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THE DEVELOPMENT OF THE MATHEMATICS PROGRAM OF THE LIVONIA PUBLIC SCHOOLS FROM 1944 TO 1975

Volume I

by
Allan Arthur Edwards

A dissertation submitted in partial fulfillment
of the requirements for the degree of
Doctor of Education
(Education)
in The University of Michigan
1976

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LIST OF ABBREVIATIONS

CEEB	College Entrance Examination Board
CTBS	Comprehensive Test of Basic Skills
DAT	Differential Aptitude Test
EMSG	Elementary Mathematics Study Group
GCMP	Greater Cleveland Mathematics Program
IPI-Math	Individually Prescribed Instruction-Mathematics
ITBS	Iowa Test of Basic Skills
LPS	Livonia Public Schools
MAA	Mathematical Association of America
MCTM	Michigan Council of Teachers of Mathematics
MEAP	Michigan Educational Assessment Program
NAEP	National Assessment of Education Progress
NCTM	National Council of Teachers of Mathematics
NDEA	National Defense Education Act
NEA	National Education Association
NLSMA	National Longitudinal Study of Mathematical Abilities
NSF	National Science Foundation
PEA	Progressive Education Association
SMC	Secondary Mathematics Committee
SMSG	School Mathematics Study Group
UICSM	University of Illinois Committee on School Mathematics
UMMaP	University of Maryland Mathematics Project

CHAPTER I

THE PROBLEM AND SCOPE OF THE STUDY

Introduction

The era from the end of World War II to 1975 was one of extensive change and innovation in education. Curriculum revision and reorganization occurred in most subject matter areas in both the elementary and secondary schools. At the national level changes in mathematics education exemplify many of the movements which occurred. The reports of various commissions and the curriculum projects of the 1950s and 1960s in mathematics education are representative of the extensive forces in effect at the national level during this period.

There also occurred other more general forces which had an impact on mathematics education. Technological innovations such as educational television, programmed instruction, and computers all introduced new equipment and techniques into the classroom. Still other innovations which effected mathematics instruction resulted from movements toward the reorganization of personnel into teaching teams or the reorganization of class time for flexible scheduling or independent study.

For many school districts there also occurred during this same period significant changes in size and composition. These

changes resulted from the large number of "post war babies," the consolidation of school districts and a movement of families into suburban areas. This resulted in rapidly expanding suburban school systems. The Livonia Public Schools School District is a district which experienced this growth during the 1950s and 1960s. The present district is the result of the consolidation or annexation of a total of nine districts over a period of thirty years. Its enrollment has varied from 2588 in 1949-50, the first year it operated a K-12 program, to a maximum of 38,500 in 1971-72, to an enrollment of 34,227 during the 1974-75 school year.

Rapid growth, the resulting number of new buildings, increasing numbers of staff members and the opportunities for the implementation of new programs are all factors which have been identified as conducive to change in educational programs.[1] If these conditions are conducive to change, the changes in an expanding system such as Livonia can be expected to reflect the national forces current during this period.

The mathematics program in the Livonia Public Schools, and nationwide to the extent that it is reflected in a single district, can be most fully understood in relation to its historical development. The examination of this history can reveal the interrelationships between the forces and events that influenced the mathematics curriculum and the actual changes and innovations made to reshape the mathematics program in response to these forces and events.

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[1]Matthew B. Miles, "Innovation in Education: Some Generalizations," in Innovation in Education, ed. Matthew B. Miles (New York: Bureau of Publications, Teachers College, Columbia University, 1964), pp. 631-62.

The Problem

The purpose of this study was to trace the development of mathematics education in the Livonia Public Schools from 1944 to 1975. The changes which occurred were studied for long term trends as well as short term effects. The process through which these changes were agreed upon and implemented were examined as well as the forces, both external and internal, which influenced these changes.

The study has sought answers to the following questions:

1. What were the significant changes in course offerings, required mathematics courses and student enrollments in mathematics courses in the Livonia Public Schools?
2. What was the relationship of textbook changes to the changes in the mathematics program in the Livonia Public Schools?
3. What were the significant forces which affected the development of the mathematics program in the Livonia Public Schools?
4. What were the significant programs and innovations related to or affecting the mathematics program which were introduced by the Livonia Public Schools and which of these have been retained or extended by the district?
5. What processes were used to implement or establish innovations or changes in the Livonia Public Schools?
6. What was the role of the teaching staff and what was the role of administrative personnel in the development of the mathematics program?

