significant relationships between the sex of the teachers and their expressed responses. While 56.4 percent of all male teachers disagreed, only 42 percent of all female teachers also disagreed. Furthermore, there were significant relationships between the race of the teachers and their expressed responses. Of all white teachers 56.9 percent disagreed, whereas only 31.7 percent of all nonwhites disagreed.

The data in Table 15 indicated that there were no significant relationships between the age group of the teachers, the number of years of teaching experience of the teachers, or the recency of their college or university attendance and their expressed responses to item 13.

There were, however, significant relationships between the highest degree held by the teachers and their expressed responses. Those who disagreed were 18.8 percent with less than the bachelor's degree, 57.3 percent with bachelor's, 51 percent with bachelor's plus graduate work, and 54.1 percent with master's or above.

Under the category of grade level, a significant relationship was revealed between the grade level taught and the expressed responses. There was a smaller percentage of teachers of higher grade level of

TABLE 15

TEACHERS' RESPONSES TO OPINION SURVEY SCALE ITEM 13[a] BY SEX, RACE, AGE, TEACHING EXPERIENCE, RECENCY OF COLLEGE OR UNIVERSITY COURSES TAKEN, HIGHEST DEGREE HELD, PRESENT TEACHING LEVEL, KNOWLEDGE OF THE NEW MATH, ATTENDANCE AT NEW MATH INSTITUTIONS OR WORKSHOPS, AND TEACHING PREFERENCE

Criterion	Percentage of All Respondents SD+D	U	SA+A	Σ	χ^2	Sig.
Sex						
Male	56.4	15.6	28.1	527	34.17*	0.000
Female	42.0	7.3	50.8	193		
Race						
White	56.9	13.3	29.8	594	31.49*	0.000
Nonwhite	31.7	13.5	54.8	126		
Age Group						
20-30 years	44.6	14.9	40.5	242	10.64	0.100
30-40 years	54.2	11.4	34.3	166		
40-50 years	57.1	13.6	29.4	177		
50 or more years	58.5	12.6	28.9	135		
Teaching Experience						
0-4 years	50.3	14.4	35.3	187	7.47	0.279
5-9 years	56.4	13.8	29.8	188		
10-14 years	45.4	10.9	43.7	119		
15 or more years	54.9	13.3	31.9	226		
Recency of College or University Courses Taken						
Now taking	56.1	14.2	29.7	155	11.55	0.172
Within 1-4 years	49.0	14.8	36.2	304		
Within 5-9 years	52.7	18.8	36.5	148		
10 years or longer	57.1	10.7	32.1	112		
Highest Degree Held						
Less than bachelor's	18.8	6.3	75.0	32	26.84	0.000
Bachelor's	57.3	12.4	30.3	241		
Bachelor's plus graduate work	51.0	14.7	34.3	251		
Master's or above	54.1	13.8	32.1	196		

TABLE 15 (continued)

Criterion	Percentage of All Respondents SD+D	U	SA+A	Σ	χ^2	Sig.
Present Teaching Level						
Kindergarten	94.4	2.8	2.8	36		
Grades 1-4	56.3	17.9	25.8	318	59.94*	0.000
Grades 5-8	47.5	11.6	40.9	242		
Grades 9-12	40.3	8.1	51.6	124		
Knowledge of the New Mathematics						
Thorough understanding	51.3	11.6	37.1	224		
Average understanding	54.6	14.3	31.1	412	11.76	0.068
Slight understanding	34.1	17.5	44.4	63		
No understanding	66.7	0.0	33.3	21		
New Math Institution or Workshop Attended						
Yes	51.9	14.9	33.2	455	4.60	0.330
No	53.2	10.6	36.1	263		
Teaching Preference						
The traditional curriculum	59.1	11.6	29.3	232		
The new math curriculum	26.9	7.7	65.4	52	30.60*	0.000
A modification of both	52.3	14.7	32.9	434		
None of these	0.0	50.0	50.0	2		
TOTAL	378	96	246	720		
	52.5%	13.3%	34.2%	100%		

[a]Item 13. The introduction of such axioms as commutative and associative properties eliminate difficulties in learning mathematics.

*Significant at the .05 level of significance.

teaching who disagreed to item 13. Those who disagreed were 74.4 percent of the kindergarten teachers, 56.3 percent of the elementary teachers, 47.5 percent of the middle school teachers (grades 5-8), and only 40.3 percent of the high school teachers.

The data also reveal no significant relationships between the knowledge of the new math and the teachers' responses. Neither were there any relationships between the attendance at workshops or institutions which dealt with the implementation of new math and teachers' responses to the above item.

A significant relationship between the teaching preference and the expressed reactions to item 13 is detected from the data of Table 15. While 59.1 percent of those who chose the traditional curriculum as their teaching preference disagreed, only 26.9 percent of those who indicated the new math curriculum as their teaching preference also disagreed. Furthermore, 52.3 percent of those who indicated the modification of the new math curriculum also disagreed to item 13.

Item 14

Axioms such as the closure, order, uniqueness, etc., provide deep mathematical insight to the proofs of theorems.

Table 16 presents the distribution of teachers' responses for the opinion survey scale to the above item by the 10 categories under consideration. The data reveal that there were significant relationships between the sex of the teachers and their responses. Thirty-four and seven-tenths percent of all male teachers agreed, whereas

TABLE 16

TEACHERS' RESPONSES TO OPINION SURVEY SCALE ITEM 14[a] BY SEX, RACE, AGE, TEACHING EXPERIENCE, RECENCY OF COLLEGE OR UNIVERSITY COURSES TAKEN, HIGHEST DEGREE HELD, PRESENT TEACHING LEVEL, KNOWLEDGE OF THE NEW MATH, ATTENDANCE AT NEW MATH INSTITUTIONS OR WORKSHOPS AND TEACHING PREFERENCE

Criterion	Percentage of All Respondents SD+D	U	SA+A	Σ	χ^2	Sig.
Sex						
Male	24.5	40.8	34.7	527	34.92*	0.000
Female	17.1	23.8	59.1	193		
Race						
White	25.9	36.7	37.4	594	30.25*	0.000
Nonwhite	6.3	34.1	59.5	126		
Age Group						
20-30 years	22.3	29.8	47.9	242	17.35*	0.008
30-40 years	22.9	37.3	39.8	166		
40-50 years	16.4	43.5	40.1	177		
50 or more years	30.4	37.0	32.6	135		
Teaching Experience						
0-4 years	19.3	36.9	43.9	187	8.73	0.189
5-9 years	25.0	38.3	36.7	188		
10-14 years	17.6	31.9	50.4	119		
15 or more years	25.7	36.3	38.1	226		
Recency of College or University Courses Taken						
Now taking	25.2	34.8	40.0	155	8.76	0.362
Within 1-4 years	22.7	32.2	45.1	304		
Within 5-9 years	18.9	43.2	37.8	148		
10 years or longer	23.2	39.3	37.5	112		
Highest Degree Held						
Less than bachelor's	15.6	12.5	71.9	32	39.91*	0.000
Bachelor's	17.0	45.2	37.8	241		
Bachelor's plus graduate work	19.5	37.5	43.0	251		
Master's or above	34.2	27.6	38.3	196		

TABLE 16 (continued)

Criterion	Percentage of All Respondents SD+D	U	SA+A	Σ	χ^2	Sig.
Present Teaching Level						
Kindergarten	11.1	80.6	8.3	36	116.35*	0.000
Grades 1-4	23.0	49.4	27.7	318		
Grades 5-8	24.4	25.2	50.4	242		
Grades 9-12	21.0	11.3	67.7	124		
Knowledge of the New Mathematics						
Thorough understanding	25.0	24.6	50.4	224	26.66	0.000
Average understanding	22.6	41.3	36.2	412		
Slight understanding	19.0	36.5	44.4	63		
No understanding	4.8	61.9	33.3	21		
New Math Institution or Workshop Attended						
Yes	21.1	37.6	41.3	455	2.42	0.659
No	25.1	33.8	41.1	263		
Teaching Preference						
The traditional curriculum	31.5	33.2	35.3	232	46.56*	0.000
The new math curriculum	0.0	21.2	78.8	52		
A modification of both	20.5	39.6	39.9	434		
None of these	0.0	50.0	50.0	2		
TOTAL	162	261	297	720		
	22.5%	36.3%	41.3%	100%		

[a]Item 14. Axioms such as the closure, order, uniqueness, etc., provide deep mathematical insight to the proofs of theorems.