7. Who were the leaders in the development of the mathematics program of the Livonia Public Schools and what were their contributions?

In order to place the answers to these questions in the proper perspective, this study sought to examine the trends in curriculum development, and in particular the mathematics curriculum, in the United States which influenced the development in Livonia. In the identification of these forces and events, the following questions were stressed.

1. What were the major curricular forces in the United States prior to and during the development of the mathematics program in the Livonia Public Schools?
2. What were the major curricular developments in mathematics education in the United States prior to and during the development of the mathematics program in the Livonia Public Schools?
3. What statewide or regional forces added direction or impetus to changes in the development of the mathematics program in the Livonia Public Schools?

Significance of the Study

This study was undertaken with the hope that it would make a significant contribution to the knowledge of curriculum development in mathematics education at the local level. It was designed to provide a historical documentation of those changes which occurred in a growing suburban school system during a period of significant change in mathematics education. As various national forces impinged

upon local programs, the changes which occurred varied in size and direction. The historical perspective provided by this study may provide guidelines for a better understanding of the present status and future directions of the mathematics curriculum.

Since all persons who work with curriculum development and change need to understand how the present curriculum and curricular structure have grown from the past, this study was designed to be of value to curriculum specialists, curriculum coordinators, mathematics coordinators and teachers of mathematics. Procedures and methods which are identified as being positive factors in introducing and reinforcing change can be of help to such persons and the systems they represent in planning changes in mathematics programs.

The study will also help the teachers and administrators of the Livonia Public Schools understand the growth and development of their present mathematics program. The change process which has occurred will provide information upon which to formulate and evaluate future changes. Finally, it may be possible to identify directions which the mathematics program of the Livonia Public Schools may be expected to follow during the next several years.

Limitations of the Study

Several limitations were placed upon this study at its inception. The study was limited to the development of the mathematics program in the Livonia Public Schools from 1944 to 1975. This is the period from the original consolidation of seven districts as the Livonia Public Schools in 1944 through the end of the school year 1974-75. Where districts were absorbed by the Livonia Public

Schools during this period, no attempt was made to examine the program of these districts prior to their becoming a part of the Livonia district. Similarly, where students attended schools outside the district, prior to the building of a high school in Livonia, no attempt was made to examine the program in mathematics provided for these students.

Background information concerning curriculum development was limited to the extent that only such historical information as was necessary to provide a base for the period from 1940 to 1945 was examined. Beyond this the developments in mathematics education during the period from 1945 to 1975, as well as innovations and changes in the general curricular development which may have effected mathematics education, provide the background for this study.

Local background information was limited to the development and growth of the City of Livonia, the formation and the physical growth of the Livonia Public Schools, the changes in administrative structure of the schools and the personnel changes within the system.

All types of programs involving mathematics education, including elementary, secondary, summer school and in-service programs for teachers were examined as a part of the study. The major emphasis, however, was placed upon the program of the secondary schools and to this extent certain limitations were placed upon the examination of the other programs.

No limitations were placed upon the sources of data. However, no extensive study of the textbooks used was planned beyond a determination of the extent to which they reflected general changes in content or objectives as identified in other documents.

Definition of Terms

For the purpose of this study the following definitions will be used:

1. Elementary program: The elementary program is the educational program provided for grades kindergarten through six.

2. Junior high school program: The junior high school program is the educational program provided for grades seven through nine.

3. High school program: The high school program is the educational program provided for grades ten through twelve.

4. Secondary program: The secondary program is the educational program provided for grades seven through twelve.

5. Program of studies: A program of studies is a listing and/or set of descriptions by grade level of the instructional offerings (courses, subjects or classes) of a school.

6. Mathematics program: The mathematics program consists of all mathematics subjects and their contents offered as a part of the school program together with all other experiences in mathematics provided by the schools.

7. Course of study: A course of study is a guide which indicates the courses to be taught in a given program. This guide may contain an outline of content of the courses, statements of objectives and methodological suggestions.

8. Innovation: An innovation is a change in content, methodology or organization which results in a program significantly different from that which previously existed.

9. Individualized program: An individualized program is one which allows a student to progress through an area of content at a pace determined by his own abilities and knowledge.

10. Basic text: A basic text is a textbook formally adopted by the Board of Education for use in a course.

11. Co-basic text: Co-basic texts are two or more textbooks adopted by the Board of Education for concurrent use in a course.

12. Supplemental text: A supplemental text is a textbook that is not offically adopted by the Board of Education but that is purchased to supplement the basic text for a course.

13. Pilot program: A pilot program is the trial use of a text, a methodology or an organizational plan with an intent to evaluate, either formally or informally, and to accept or reject such use on the basis of the evaluation.

14. UNIPAC: A UNIPAC is a packet of materials which covers a single concept and is designed for self-instruction.

15. Broken front approach: The broken front approach to curriculum development is an approach in which the individual units (buildings) of the educational organization are able to develop and introduce program changes independently.

16. Modern mathematics: "Modern mathematics" is used to describe the mathematics education concerns and developments of the period from 1955 to 1970 and the content and methodology that was introduced into school mathematics as a result of these concerns.

Design and Method of the Study

Procedures Used

The research for this study was conducted using the procedures of the historical method. A search was made for materials pertaining to or related to the mathematics program of the Livonia Public Schools. Also, materials related to the growth of the City of Livonia and the Livonia Public Schools were collected. A search for pertinent data was made at the following locations and offices.[1]

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[1]Five of the offices in which materials were examined were eliminated in an administrative reorganization in January 1975: the Bentley/Stevenson Regional Office, the Bentley/Stevenson Resource Center, the Franklin/Churchill Regional Office, the Franklin/Churchill Resource Center and the Office of the Coordinator of Guidance, Testing and Pupil Records.

Livonia Board of Education Offices

- Superintendent's Office
- Personnel Office
- Office of the Director of Elementary Education
- Office of the Director of Secondary Education
- Child Accounting Office
- Department of Extended School Services
- Bentley/Stevenson Regional Office
- Franklin/Churchill Regional Office
- Office of the Coordinator of Guidance, Testing and Pupil Records

Other School Offices

- Department of Curriculum Development
- Offices of the Coordinators of Mathematics/Science
- Bentley/Stevenson Resource Center
- Franklin/Churchill Resource Center

Livonia Public Schools Professional Library

High Schools, Junior High Schools and Elementary Schools

- Principals' Offices
- Mathematics Department Offices

The data gathered from this search were arranged in chronological and topical order. The documents were then read and a list of persons who had been closely involved in the development of the mathematics program was prepared. At the same time, items for which the data collected were incomplete or missing were identified. Wherever possible the appropriate person from the list was contacted and interviewed to help clarify the incomplete data.

All the data collected were subjected to internal criticism with respect to the meaning, accuracy, extent of bias and general level of trust-worthiness of the statements made in the documents. Additionally the data were examined for their significance as a source of information pertaining to the problem of the study.

Sources of Data

Data and information concerning the development of the mathematics program in the Livonia Public Schools were obtained largely from primary sources. These sources consisted of the minutes of the Livonia Board of Education, annual reports by school administrators, notices of the various offices and departments, minutes of mathematics committees, internal memoranda and letters sent and received by members of the staff of the Livonia Public Schools. Additional information was obtained from materials and guides developed and published by the district for use by the staff.

Secondary sources of two types were also examined. Articles concerning Livonia's mathematics program were identified in several journals as well as in the local newspapers. Also, the textbooks which were adopted for use by the system or received extensive use as supplementary materials were examined for information concerning the changes in content, objectives and methodology which took place. Data related to the development of the City of Livonia were obtained from several books which had been published locally.

Data related to the historical development of the mathematics curriculum in the United States were located in the publications of the National Council of Teachers of Mathematics; relevant reports of

national organizations, committees, and commissions; and texts on mathematics education. The historical data on general curricular development were obtained primarily from reports of national organizations and committees and from textbooks on curriculum development.