*Significant at the .05 level of significance.

59.1 percent of all female teachers also agreed. Furthermore, the data reveal that there were significant relationships between the race of the teachers and their expressed responses. Of all white teachers 37.4 percent agreed, whereas 59.5 percent of all nonwhites also agreed.

Under the category of age groups, the data reveal significant relationships between the age of the teachers and their expressed responses. Of those who were 50 years of age or older, 32.6 percent agreed to item 14, while 40.1 percent of those between the ages of 40 to 40, 39.8 percent of those between the ages of 30 to 40, and 47.9 percent of those between the ages of 20 to 30 also agreed.

Under the categories of teaching experience and recency of college or university courses taken, there were no significant relationships between the number of years of teaching experience of teachers and their expressed responses. Furthermore, the data show no significant relationships between the recency of college or university courses taken and the expressed opinions to item 14.

An examination of the data reveal that there were significant relationships between the highest degree held by the teachers and their expressed responses. A larger percentage of teachers with a higher degree indicated their disagreement to item 14. Furthermore, while 71.9 percent of the teachers with less than the bachelor's degree agreed, only 38.3 percent of those teachers holding master's or above also agreed.

Under the category of grade level a significant relationship was revealed between the grade level taught and the responses to item 14.

There was a larger percentage of teachers of higher grade level of teaching who agreed. While 8.3 percent of the kindergarten teachers agreed, 27.7 percent of the elementary teachers, 50.4 percent of the middle schools teachers (grades 5-8), and 67.7 percent of the high school teachers also agreed.

Under the category of knowledge of the new math, the data show significant relationships between teachers' knowledge of the new math and their expressed responses. Those who agreed were 50.4 percent with thorough understanding, 36.2 percent with average understanding, 44.4 percent with slight understanding, and only 33.3 percent with no understanding. The data reveal that lack of knowledge of the new math tended to decrease the percentage of those who disagreed with item 14. Furthermore, the data show no significant relationship between the attendance at workshops or institutions which dealt with the implementation of the new math and teachers' responses to item 14.

A significant relationship between the teaching preference and the expressed reactions to item 14 is detected from the data of Table 16, page 100. While 35.3 percent of those who chose the traditional curriculum as their teaching preference agreed and 31.5 percent of them disagreed, 78.8 percent of those who indicated the new math curriculum as their teaching preference agreed and none of them disagreed. Furthermore, 39.9 percent of those teachers who indicated the modification of the new math curriculum agreed and 20.5 percent of them disagreed to item 14.

Item 15

The study of pure mathematics for its own sake helps in developing understanding and appreciation of its structure.

Table 17 presents the distribution of teachers' responses for the opinion survey scale to the above item by the ten categories under consideration. The data indicate that there were no significant relationships between the sex of the teachers and their expressed responses. However, the data show significant relationships between the race of the teachers and their expressed responses. While 63.6 percent of the white teachers agreed, only 46 percent of the nonwhites agreed.

Under the category of age group the data reveal no significant relationships between the ages of the teachers and their expressed responses; whereas under the category of teaching experience, the data indicate significant relationships between the number of years of teaching experience of teachers and their expressed responses. Those who agreed were 62.6 percent of teachers with 4 or less years of teaching experience, 65.4 percent of those with 5 to 9 years of experience, 70.6 percent of those with 10 to 14 years of experience, and only 49.6 percent of teachers with 15 or more years of teaching experience.

An examination of Table 17 reveals that there were no significant relationships between the recency of college or university training and the expressed opinion to item 15. It also reveals no significant relationships between the highest degree held by the teachers and their responses to item 15.

TABLE 17

TEACHERS' RESPONSES TO OPINION SURVEY SCALE ITEM 15[a] BY SEX, RACE, AGE, TEACHING EXPERIENCE, RECENCY OF COLLEGE OR UNIVERSITY COURSES TAKEN, HIGHEST DEGREE HELD, PRESENT TEACHING LEVEL, KNOWLEDGE OF THE NEW MATH, ATTENDANCE AT NEW MATH INSTITUTIONS OR WORKSHOPS, AND TEACHING PREFERENCE

Criterion	Percentage of All Respondents SD+D	U	SA+A	Σ	χ^2	Sig.
Sex						
Male	22.4	17.5	60.2	527	0.91	0.631
Female	23.8	14.5	61.7	193		
Race						
White	17.5	18.9	63.6	594	56.45*	0.000
Nonwhite	47.6	6.3	46.0	126		
Age Group						
20-30 years	19.0	17.8	63.2	242	11.95	0.063
30-40 years	18.7	18.1	63.3	166		
40-50 years	27.1	11.9	61.0	177		
50 or more years	28.9	19.3	51.9	135		
Teaching Experience						
0-4 years	18.7	18.7	62.6	187	30.36	0.000
5-8 years	17.0	17.6	65.4	188		
10-14 years	15.1	14.3	70.6	119		
15 or more years	35.0	15.5	49.6	226		
Recency of College or University Courses Taken						
Now taking	24.5	20.0	55.5	155	8.73	0.365
Within 1-4 years	19.7	14.8	65.5	304		
Within 5-9 years	22.3	18.2	59.5	148		
10 years or longer	29.5	15.2	55.4	112		
Highest Degree Held						
Less than bachelor's	21.9	9.4	68.8	32	8.12	0.229
Bachelor's	20.3	14.1	63.6	241		
Bachelor's plus graduate work	22.3	17.5	60.2	251		
Master's or above	26.5	19.9	53.6	196		

TABLE 17 (continued)

Criterion	Percentage of All Respondents SD+D	U	SA+A	Σ	χ^2	Sig.
Present Teaching Level						
Kindergarten	22.2	8.8	75.0	36		
Grades 1-4	25.5	20.8	53.8	318		
Grades 5-8	20.2	15.3	64.5	242	15.46*	0.017
Grades 9-12	21.0	12.9	66.1	124		
Knowledge of the New Mathematics						
Thorough understanding	19.2	15.2	65.6	224		
Average understanding	22.1	16.7	61.2	412		
Slight understanding	30.2	25.4	44.4	63	20.66*	0.002
No understanding	52.4	4.8	42.9	21		
New Math Institution or Workshop Attended						
Yes	17.1	17.1	65.7	455		
No	32.3	16.0	51.7	263	23.41*	0.000
Teaching Preference						
The traditional curriculum	29.7	14.7	55.6	232		
The new math curriculum	0.0	7.7	92.3	52		
A modification of both	21.9	18.9	59.2	434	32.33*	0.000
None of these	0.0	0.0	100.0	2		
TOTAL	164	120	436	720		
	22.8%	16.7%	60.6%	100%		

[a]Item 15. The study of pure mathematics for its own sake helps in developing understanding and appreciation of its structure.

*Significant at the .05 level of significance.

Under the category of grade level, a significant relationship was revealed between the grade level taught and the responses of the teachers. Those who agreed were 75 percent of the kindergarten teachers, 53.8 percent of the elementary teachers, 64.5 percent of the middle school teachers (grades 5-8), and 66.1 percent of the high school teachers.

Data, under the category of knowledge of the new math, show significant relationships between teachers' knowledge of the new math and their expressed responses. Lack of knowledge of the new math tended to reduce the percentage of those who agreed and increase the percentage of those who disagreed. While 65.6 percent of those with thorough understanding agreed, 61.2 percent of those with average understanding, 44.4 percent of those with slight understanding, and 42.9 percent of those with no understanding of the new math agreed. Furthermore, 19.2 percent of those with thorough understanding disagreed as compared to 52.4 percent of those with no understanding of the new math who also disagreed.

There were also significant relationships between the attendance at workshops or institutions which dealt with the implementation of the new math and teachers' responses to item 15. Of those who attended such workshops, 65.7 percent agreed to item 15 while only 51.7 percent of those who did not attend such workshops also agreed.

A significant relationship between the teaching preference and the expressed reactions to item 15 is detected from the data of Table 17. Only 55.6 percent of those who indicated the traditional curriculum as

their teaching preference agreed, as compared to 92.3 percent of those teachers who chose the new math curriculum as their teaching preference and who also agreed. Furthermore, 59.2 percent of those teachers who indicated the modification of the new math curriculum also indicated their agreement to item 15.

CHAPTER V

SUMMARY, CONCLUSION, AND RECOMMENDATIONS

I. INTRODUCTION

The purpose of this study was to ascertain the opinion of elementary, middle, and secondary school teachers in North Alabama regarding the impact of the new mathematics, the merit of the innovation, and whether the new curriculum had actually improved the teaching of mathematics and had indeed made the subject more accessible to the students.