Organization of the Study

Chapter II of this study is concerned with curriculum development in the United States during the years 1945-1975. The discussion of this development is divided into three sections. The first section reviews some of the major events and forces in general curriculum development preceding and during this period. The events and forces reviewed were selected because of their possible influence, either directly or indirectly, on the mathematics curriculum during this period. The second section presents a discussion of major events and forces related to the mathematics curriculum from 1945 to 1975. An account is given of the factors which contributed to the mathematics curriculum as it existed at the beginning of this period. The factors and events which influenced the changes during the period are then reviewed. In each of these two sections there is no intent to provide a complete or exhaustive description of all the forces and events. For as Miles comments, "As we review this complex of subsystems, each exerting influence on educational innovation, it is hard to avoid the conclusion that it constitutes a listing of all the significant aspects of American culture."[1] These

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[1]Matthew B. Miles, "Educational Innovation: The Nature of the Problem," in Innovation in Education, ed. Matthew B. Miles (New York: Bureau of Publications, Teachers College, Columbia University, 1964), p. 39.

sections therefore focus on those national forces which were most likely to be reflected in the development of the mathematics program of an individual school system such as the Livonia Public Schools. The third section reviews some of the literature and research concerning: (1) the implementation of change in local school districts and (2) the change process as it has been investigated at the local district level relative to mathematics education.

Chapter III is devoted to the development and growth of the Livonia Public Schools. The initial section briefly describes the settling of the area and the formation and growth of the City of Livonia. The second section describes the physical growth of the school district. The number of buildings and the student enrollment are reported on a yearly basis to illustrate the rapid growth of the district during the 1950s and 1960s. The final section describes the several administrative organizational patterns under which the district operated. The positions to which the supervision and implementation of the mathematics program were assigned are described. The duties assigned to these positions are stated and the persons who filled the positions are identified.

Chapter IV presents the chronological development of the mathematics program of the Livonia Public Schools. The chapter is divided into four periods: 1944 to 1959, 1959 to 1964, 1964 to 1970, and 1970 to 1975. Each of these periods was characterized by a different organizational pattern for program development and leadership. For each period the elementary and secondary program are described, the important forces are indicated, major committees are

identified, and major program changes are described. Also, the significant pilot programs, inservice activities and text changes are discussed and examples of both building and districtwide curricular activities are given. The summary concluding each section relates the developments in Livonia during the period to some of the corresponding national developments in mathematics education.

Chapter V is concerned with the course offerings and enrollments in the secondary mathematics program of the Livonia Public Schools. Each of the adopted courses is treated in terms of its objectives, content and text adoptions. The enrollments in specific courses or groups of related courses are examined for trends which can be related to program changes.

Chapter VI presents the development of two special programs in the high schools: the Advanced Placement Program and a computer mathematics program. Attention is given to the initial planning for each of these programs and the problems which were encountered in maintaining them as viable programs. The success of each program is examined in relation to its enrollment and for the Advanced Placement Program its success is also examined in relation to the scores obtained by students on the Advanced Placement Examinations.

Chapter VII is concerned with the in-service programs of the school district. The major in-service activities provided for elementary and secondary teachers are identified. These major activities are described in terms of the leadership provided for the activity, the number of teachers involved, the purpose of the activity and the apparent level of success of the activity.

Chapter VIII is devoted to the summary and conclusions of the study. The problem, procedures used and sources of data are briefly reviewed. The findings of the study are summarized and some possible future directions for the mathematics program are presented.

CHAPTER II

CURRICULUM DEVELOPMENT IN THE UNITED STATES: 1945-1975

Events and Forces in General Curriculum Development

Early Commissions and Committees

Of the many forces impinging upon the curriculum the one which receives the most frequent mention in the literature is that of national commissions and groups. The proposals of these commissions have often been met with mixed reactions. "Some proposals have resulted in substantial change; many have resulted only in discussion, not in change. . . . Historically, the most effective proposals for curriculum change have been made by national commissions."[1]

Prior to 1945 several commissions and the proposals they presented had a significant impact on the educational system. In 1918 the Commission on the Reorganization of Secondary Education of the National Education Association presented a broadened and functional conception of the objectives of education. In its report, Cardinal Principles of Secondary Education, seven major objectives were prescribed: health, command of fundamental processes, worthy home membership, vocation, citizenship, worthy use

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[1]Arthur W. Foshay and Lois A. Beilin, "Curriculum," in Encyclopedia of Educational Research, 4th ed., ed. Robert L. Ebel (New York: Macmillan Co., 1969), p. 277.

of leisure and ethical character.[1] While the immediate impact of this report in changing secondary education may not have been great, this report exerted considerable influence on educational thought over an extended period of time.[2]

> As late as 1966, the Research Division of the National Education Association polled a sample of the teaching profession on the appropriateness of the Seven Cardinal Principles as current goals. The questions was, 'Is this a satisfactory list of the major goals of education today as you would see them?' More than 85 percent of the teachers polled responded, 'Yes.'[3]

The Progressive Education Association was formed in 1919 for the purpose of uniting those who were experimenting with the newer schools.[4] For twenty years this group was to have a major impact on the schools and particularly upon the elementary schools. Through its attacks on logically organized subject matter and its emphasis on projects developed around units of life experience, it did much to: (1) free the school from the grip of formalism, (2) place the interests and needs of children in their proper perspective in the educational program and (3) make educators and teachers generally more aware of the importance of direct experience

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[1]Commission on Reorganization of Secondary Education, Cardinal Principles of Secondary Education (Washington, D.C.: Government Printing Office, 1918).

[2]William G. Brink, "Secondary Education Programs," in Encyclopedia of Educational Research, 3rd ed., ed. Robert L. Ebel (New York: Macmillan Co., 1960), p. 1261.

[3]The National Commission on the Reform of Secondary Education, The Reform of Secondary Education (New York: McGraw-Hill Book Co., 1973), p. 28.

[4]Harl R. Douglass, Secondary Education in the United States (New York: Ronald Press Co., 1964), p. 13.

in the educational process.[1] In 1933 this group sponsored what became known as the "Eight-Year Study." The study undertook to determine whether the study of certain subjects in secondary school was essential for success in college. The results of this study which appeared in 1942 reported no discoverable relationship between the pattern of subjects taken in school and student success in college.[2]

For this period preceeding the 1940s the major trends in curriculum development have been summarized as being three in number.

> First, educators continued to be deeply concerned about subject matter and methods of teaching in the content field. Second, the scientific movement in education became firmly established and has continued as an enduring force in subsequent decades. Third, the activity curriculum established a firm hold on the schools of the nation.[3]

However, even with the existence of these trends the secondary schools of the period continued to reflect conventional patterns.[4] They maintained curricula which seemed dominated by college entrance requirements.

In 1944 the Educational Policies Commission of the National Education Association (NEA) issued its first statement on educa-

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[1]Newton Edwards and Herman G. Richey, The School in the American Social Order, 2nd ed. (Boston: Houghton Mifflin Co., 1963), pp. 544-45.

[2]Ibid.

[3]Council of Chief State School Officers, Education in the States: Nationwide Development Since 1900 (Washington D.C.: National Education Association, 1969), p. 245.

[4]Carl H. Gross and Charles C. Chandler, The History of American Education through Readings (Boston: D.C. Heath & Co., 1964), p. 344.

tional needs.[1] This statement stressed the fact that only fifty percent of youth graduated from high school.[2] In keeping with this emphasis the report set forth what it called the "ten imperative needs of youth."

> Salable skills and intelligent and productive participation in economic life; physical and mental health; understanding of citizenship, and diligence and competence in performing the obligations of citizenship at all levels; understanding the significance of the family and of the conditions conducive to successful family life; intelligent consumership; understanding of the methods and influence of science; development of appreciative and creative capacities; use of leisure time in activities that yield personal satisfaction and are socially useful; desirable interpersonal relations and growth in moral and spiritual life; ability to think rationally, to express thoughts clearly, to read and listen with understanding.[3]

Post World War II Forces

Up to the period of World War II the process of curriculum change had tended to reflect the relatively gradual evolution of society.[4] With the end of World War II the educational system was ready for more rapid and widespread changes. The wartime testing programs had shown a near absence of scientific and mathematical comprehension among high school graduates. These deficiencies, which were at least in part blamed on progressive education, together with the lack of emphasis on the schools during the war

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[1]"The Imperative Needs of Youth of Secondary School Age," Bulletin of the National Association of Secondary School Principals 31(March 1947).

[2]Gross and Chandler, p. 345.