The study was made by means of a questionnaire and an opinion survey scale. The questionnaire was designed to provide personal background variables, and the opinion survey scale was composed of different opinions given by various publications, articles, and teachers of mathematics concerning the impact of the new math to be judged according to a given set of scales (see Appendix).

The questionnaire and the opinion survey scale were distributed to a population consisting of 987 elementary, middle, and secondary teachers of mathematics in 136 school systems in North Alabama. The addresses of these schools were randomly drawn from a list of all teachers employed in North Alabama provided in the Educational Directory 1974-75 of the State of Alabama, Department of Education Bulletin, 1975, No. 1.

The study sought to determine whether the sex, race, age, teaching experience, recency of college or university training, highest degree held, grade level taught, knowledge of the new math, institutions or workshops attendance, and the teaching preference of the teacher affected the teacher's opinion regarding the new curriculum of mathematics.

II. SUMMARY

Item 1: The new math teaches new routines far more useless than the traditional routines.

The distributions of teachers' responses to item 1 revealed significant relationships between 8 out of the 10 categories under consideration and the expressed reactions of teachers. There were no significant relationships between teachers' responses to item 1 and the recency of college or university courses taken or the highest degree held by the teachers. Furthermore, out of 720 participants 261, or 36.3 percent disagreed or strongly disagreed; 77, or 10.7 percent, were undecided; and 382, or 53.1 percent of all teachers, agreed or strongly agreed. Higher percentages of those teachers with older age, longer teaching experience, who held the bachelor's degree or less, taught middle schools (grades 5-8), with slight knowledge of the new math, or who had not attended workshops or institutions implementing the new math, agreed or strongly agreed to the opinion that the new math taught new routines far more useless than the traditional routines.

Item 2: The formalism of the new math leads to an erosion of the vitality of mathematics and to authoritarianism in teaching.

The distributions of teachers' responses to item 2 revealed significant relationships between nine out of the ten categories under consideration and the expressed reactions of teachers. There were no significant relationships between the race of the teachers and their expressed opinions to item 2. Furthermore, out of 720 participants 227, or 31.5 percent, agreed or strongly agreed; 173, or 24 percent, were undecided; and 320, or 44.4 percent of all teachers, disagreed or strongly disagreed. Higher percentages of these teachers with older age, longer teaching experience, no college courses recently taken, who held the bachelor's degree or less, and had slight or no understanding of the new math agreed or strongly agreed to the opinion that the formalism of the new math led to an erosion of the vitality of mathematics and to authoritarianism in teaching.

Item 3: The subject of sets in the new math is of no use in understanding the elementary mathematics.

The distribution of teachers' responses to item 3 revealed significant relationships between nine out of the ten categories under consideration and the expressed reactions of teachers. There were no significant relationships between the age group of teachers and their expressed opinions to item 3. Furthermore, out of 720 participants 137, or 19 percent, agreed or strongly agreed; 59, or 8.2 percent, were undecided; and 524, or 72.8 percent of all teachers, disagreed or strongly disagreed. Higher percentages of those teachers with

younger age, 10 to 14 years of experience, who had attended colleges within 5 to 9 years, held master's degree or above, taught kindergarten or elementary school (grades 1-4), or had thorough understanding, disagreed or strongly disagreed to the opinion that the subject of sets in the new math was of no use in understanding the elementary mathematics.

Item 4: The subject of bases in the new math is confusing and has no significance in the understanding of base ten.

The distributions of teachers' responses to item 4 revealed significant relationships between six out of the ten categories under consideration and the expressed reactions of teachers. There were no significant relationships between teachers' responses to item 4 and the sex, race, age group, or teaching experience of the teachers. Furthermore, out of 720 participants 300, or 41.7 percent, agreed or strongly agreed; 117, or 16.3 percent, were undecided; and 303, or 42.1 percent of all participants, disagreed or strongly disagreed. Higher percentages of those teachers with no college courses recently taken, who held bachelor's degree or less, taught middle school (grades 5-8), or had slight or no understanding of the new math agreed or strongly agreed to the opinion that the subject of bases in the new math was confusing and had no significance in aiding the understanding of base ten.

Item 5: There seems to be nothing to recommend the study of arithmetic modulo for the elementary level except its pointless novelty.

The distributions of teachers' responses to item 5 revealed significant relationships between the ten categories under consideration

and the expressed reactions of teachers. Out of 720 participants, 206, or 28.6 percent, disagreed or strongly disagreed; 283, or 39.3 percent, were undecided; and 231, or 32.1 percent of all participants, agreed or strongly agreed. Higher percentages of those male teachers, nonwhite, between the ages of 30 to 40, with 5 to 9 years teaching experience, who had attended college within 5-9 years, held master's degree or above, taught kindergarten, had a thorough understanding of the new math, and had attended institutions or workshops implementing the new math disagreed or strongly disagreed to the opinion that there seemed to be nothing to recommend the study of arithmetic modulo for the elementary level except its pointless novelty.

Item 6: Boolean algebra and symbolic logic are specialties, useless to noncollege students, and should be reserved for specialists.

The distributions of teachers' responses to item 6 revealed significant relationships between six out of the ten categories under consideration and the expressed reactions of teachers. There were no significant relationships between teachers' responses to item 6 and the race, age group, teaching experience, or teachers' attendance to institutions or workshops implementing the new math. Furthermore, out of 720 participants 119, or 16.5 percent, disagreed or strongly disagreed; 314, or 43.6 percent, were undecided; and 287, or 39.9 percent of all participants, agreed or strongly agreed to item 6. Higher percentages of those male teachers, white, between the ages of 20 to 30, with 10 to 14 years of teaching experience, who had not recently attended school, held less than the bachelor's degree, taught

high school (grades 9-12), had thorough knowledge of the new math, or had not attended institutions or workshops implementing the new math agreed or strongly agreed to the opinion that Boolean algebra and symbolic logic were specialties, useless to noncollege students, and should be reserved for specialists.

Item 7: There is no justification for teaching matrices at the twelfth grade level, as advocated by the new math movement.

The distributions of teachers' responses to item 7 revealed significant relationships between eight out of the ten categories under consideration and the expressed reactions of teachers. There were no signficant relationships between teachers' responses to item 7 and the age group of the teachers or the attendance to new math institutions or workshops. Furthermore, out of 720 participants 99, or 13.8 percent, agreed or strongly agreed; 426, or 59.2 percent, were undecided; and 194, or 26.9 percent of all participants, disagreed or strongly disagreed to item 7. Higher percentages of those female teachers, white, 40 years of age or older, with 10 to 14 years of teaching experience, who had not recently attended school, held less than the bachelor's degree, taught high school (grades 9-12), with slight or no understanding of the new math, or had not attended institutions or workshops implementing the new math, agreed or strongly agreed to the opinion that there was no justification for teaching matrices at the twelfth grade level, as advocated by the new math movement.

Item 8: The new math failed to present the relationship of mathematics to allied subjects and the real world.

The distributions of teachers' responses to item 8 revealed significant relationships between the ten categories under consideration and the expressed reactions of teachers. Out of 720 participants 341, or 47.4 percent, agreed or strongly agreed; 100, or 13.9 percent, were undecided; and 279, or 38.8 percent, disagreed or strongly disagreed to item 8. Higher percentages of those female teachers, nonwhites, forty years of age or older, with 15 or more years teaching experience, who had not recently attended school, held less than the bachelor's degree, taught high school (grades 9-12), had slight or no understanding of the new math, and had not attended institutions or workshops implementing the new math, agreed or strongly agreed to the opinion that the new math failed to present the relationship of mathematics to allied subjects and the real world.

Item 9: The new math offers an abstract and rigorous version that conceals the rich and fruitful essence of mathematics.

The distributions of teachers' responses to item 9 revealed significant relationships between eight out of the ten categories under consideration and the expressed reactions of teachers. Out of 720 participants 269, or 37.4 percent, agreed or strongly agreed; 154, or 21.4 percent, were undecided; and 297, or 41.3 percent of all participants, disagreed or strongly disagreed to item 9. There were no significant relationships between teachers' responses to item 9 and the race or the teaching experience of the teachers. Higher percentages of those female teachers 40 years or older, who had not recently attended school, held less than the bachelor's degree, had

slight or no understanding of the new math, or had not attended institutions or workshops implementing the new math agreed or strongly agreed to the opinion that the new math offered an abstract and rigorous version that concealed the rich and fruitful essence of mathematics.