[3]Brink, p. 1261

[4]John Goodlad, Renta Von Stoephasius and M. Frances Klein, The Changing School Curriculum (New York: The Fund for the Advancement of Education, 1966), p. 9.

formed the basis upon which the major changes of the following thirty years were to be built. The decade following the end of the war was one in which the schools were relatively free of controversy.[1] This period experienced an expanding economy and as a result an expanding, prosperous middle class who saw education as the means to even better things for their children. They turned to their schools, which were often new schools in new communities, with great expectations. At the same time that these communities were developing, changes were taking place in old values. Job opportunities were causing young couples to move from familiar surroundings and to face challenges they had not faced before. As a result people were beginning to feel a need for adaptability and a rational approach to solving new problems. This need was transfered to the operational pattern that the public felt should operate in the educational system. At the same time knowledge was increasing at a rapid rate and the scientific advances from the war period had as yet made only minimal impact on the curriculum of the elementary and secondary schools.

There was, however, at least one movement whose effects were felt by the schools during this time. In June 1945 at the conclusion of a two-day conference on "Vocational Education in the Years Ahead" which had been sponsored by the United States Office of Education, Charles A. Prosser made the summarizing statement for the conference.

> It is the belief of this conference that with the aid of this report in final form, the vocational school of a community will be able better to prepare 20 percent of its youth of secondary-school age for entrance upon desirable skilled

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[1] Ibid., p. 12.

> occupations; and that the high school will continue to prepare 20 percent of its students for entrance to college. We do not believe that the remaining 60 percent of our youth of secondary-school age will receive the life adjustment training they need and to which they are entitled as American citizens unless and until the administrators of public education with the assistance of the vocational education leaders formulate a comparable program for this group.[1]

This statement served as the keynote for the "Life Adjustment Education" movement. This movement emphasized the "practical" and was originally concerned with the 60 percent of the students for whom it felt the schools were providing no satisfactory program. It was the feeling of this group that:

> Many high schools, however, continue to be dominated by traditional curriculum patterns which emphasize verbal and abstract learning or place undue emphasis on specialized courses useful to a relatively small number of pupils. As a result many pupils unable to benefit from either of these types of instruction are left to flounder or to leave the schools as soon as the compulsory education laws will permit.[2]

Even after this movement had fallen into disrepute in the middle and late 1950s, its concerns about dropouts and potential dropouts continued as concerns on into the academic reforms and revival of the early 1960s.[3]

Some of the changes advocated by these proponents of less academically oriented education were beginning to take place by 1950. A United States Office of Education survey in 1948-49 which compared changes in secondary school enrollments over a sixty year

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[1]Quoted in Edward A. Krug, Salient Dates in American Education: 1635-1964 (New York: Harper & Row, Publishers, 1966), p. 131.

[2]Developing Life Adjustment Education in a Local School, Circular no. 253 (Washington D.C.: Office of Education, February 1949), p. 3.

[3]Krug, p. 135.

period gave several interpretations of their data which support this.

> . . . For the most part, the changes are in the direction of more functional education. They represent efforts to meet like needs of increasingly diverse bodies of pupils. . . . In many instances enrollments in general courses have expanded while enrollments in more specialized courses have declined. . . . General mathematics has grown at the expense of algebra and geometry. . . .[1]

Even though these changes were taking place, Goodlad gives an overview of the curriculum of this period in the following way.

> . . . subject matter was never out of the curriculum; there could not be a curriculum without it. However, much of what was taught in elementary and secondary schools in 1950 was sterile and out of date. Layers of minor revisions had been pasted upon previous layers of minor revisions until school subjects had lost much of the coherence and identity they once possessed.[2]

Forces and Events of the 1950s

The early 1950s marked the beginning of many projects and activities for which the launching of Sputnik I by the Soviet Union in October 1957 was to serve as a catalyst for expansion and growth. The Advanced Placement Program developed as the result of two studies which were begun in 1952. These were the study on "General Education in School and College" directed by Alan Blackmer of Phillips Academy, Andover, and the study on "School and College Study of Admission with Advanced Standing" under the direction of

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[1]Binennial Survey of Education 1948-50, quoted in William M. Alexander, J. Galen Saylor, and Emmett L. Williams, The High School Today and Tomorrow (New York: Holt, Rinehart and Winston, 1973), p. 197.