Item 10: The new math stresses final sophisticated versions of simple ideas while treating superficially the deeper ones.

The distributions of teachers' responses to item 10 revealed significant relationships between eight out of the ten categories under consideration and the expressed reactions of teachers. There were no significant relationships between teachers' responses to item 10 and the recency of college or university courses taken or the present teaching level. Furthermore, out of 720 participants 397, or 55.1 percent, agreed or strongly agreed; 129, or 17.9 percent, were undecided; and 194, or 26.9 percent of all participants, disagreed or strongly disagreed to item 10. Higher percentages of those female teachers, nonwhite, 40 or more years of age, who had 15 or more years of experience, had not recently attended school, held less than the bachelor's degree, taught kindergarten, had slight or no understanding of the new math, agreed or strongly agreed to the opinion that the new math stressed final sophisticated versions of simple ideas while treating superficially the deeper ones.

Item 11: The new math is ideal for the students who will ultimately enter into the full variety of professional careers and trades.

The distributions of teachers' responses to item 11 revealed significant relationships between eight out of the ten categories

under consideration and the expressed reactions of teachers. There were no significant relationships between teachers' responses to item 11 and the race or the number of years teaching experience of the teachers. Furthermore, out of 720 297, or 41.3 percent, agreed or strongly agreed; 150, or 20.8 percent, were undecided; and 273, or 37.9 percent, disagreed, or strongly disagreed to item 11. Higher percentages of those male teachers under the age of 30 with 4 or less years teaching experience, who had recently attended colleges or universities, held the bachelor's degree plus graduate work, tuaght kindergarten or middle school (grades 5-8), had thorough understanding of the new math, or had attended institutions or workshops implementing the new math agreed or strongly agreed to the opinion that the new math was ideal for the students who would ultimately enter into the full variety of professional careers and trades.

Item 12: The new math is appealing and inviting to the students and provides for superior understanding.

The distributions of teachers' responses to item 12 revealed significant relationships between eight out of the ten categories under consideration and the expressed reactions of teachers. There were no significant relationships between teachers' responses to item 12 and their sex or present teaching level. Furthermore, out of 720 participants 220, or 30.6 percent agreed or strongly agreed; 90, or 12.5 percent, were undecided; and 410, or 46.9 percent of all participants, disagreed or strongly disagreed to item 12. Higher percentages of those female teachers, white, 30 years of age or

younger, with 9 or less years of teaching experience, who had attended college within 1 to 4 years, held bachelor's plus graduate work, taught kindergarten, had thorough knowledge of the new math, or had attended institutions or workshops implementing the new math, agreed or strongly agreed to the opinion that the new math was appealing and inviting to the students and provided for superior understanding.

Item 13: The introduction of such axioms as commutative and associative properties eliminate difficulties in learning mathematics.

The distributions of teachers' responses to item 13 revealed significant relationships between five out of the ten categories under consideration and the expressed reactions of teachers. There were no significant relationships between teachers' responses to item 13 and the age group, number of years teaching experience, recency of college or university attendance, knowledge of the new math, or attendance at institutions or workshops implementing the new math. Furthermore, out of 720, 246, or 34.2 percent agreed or strongly agreed; 96, or 13.3 percent, were undecided; and 378, or 52.5 percent, disagreed or strongly disagreed to item 13. Higher percentages of those female teachers, nonwhites, 30 years of age or younger, with 10 to 14 years teaching experience, who had attended college within 5 to 9 years, held less than the bachelor's degree, taught high school (grades 9-12), and had attended institutions or workshops implementing the new math, agreed or strongly agreed to the opinion that the introduction of such axioms as commutative and associative properties eliminated difficulties in learning mathematics.

Item 14: Axioms such as the closure, order, uniqueness, etc., provide deep mathematical insight to the proofs of theorems.

The distributions of teachers' responses to item 14 revealed significant relationships between seven out of the ten categories under consideration and the expressed reactions of teachers. There were no significant relationships between teachers' responses to item 14 and the number of years teaching experience, recency of college or university courses taken, or attendance at institutions or workshops implementing the new math. Furthermore, out of 720, 297, or 41.3 percent, agreed or strongly agreed; 261, or 36.3 percent, were undecided; and 162, or 22.5 percent of all participants, disagreed or strongly disagreed to item 14. Higher percentages of those female teachers, nonwhites, 30 years of age or younger, with 10 to 14 years of teaching experience, who had attended college within 1 to 4 years, held less than the bachelor's degree, taught high school (grades 9-12), or had thorough knowledge of the new math agreed or strongly agreed to the opinion that axioms such as the closure, order, uniqueness, etc., provided deep mathematical insight to the proofs of theorems.

Item 15: The study of pure mathematics for its own sake helps in developing understanding and appreciation of its structure.

The distributions of teachers' responses to item 15 revealed significant relationships between six out of the ten categories under consideration and the expressed reactions of teachers. There were no significant relationships between teachers' responses to item 15 and the sex, age group, recency of college or university courses taken, or

the highest degree held by the teachers. Furthermore, out of 720, 436, or 60.6 percent, agreed or strongly agreed; 120, or 16.7 percent, were undecided; 169, or 22.8 percent of all participants, disagreed or strongly disagreed to item 15. Higher percentages of those white teachers, with 10 to 14 years teaching experience, teaching kindergarten, with thorough knowledge of the new math, or who had attended institutions or workshops implementing the new math agreed or strongly agreed to the opinion that the study of pure mathematics for its own sake helped in developing understanding and appreciation of its structure.

III. CONCLUSIONS

Tne hypotheses were examined. All ten hypotheses stated in the null form were rejected. The teacher's sex, race, age, years of teaching experience, recency of college courses taken, highest degree held, teaching level, knowledge of the new math, attendance at institutions or workshops implementing the new math, and the indicated preference of curriculum had a great bearing and influence on the opinion toward the impact of the new math.

Sex

Female teachers tended to indicate a more negative attitude toward the impact of the new math than male teachers.

Race

Nonwhite teachers tended to indicate a more positive attitude toward the impact of the new math than white teachers.

Age

Younger teachers tended to indicate a more positive attitude toward the impact of the new math than teachers with older age. The older the age group, the higher the negative attitude toward the new math.

Teaching Experience

Teachers possessing more years of teaching experience tended to indicate a more negative attitude toward the new math than teachers with fewer years of teaching experience.

Recency of College or University Courses Taken

Teachers who attended colleges or universities more recently tended to indicate a more positive attitude toward the new math than teachers who attended ten years before or more.

Highest Degree Held

Teachers with master's degrees or above tended to indicate a more positive attitude toward the impact of the new math than teachers with the bachelor's degree or less.

Present Teaching Level

Kindergarten and middle school (grades 5-8) teachers tended to indicate a more negative attitude toward the impact of the new math than teachers of elementary grades or high school levels. High school teachers tended to indicate a more positive attitude toward the new math than any of the other three grade levels, and kindergarten

teachers tended to indicate more negative attitudes than any of the other three grade levels.

Knowledge of the New Math

Teachers with thorough understanding of the new math tended to indicate a more positive attitude toward the impact of the new math than teachers with slight or no understanding of the new math.

New Math Institutions or Workshops Attended

Teachers who attended institutions or workshops implementing the new math tended to indicate a more positive attitude toward the impact of the new math than teachers with no attendance at any new math workshops or institutions.

Teaching Preference

Teachers who chose the traditional curriculum tended to indicate a more negative attitude toward the new math than those who indicated the modification of both the new math and the traditional curriculum. Furthermore, teachers who chose the new math curriculum as their teaching preference indicated a significantly positive attitude toward the opinion that boolean algebra and symbolic logic are specialties, useless to noncollege students, and should be reserved for specialists, and were undecided whether or not there was any justification for teaching matrices at the twelfth grade level.

IV. RECOMMENDATIONS

As a result of this study the following recommendations seem appropriate:

1. Improving the competence of all prospective teachers is vital to continued improvement of mathematics learning.

2. Committees on teacher education, such as those active in NCTM, the Cambridge Conference, and MAA should recommend and support new ventures in teacher education.

3. Mathematical writings should be more human and should motivate and interpret mathematics in terms of genuine physical problems within the child's universe.

4. No one should introduce new mathematics merely to change the subject content of instruction; if he does, the new will confuse the learning process, the real purpose is lost, and the educational significance of mathematics is also lost.

5. Distinction needs to be made between what is possible to teach and what is the most desirable to teach. Further research needs to be done on this distinction.

6. The arithmetic should be taught by mathematicians prepared in the elementary school, and the problem of remedial instruction in arithmetic in the high school should be studied.

7. Each teacher must be thoroughly prepared, not only in the foundations underlying the subject in which he instructs but also in mathematical concepts the pupils will study subsequently.

8. It would be useful and instructive to extend the study of teachers' opinions toward the impact of the new math to embrace a larger sample of teachers in a greater number of schools.

Sitting still and wishing
Makes no person great.
The good Lord sends the fishing
But one must dig the bait.[1]

---

[1]Emily Van Horn, "The President's Message," New York State Mathematics Teachers Journal (October, 1960), p. 132.

BIBLIOGRAPHY

BIBLIOGRAPHY

A. BOOKS

Beberman, Max. An Emerging Program of Secondary School Mathematics. Cambridge, Mass.: Harvard University Press, 1958.

Cambridge Conference on School Mathematics. Goals for School Mathematics. Boston: Houghton Mifflin Co., 1963.

Johnson, Donovan A., and Robert Rahtz. The New Mathematics in Our Schools. New York: The Macmillan Company, 1966; London: Collier-Macmillan Limited, 1966.

Kinsella, John J. Secondary School Mathematics. New York: The Center for Applied Research in Education, Inc., 1965.

Kline, Morris. Why Johnny Can't Add: The Failure of the New Math. New York: Random House, 1973.

Nuffield Mathematics Project. I Do, and I Understand. New York: John Wiley and Sons, Inc., 1967.

B. PUBLICATIONS OF THE GOVERNMENT, LEARNED SOCIETIES AND OTHER ORGANIZATIONS

Commission on Mathematics. College Entrance Examination Board: Program for College Preparatory Mathematics and Appendices. Princeton, N.J.: Educational Testing Service, 1959.

Deans, Edwina. Elementary School Mathematics: New Directions. Washington, D.C.: U.S. Department of Health, Education and Welfare, 1963.

Lockard, David J. Report of the International Clearinghouse on Science and Mathematics Curricular Developments. College Park, Md.: American Association for the Advancement of Science and the Science Teaching Center, May, 1967.

New Development in Secondary School Mathematics. Washington, D.C.: National Council of Teachers of Mathematics, May, 1959.

The Continuing Revolution in Mathematics. Washington, D.C.: National Council of Teachers of Mathematics, 1968.

The Revolution in School Mathematics. Washington, D.C.: National Council of Teachers of Mathematics, 1961.

C. PERIODICALS

Adler, Alfred. "Reflections Mathematics and Creativity," New Yorker (February 19, 1972), pp. 39-45.

Allendoerfer, Carl B. "The Second Revolution in Mathematics," The Mathematics Teacher (December, 1965), p. 690.

Begle, E. G. "Some Lessons Learned by SMSB," Mathematics Teacher (March, 1973), p. 207.

Buchwald, Art. "Why Parents Can't Add," Reader's Digest (October, 1966), pp. 151-152.

"Captivating Key to Math," Life (February 10, 1961), p. 47.

Cohen, Monroe D. "The Strange Case of the New Math," Childhood Education (February, 1974), p. 210.

Cohn, Nathan. "The New Math at 33 1/3," Saturday Review (March 16, 1968), p. 55.

Corle, Clyde G. "The New Mathematics," The Arithmetic Teacher (April, 1964), p. 244.

Creswell, J. L. "Mom and Dad Study the New Math," Parents Magazine (September, 1966), pp. 58-59.

Creswell, John L. "Are American Children Behind in Math?" Parents Magazine (March, 1968), pp. 58-59.

Davis, R. B. "New Math: Success/Failure," Education Digest (March, 1974), pp. 10-12.

Davis, Robert B. "The Changing Curriculum: Mathematics," Association for Supervision and Curriculum Development, NEA (1967), pp. 1-4.

Denny, R. R. "How to Check With Arithmetic," Better Homes and Gardens (January, 1963), pp. 76-78.

"Digits and Dunces," Newsweek (April 9, 1956), p. 78.

Drucker, Peter F. "Math Every Parent Can Understand," Harper's (April, 1958), pp. 73-75.

Dunbar, R. "Why Johnny Can't Add," Saturday Review (September 8, 1956), p. 28.

Eleanor, M. "A Secondary School Mathematics Program," The Bulletin of the National Association of Secondary School Principals (May, 1959), pp. 12-18.

Ellison, Louis. "Mathematics for the Very Young," Parents Magazine (July, 1969), pp. 88-89.

Feinstein, Irwin K. "Mastering Modern Math," PTA Magazine (September, 1964), pp. 19-22.

Foreman, Dale I., and William A. Mehrens. "National Assessment in Mathematics," The Arithmetic Teacher (March, 1971), pp. 141-142.

Garstens, Helen L. "University of Maryland Mathematics Project," The Arithmetic Teacher (February, 1960), pp. 61-65.

Geddes, Dorothy, and Sally I. Lipsey. "Sets--Natural, Necessary, Knowledge?" The Arithmetic Teacher (April, 1968), p. 337.

Heath, Aloise B. "Spare Me the Rods," National Review (December 31, 1963), pp. 562-566.

"How They're Teaching Math to Your Kids," Changing Times: The Kiplinger Magazine (November, 1969), pp. 19-22.

"Inside Numbers," Time (January 31, 1964), pp. 34-35.

Kendig, F. "Does New Math Add Up?" Time (January 6, 1974), pp. 14-15; January 27, 1974), p. 4.

Kline, Morris. "The New Math: A Passing Aberration," Learning (January, 1974), p. 18.

Lawson, J. H. "Is the New Math Doing the Job?" Education Digest (December, 1973), pp. 16-17.

"Least Popular Subject," Time (June 18, 1956), p. 74.

Lerner, Norbert. "'Sets' and Elementary School Mathematics," The Arithmetic Teacher (November, 1958), p. 239.

Martin, Richard. "The New Math Strikes Out," Science Digest (October, 1973), pp. 65-69.

"Math and Ticktacktoe," Time (July 23, 1956), pp. 78-80.

"Math Demonstrates It Still Appeals to Youngsters," Business World (March 31, 1956), pp. 24-25.

"Math Made Easy," Newsweek (February 8, 1960), p. 91.

"New Math--Does It Really Add Up?" Newsweek (May 10, 1965), pp. 112-118.

"New Math Your Children May Be Learning," Good Housekeeping (January, 1965), pp. 132-133.

"Path to Math," Fortune (April, 1956), p. 110.

Petronia, Sister Mary. "A Letter to Parents About the 'New Mathematics,'" The Arithmetic Teacher (October, 1966), p. 471.

Pine, Particia. "New Math Road Show: Madison Project Workshop for Teachers," American Education (July, 1968), pp. 27-29.

"Poor Marks in Math for U.S. Pupils, But--," U.S. News and World Report (March 20, 1967), p. 12.

Rowan, Helen. "The Wonderful World of Why," Saturday Review (November 2, 1957), pp. 42-45.

Sharp, Evelyn. "New Math: You Don't Count on Your Fingers Anymore," Saturday Review (January 19, 1963), pp. 65-67.

Sharp, Evelyn. "Progress Report on Mathematical Revision," Saturday Review (March 20, 1965), pp. 62-63.

Sharp, Evelyn. "Progress Report on the Mathematics Revolution," Saturday Review (March 20, 1965), pp. 62-63.

Stewart, James Gordon. "She Turns Figures Into Fun," Reader's Digest (June, 1961), pp. 211-212.

Strehler, Allen F. "What's New About the New Math?" Saturday Review (March 21, 1964), pp. 68-69.

Suppes, Patrick. "Adding Up the New Math," PTA Magazine (October, 1965), pp. 8-10.

"Trials of New Math," Time (January 22, 1965), p. 38.

Van Dine, Alan. "Who's Afraid of the New Math?" Parents Magazine (September, 1957), pp. 62-63.

Willoughby, Stephen S. "What is the New Mathematics?" Education Digest (September, 1968), pp. 47-50.

Wren, F. Lynwood. "It's Not How New You Make It, But How You Make It New," The Arithmetic Teacher (January, 1971), pp. 7-8.

D. UNPUBLISHED MATERIALS

Grafft, William D. "Cognitive Outcomes of the SMSG Mathematics Program in Grades 4, 5, and 6." Unpublished Doctoral dissertation, University of California, 1966.

Schott, Andrew F. (Consultant to Education, Inc.). "The Fifth Study in the Improvement of Elementary Mathematics Education," 1960.

APPENDIX

RUSSELVILLE CITY SCHOOLS

Waterlog Road
P. O. Box 980

Russelville, Alabama 35653

R. M. Courington
Superintendent

Telephone
(205) 332-3223

December 2, 1974

To: Principals

From: R. M. Courington

Mr. Hisham Durdunji, a Russellville High School mathematics teacher, is conducting a study regarding teachers' opinions of the "new math curriculum" in North Alabama.

The study is concerned with group opinions only and any individual information supplied will be kept in the strictest of confidence. Results of the study will be supplied upon your request.

This letter is to let you know that we endorse Mr. Durdunji's study and to seek your assistance in distributing the enclosed questionnaires to your elementary, middle school and secondary teachers of mathematics.

Your cooperation in this endeavor will be deeply appreciated.

RMC:ef

RUSSELLVILLE HIGH SCHOOL

Russelville, Alabama

January 15, 1975

Dear Fellow Teacher:

For the interest of education and to provide an opportunity for mathematics teachers to express their opinion, I am conducting a survey of teachers' opinions in regard to the "new math," which has been adopted to the curriculum for the past fifteen years.

You were selected by random sampling of the elementary, middle school, and secondary teachers of mathematics in North Alabama. And in order to obtain an accurate picture of all teachers' opinions, it is most important to have your response.

Since the study is concerned only with compiled group opinions, any opinion and information you supply will be kept in the strictest confidence.

I would appreciate you taking a few minutes of your time to complete the questionnaire and return it sealed in the enclosed envelope to your principal's office by February 1, 1975.

Sincerely,

signed

Hisham R. Durdunji

QUESTIONNAIRE

1. Indicate your sex
   _____female _____male

2. Indicate your group
   _____white _____nonwhite

3. What is your present age?
   _____20-30 _____40-50
   _____30-40 _____50 or more

4. Number of years teaching experience
   _____0-4 years _____10-14 years
   _____5-9 years _____15 or more years

5. Recency of formal college or university courses taken
   _____now taking _____within 5-9 years
   _____within 1-4 years _____10 years or longer

6. Highest degree held
   _____less than bachelor _____bachelors plus graduate work
   _____bachelors _____masters or above

7. Present teaching level
   _____Kindergarten _____Grades 5-8
   _____Grades 1-4 _____Grades 9-12

8. How do you grade your knowledge of the "new math?"
   _____thorough understanding _____slight understanding
   _____average understanding _____no understanding

9. Have you attended any institutions or workshops which dealt with the implementation of the "new math?"
   _____yes _____no

10. Indicate your teaching preference
    _____the traditional curriculum _____a modification of both
    _____the "new math" curriculum _____none of these

OPINION SURVEY SCALE

The following are different opinions given by various teachers of both elementary and secondary levels concerning the impact of "new math" to be judged according to a given set of scales.

Please read the statements below and decide whether you strongly agree, agree, are undecided, disagree, or strongly disagree, and indicate your choice with a check mark (✓).

strongly agree	agree	undecided	disagree	strongly disagree	
					1. The new math teaches new routines far more useless than the traditional routines.
					2. The formalism of the new math leads to an erosion of the vitality of mathematics and to authoritarianism in teaching.
					3. The subject of sets in the new math is of no use in understanding the elementary mathematics.
					4. The subject of bases in the new math is confusing and has no significance in aiding the understanding of base ten.
					5. There seems to be nothing to recommend the study of arithmetic modulo for the elementary level except its pointless novelty.
					6. Boolean algebra and symbolic logic are specialties, useless to noncollege students, and should be reserved for specialists.
					7. There is no justification for teaching matrices at the twelfth grade level, as advocated by the new math movement.
					8. The new math failed to present the relationship of mathematics to allied subjects and the real world.
					9. The new math offers an abstract and rigorous version that conceals the rich and fruitful essence of mathematics.
					10. The new math stresses final sophisticated versions of simple ideas while treating superficially the deeper ones.
					11. The new math is ideal for the students who will ultimately enter into the full variety of professional careers and trades.

					12. The new math is appealing and inviting to the students, and provides for superior understanding.
					13. The introduction of such axioms as commutative and associative properties eliminate difficulties in learning mathematics.
					14. Axioms such as the closure, order, uniqueness, etc., provide deep mathematical insight to the proofs of theorems.
					15. The study of pure mathematics for its own sake helps in developing understanding and appreciation of its structure.

TEACHERS' OPINIONS OF THE NEW MATH

The following are opinions given by teachers of elementary, middle, and secondary school levels concerning the impact of the new math.

1. The logical approach of the "new math" eliminates rote learning.
2. Axioms such as the closure, associative, commutative, and distributive properties are useless.
3. The deductive approach (proofs) needs to be applied only to high school geometry.
4. Students cannot comprehend the structure of the number system.
5. Students cannot comprehend the theory of logic.
6. Students cannot comprehend the set theory.
7. Students cannot comprehend probability and statistics.
8. It is too early to teach calculus in high school.
9. Students view the learning of the theory of logic as nonsense.
10. The new math per se has no place in my classroom.
11. The new math has reformed the teaching method.
12. The new math introduced many concepts, symbols, and formalism with no validity.
13. The new math produces much better thinkers.
14. The new math promotes better attitudes toward mathematics among the students.
15. Mathematics is more easily learned by discovery rather than by drill.
16. The set theory is too abstract to comprehend.
17. Boolean algebra is too abstract to comprehend.
18. The level of abstraction in the "new math" is over the heads of most students.

19. Abstract algebra is too abstract for students to understand.

20. Students cannot comprehend the postulational system.

21. The study of "axioms" and "postulates" are more easily acceptable than the arbitrary "rules."

22. The rigor of the new math does not suit the age and maturity of the students.

23. The students lap up the teaching of logic.

24. Logic helps students understand the structure of the deductive process.

25. Students comprehend the true nature of deductive reasoning.

26. Topology makes no contribution to students' understanding of mathematics.

27. Boolean algebra plays no role at all in mathematics.

28. The concepts of abstract algebra are of no use in promoting the understanding of mathematics.

29. It is difficult for students to accept the logical concept of the irrational number.

30. The new math does not improve the teaching of mathematics.

31. The new math arouses interest in the subject.

32. The new math provides motivation and purpose.

33. The new math makes each mathematical idea or procedure intuitively clear to the students.

34. The new math is more accepted by the students.

35. Students are more receptive to the new math.

36. Students have a more favorable attitude toward the new math.

37. The new math is easier to understand than the old math.

38. The new math is more difficult to understand than the old math.

39. The new math is more interesting than the old math.

40. The new math is less interesting than the old math.

41. The new math reduces students' ability to compute.

42. The new math is easier to teach.

43. The use of basic properties such as the associative and the commutative properties makes a meaningful contribution to students' insight into mathematics.

44. The new math provides no knowledge of how mathematics fits into the student's world.

45. The imposed deductive approach of the new math eliminates discovery.

46. Logic aids students in understanding mathematical proof.

47. The study of other bases increases proficiency and understanding of base ten.

48. Slow learners score higher achievement in using a new math program.

49. The new math is a real challenge to superior students.

50. The new math provides a better understanding of numbers.

51. Parents are pleased with students' performance in mathematics.

52. In the new math, students are taught to think, not to memorize.

53. The new math promotes greater interest in teaching mathematics.

54. The new math failed to teach on the learning level of the student.

55. The new math failed to arouse interest.

56. The new math provides no sympathy for the "slow learner."

57. The new math provides sophisticated mathematics to children at too early an age.

58. Experience with modern mathematics affects the formal reasoning of students.

59. The new math has no contributions to the general education of man.

60. Students comprehend the unificational outcome of sets, relations, and functions.

61. The logical approach eliminates difficulties students have had in learning mathematics.

62. Symbolism and the language of sets secures precision.

63. Symbolism and the language of sets unifies various branches of mathematics.

64. The study of pure mathematics, for its own sake, helps in developing an appreciation of its structure.

65. The formalism of the new math leads to an erosion of the vitality of mathematics.

66. The new math leads to authoritarianism in teaching.

67. The new math teaches useless routine.

68. The subject of sets in the new math is of no use in understanding mathematics.

69. The new math failed to present its relationship to allied subjects or to the real world.

70. The study of bases other than ten is confusing.

71. The study of bases other than ten has no significance in aiding understanding of base ten.

72. There is nothing to recommend the study of arithmetic modulo except its pointless novelty.

73. There is no value in teaching inequality below college level.

74. Boolean algebra should be reserved for specialists.

75. Symbolic logic should be reserved for a specialist.

76. There is no justification for teaching matrices at the twelfth grade level.

77. The students can absorb the topics of the new math.

78. The new math is ideal for students with any occupational interest.

79. The new math develops mathematicians.

80. The new math remedies the defects of the old math (the traditional curriculum).

COUNTY AND CITY SCHOOLS WHICH PARTICIPATED IN THE STUDY

The following school listing is divided alphabetically into three groups: (1) schools which have twelfth grade, (2) schools which have one or more secondary grades, and (3) schools which have elementary only. The symbols used in status column denote the following:

P = Probation by State
S = Southern Association Accredited
U = Unapproved Center
T = Temporary Center Approved for Grades Indicated

Name of School	Mailing Address	Principal	Grades Supervised	Grades State Accredited	Status
COLBERT COUNTY					
Colbert Heights High School	Woodmont Dr., Tuscumbia, 35674	Leroy Finch	1-12	7-12	S
County High School	Leighton, 35646	Marshall W. Newman	9-12	9-12	S
Deshler High School	Tuscumbia, 35674	Fred Johnson	8-12	8-12	S
Muscle Shoals High School	Avalon Ave., Muscle Shoals, 35660	Doug Worley	9-12	9-12	S
Sheffield High School	2800 19th Ave., Sheffield, 35660	Howard C. Jaggers	9-12	9-12	S
Avalon Middle School	Avalon Ave., Muscle Shoals, 35660	Charles L. Carter	5-8	None	
Cherokee Middle School	P.O. Box H, Cherokee, 35616	P. B. Reynolds	5-8	5-8	
Leighton Middle School	Leighton, 35646	James Meherg	5-8	7-8	S
Littleville Elementary School	Rt. 3, Tuscumbia, 35674	Theron Morgan	1-8	None	U
Wilson, L. E., Middle School	Jackson Pk., Sheffield, 35660	Jesse M. Joiner, Jr.	6-8	7-8	S
Annapolis Ave. Elementary School	900 Annapolis Ave., Sheffield, 35660	Cary O. Johnson	1-5	1-5	
Blake Elementary School	12th Ave., Sheffield, 35660	Eddie Myrick	1-5	1-5	
Brewster, C. M., Elementary School	Chickamauga St., Sheffield, 35660	Mrs. Polly T. Worley	1-5	1-5	
Cherokee Elementary School	Cherokee, 35616	Hubert Thorn	1-4	None	
Howell-Graves Elementary School	Wilson Dam Hwy., Muscle Shoals, 35660	Mrs. Maudine Smith	1-4	None	
Leighton Elementary School	Leighton, 35646	Paul E. Jones	1-4	None	
Northside Elementary School	Tuscumbia, 35674	John B. Smith	4-7	4-7	
Southeast Sheffield Elementary School	701 E. 17th St., Sheffield, 35660	L. E. Garrett	1-5	1-5	
Southwest Sheffield Elementary School	1300 S. W. 8th, Sheffield, 35660	Mrs. Polly T. Worley	1-5	1-5	
CULLMAN COUNTY					
Cullman Co. Area Vocational School	Rt. 14, Box 65, Cullman, 35055	James E. Porter	10-12	10-12	
Cullman Sr. High School	P.O. Drawer 488, Cullman, 35055	John Tillman	9-12	9-12	
Fairview High School	Rt. 7, Cullman, 35055	Donald W. Jones	1-12	1-12	
Hanceville High School	Hanceville, 35077	John Holtzclaw	1-12	7-12	
Vinemont High School	Vinemont, 35179	Elton A. Hall	1-12	7-12	
West Point High School	Rt. 5, Cullman, 35055	Thomas L. Burleson	1-12	7-12	

Name of School	Mailing Address	Principal	Grades Supervised	Grades State Accredited	Status
CULLMAN COUNTY (continued)					
Cullman Middle School	Cullman, 35055	Stanley Johnson	6-8	6-8	S
Garden City Elementary School	Garden City, 35070	Mrs. Ruby Marcum	1-7	None	U
FRANKLIN COUNTY					
Belgreen High School	Rt. 6, Russellville, 35653	Donald Ezzell	1-12	1-12	S
Phil Campbell High School	Phil Campbell, 35581	Gilbert Ayers	1-12	7-12	S
Russellville High School	P.O. Box 730, Russellville, 35653	James H. Whitfied	9-12	9-12	S
Mt. Star Junior High School	Rt. 7, Russellville, 35653	John W. Glasgow	1-9	None	U
Russellville Jr. High School	Robinson St., Russellville, 35653	Thomas A. Franks, Jr.	6-8	None	
Tharpton Junior High School	Rt. 1, Russellville, 35653	Fletcher Sisson	1-9	None	
College Avenue Elementary School	North College Ave., Russellville, 35653	Dan C. Hindman	4-5	None	
West Elementary School	P.O. Box 458, Russellville, 35653	Oscar Wooten	1-3	None	
JACKSON COUNTY					
Bridgeport High School	Bridgeport, 35740	Tony Proctor	7-12	7-12	
Paint Rock Valley High School	Princeton, 35766	Bruce Money	1-12	7-12	UP
Pisgah High School	Pisgah, 35765	Paul Allred	9-12	9-12	
Stevenson High School	Stevenson, 35772	Truman Maples	7-12	7-12	P
Woodville High School	Woodville, 35776	James R. Pratt	1-12	1-12	
Bryant Junior High School	Bryant, 35958	Cecil A. Bearden, Sr.	1-9	None	U
Hollywood Junior High School	Hollywood, 35752	Billy C. Burroughs	1-9	None	
Pisgah Elementary School	Pisgah, 35765	Jerry Edmonds	1-8	1-8	
Rosalie Jr. High School	Rt. 1, Pisgah, 35765	John Parks Duke	1-9	None	U
LAUDERDALE COUNTY					
Bradshaw High School	Bradshaw Dr., Florence, 35630	Joe Brewer	9-12	9-12	S
Brooks High School	Killen, 35645	John W. McCabe	7-12	7-12	
Central High School	Rt. 4, Florence, 35630	Joel Neal Brewer	1-12	7-12	SP
Coffee High School	Hermitage Dr., Florence, 35630	Ralph Smith	9-12	9-12	S
County High School	Rogersville, 35652	E. F. Cagle	1-12	7-12	S
Lexington High School	Lexington, 35648	Raymond McMeans	1-12	7-12	S
Rogers High School	Rt. 1, Florence, 35630	Richard E. Prestage	1-12	7-12	S
Waterloo High School	Waterloo, 35677	Lacy Waynick	1-12	7-12	ST 7-12
Wilson High School	Rt. 5, Florence, 35630	John E. Johnson	1-12	7-12	

Name of School	Mailing Address	Principal	Grades Supervised	Grades State Accredited	Status
LAUDERDALE COUNTY (continued)					
Appleby Junior High School	319 Hermitage Dr., Florence, 35630	John T. Willis	7-8	7-8	
Forest Hills Elementary School	Stovall Dr., Florence, 35630	Floyd R. Parker	1-8	1-8	
Weeden Elementary School	Baldwin St., Florence, 35630	James S. Wood	1-8	1-8	
Brandon Elementary School	Cole St., Florence, 35630	Dempsey E. Rutherford	1-6	1-6	
Gilbert Elementary School	Sherrod Ave., Florence, 35630	Alvin Braly	1-6	1-6	
Harlan Elementary School	McBurney Dr., Florence, 35630	Arnold Young	1-6	1-6	
Kilby School	Florence State Univ., Florence, 35630	William A. Graham	1-6	None	
Powell Elementary School	Tune Avenue, Florence, 35630	Welton Reynolds	1-6	1-6	
LAWRENCE COUNTY					
Courtland High School	Box E. Courtland, 35618	Hoover White	9-12	9-12	P
Hatton High School	Rt. 3, Town Creek, 35672	Charles Garner	7-12	7-12	
Hazlewood High School	Box 130, Town Creek, 35672	Sherman L. Burch	7-12	7-12	
Lawrence County High School	Box 368, Moulton, 35650	Lewis A. Watkins	7-12	7-12	P
Mt. Hope High School	Rt. 1, Mt. Hope, 35651	Kenneth Cain	1-12	7-12	T 9-12
Tennessee Valley Junior High School	P.O. Box 73, Hillsboro, 35643		1-9	1-9	
Hatton Elementary School	Rt. 1, Town Creek, 35672	Thomas Smith	1-6	1-6	
Moulton Elementary School	Main St., S.E., Moulton, 35650	Merlyn Foster	1-3	1-3	
Moulton Intermediate School	601 Main St., S.E., Moulton, 35650	Ray Jeffreys	4-6	4-6	
LIMESTONE COUNTY					
Ardmore High School	Ardmore, Tenn., 38449	Robert E. Witt	1-12	7-12	
Athens High School	Hwy. 31 S., Athens, 35611	William Wise	9-12	9-12	S
Clements High School	Rt. 5, Athens, 35611	Robert A. Tinnon	1-12	1-12	
East Limestone High School	Rt. 3, Athens, 35611	Paul Hargrove	1-12	7-12	
West Limestone High School	Rt. 1, Lester, 35647	Ernest L. Adams	1-12	1-12	
Athens Middle School	So. Clinton St., Athens 35611	Cecil Armstrong	6-8	6-8	
Johnson Junior High School	Rt. 1, Athens, 35611	Acrus B. Crook	1-9	None	T 7-9
Mooresville-Belle Mina Junior High School	Tanner, 85671	Harvey Craig	1-9	None	

Name of School	Mailing Address	Principal	Grades Supervised	Grades State Accredited	Status
MADISON COUNTY					
Buckhorn High School	Rt. 2, New Market, 35761	W. D. Patrick	9-12	9-12	S
Hazel Green High School	Hazel Green, 35750	Lynn Holladay	1-12	1-12	S
Jones, Bob, High School	Madison, 35758	Elbert Deason	6-12	9-12	S
Madison County High School	Gurley, 35748	Milford Young	1-12	1-12	S
Sparkman High School	Rt. 1, Toney, 35773	Gordon Solley	9-12	9-12	S
Brownsboro School	Brownsboro, 35741	Bill Haas	1-8	None	U
Central School	Rt. 2, Huntsville, 35811	Billy Billingsley	1-8	None	
Harvest School	Harvest, 35749	Luther Carl Campbell	1-8	None	U
Madison Cross Roads School	Toney, 35773	Ross Thomas	1-8	None	*
Monrovia School	Rt. 3, Huntsville, 35806	C. W. Fanning	1-8	1-8	S
New Sharon School	Hazel Green, 35750	Orbin L. Isbell	1-8	None	U
Toney School	Toney, 35773	W. D. Owens	1-8	None	
Walnut Grove School	Rt. 1, New Market, 35761	Raymond Ricketts	1-8	None	
West Madison School	Madison, 35758	J. E. Ewing	1-5	1-5	
MARION COUNTY					
Brilliant High School	Brilliant, 35548	Glettus Miller	7-12	7-12	P
County High School	Guin, 35563	James H. Junkin	7-12	7-12	
Hamilton High School	Hamilton, 35570	Louis H. Goggans	7-12	7-12	
Brilliant Elementary School	Brilliant, 35548	Wilburn Baccus	1-6	None	
Guin Elementary School	Guin, 35563	Hubbard Estes	1-6	None	
Hamilton Elementary School	Hamilton, 35570	Paul Clark	1-6	None	
MARSHALL COUNTY					
Albertville High School	Albertville, 35950	Cecil Wright	9-12	8-12	S
Arab High School	Arab, 35016	Donald B. Richards	9-12	9-12	
Boaz High School	Boaz, 35957	Ollin Hayes	9-12	9-12	S
Douglas High School	Douglas, 35964	Arthur Jarvis	7-12	7-12	
Guntersville High School	Guntersville, 35976	Bobby Neighbors	9-12	9-12	S
Smith, Kate Duncan, High School (D.A.R.)	Grant, 35747	Percy Lee	7-12	7-12	S
Alabama Avenue Middle School	Albertville, 35950	Cecil Wright	6-8	None	
Arab Junior High School	Arab, 35016	James H. Cooley	6-8	6-8	
Asbury Junior High School	Star Rt., Albertville, 35950	Arnold Wilson	1-9	None	T 7-8
Carlisle Park Junior High School	Rt. 1, Guntersville, 35976	H. Lawayne Vanzandt	6-8	6-8	
Union Grove Junior High School	Union Grove, 35175	Walker Segars	1-9	1-9	T 7-9

Name of School	Mailing Address	Principal	Grades Supervised	Grades State Accredited	Status
MARSHALL COUNTY (continued)					
Cherokee Elementary School	Rt. 2, Guntersville, 35976	H. Lawayne Vanzandt	4-5	4-5	
Corley, L. F., Elementary School	Boaz, 35957	Truman Glassco	4-5	4-5	
McCord Elementary School	Albertville, 35950	E. H. Bailey	1-5	1-5	
West End Elementary School	Albertville, 35950	Russell Gibson	1-5	1-5	
MORGAN COUNTY					
Austin High School	Danville Rd., S.W., Decatur, 35601	J. V. Sailors	9-12	9-12	S
Brewer, Albert P., High School	Rt. 2, Box 149, Somerville, 35670	James R. Tucker	10-12	10-12	
Decatur High School	Prospect Dr., S.E., Decatur, 35601	James E. Milner	9-12	9-12	
Morgan County High School	P.O. Box 351, Hartselle, 35640	Milton L. Reed	9-12	9-12	S
West Morgan High School	Rt. 1, Trinity, 35673		1-12	7-12	
Brookhaven Middle School	Fifth Ave., S.W., Decatur, 35601	J. Ward Webster	6-8	6-8	
Hartselle Junior High School	Hartselle, 35640	J. P. Cain	1-9	None	
Oak Park Middle School	16th Ave., S.E., Decatur, 35601	Nell Clem	6-8	6-8	S
Priceville Junior High School	Rt. 2, Decatur, 35601	Herman Myers	1-9	7-9	P
Austinville Elementary School	2320 Clara Ave., S.W., Decatur, 35601	A. L. Poole	1-5	1-5	S
Burleson, F. E., Elementary School	Hartselle, 35640	John Ellenburg	1-5	1-5	
Crestline Elementary School	Hartselle, 35640	Loy L. Greenhill, Jr.	1-5	1-5	
Eastwood Elementary School	26th Ave., S.E., Decatur, 35601	Marie South	1-5	1-5	S
Flint Elementary School	Rt. 5, Decatur, 35601	Mitchell Owens	1-6	None	
Lakeview Elementary School	Wheeler Hwy., Decatur, 35601	Mrs. Susie Odom	1-5	1-5	S
West Decatur Elementary School	Memorial Drive, S.W., Decatur, 35601	Ronnie G. Beans	1-5	1-5	S
Woodmeade Elementary School	19th Ave., S.W., Decatur, 35601	James B. West	1-5	1-5	S
WINSTON COUNTY					
Addison High School	Addison, 35540	Dalton A. Sharpton	1-12	1-12	S
County High School	Double Springs, 35553	J. H. Herron	7-12	7-12	
Haleyville High School	E. 20th St., Haleyville, 35565	William G. Campbell	8-12	8-12	S
Haleyville Junior High School	19th St., Haleyville, 35565	Paul Williams	5-7	5-7	S
Double Springs Elementary School	Double Springs, 35553	Ralph Bailey	1-6	None	
Haleyville Elementary School	14th Ave., Haleyville, 35565	Mrs. Lingo Campbell	1-4	1-4	S

VITA

Hisham R. Durdunji was born in Jaffa, Palestine, February 4, 1940. Early education was obtained in Tripoli, Libya.

After entering the United States on a student visa, Mr. Durdunji attended Florence State College in 1960. A Bachelor of Science degree was obtained from Florence State College in 1965 with a major in Mathematics.

In 1970, a Master of Arts degree was obtained from Florence State University.

He is presently employed in the Russellville City School System as a mathematics teacher for the high school, grades 9 through 12, and a part-time instructor at Northwest Alabama State Junior College.

Mr. Durdunji's family includes his wife, Hilda, and two children, Sami and Sara. The family resides in Muscle Shoals City, Alabama.

He is a member of the National Council of Teachers of Mathematics, the National Education Association, the Alabama Education Association, and the local Russellville Teachers Association.