[2]Goodlad, p. 11.

Gordon Chalmers of Kenyon College.[1] Both studies were financed by the Fund for the Advancement of Education.

As a result of these studies, committees were formed in several subject areas to outline programs which would be equivalent to one year of college work and which could be used in high school. In 1955, the Committee on Advanced Placement of the College Entrance Examination Board assumed the responsibility for this program. As the program developed it focused on these concerns:

> . . . (1) to develop a curriculum for the high school that will challenge the gifted while at the same time meeting the standards of cooperating colleges and universities, (2) to select the proper students for that curriculum, (3) to encourage parental support for the newly conceived curriculum, and (4) to prepare and administer examinations which, accurately and economically, will evaluate student performance and program adequacy.[2]

The success of this program is perhaps best measured by its growth. In 1956 a total of 1,229 students from 104 high schools took the Advanced Placement Examinations.[3] By 1958 the numbers had increased to 3,715 students from 355 high schools.[4] During the 1974-75 school year a total of 65,635 students from 3,498 high schools took examinations in 19 different subject areas.[5]

In 1950 Congress created the National Science Foundation (NSF) as an educational agency of the Federal Government. It was com-

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[1]Richard S. Pieters and Elbridge P. Vance, "The Advanced Placement Program in Mathematics," The Mathematics Teacher 54 (April 1961): 201-8.

[2]Gail M. Inlow, The Emergent in Curriculum (New York: John Wiley & Sons, 1968), pp. 325-6.

[3]College Entrance Examination Board, Annual Advanced Placement Program Participation (New York: the Board, 1975).

[4]Ibid.

[5]Ibid.

missioned "to initiate and support . . . programs to strengthen scientific research potential in the mathematical, physical, medical, biological, engineering, and other sciences. . . ."[1] During its existence the NSF has been the financial underwriter of a number of large-scale science and mathematics curriculum experiments throughout the country. In addition it has undertaken teacher improvement through the media of institutes and the provision of fellowships for those in attendance. This program began with two experimental institutes in 1953 and by 1963 had expanded to 900 institutes with an attendance of 42,000 persons. These institutes until the de-emphasis of such activities in the early 1970s provided the major means of teacher retraining for the curriculum projects established in the late 1950s.

In 1954 the United States Supreme Court took an action which continues to be a force effecting the public schools. On 17 May 1954 it was ruled that racial segregation by schools deprived the individual of equal protection of the laws. In suburban systems, such as Livonia, the effects of this act were often seen as: (1) an influx of people moving into the district to escape de-segregation and (2) difficulties in passing millage as issues related to segregation were injected into the political arena.

During this period the beginnings of the curriculum reforms of the later fifties were also starting to take shape and several projects in mathematics set the pace. In 1951 the University of Illinois Committee on School Mathematics was organized. In 1955

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[1]Quoted in Inlow, p. 117.

the Commission on Mathematics of the College Entrance Examination Board was appointed to make a comprehensive study of the secondary school mathematics curriculum. Also in 1955 the Ball State experimental program began with the development of text materials in plane geometry.

During the period of the 1950s and on into the 1960s there appeared a number of prominent individuals who were highly critical of what they considered to be a tendency toward anti-intellectualism in the public schools. They insisted that equality of opportunity did not mean the same education for all. These critics represented two divergent points of view. Those critics exemplified by Arthur Bestor and Hyman Rickover approached the problem as one which called for a major restructuring of the educational system along the lines of the European system. The second group, as exemplified by James Conant and John Gardner, were more concerned about improving the educational system through the adoption and expansion of those practices within the system which they found most commendable and satisfactory. These two groups provided rallying points during the "Cold War" years and on through the "Sputnik Era" for persons concerned with the education of the academically talented and in a more general sense with the provision of a "quality" education for all.[1]

The appearance of the Russian space satellite, Sputnik I, in October 1957 served as a focus for many of the criticisms of the American high schools, especially with respect to the provisions

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[1]Gross, p. 346.

for the bright child and programs in mathematics, science and some foreign languages.[1] Interestingly, this event and the resulting criticism occurred at the same time that secondary school enrollments were starting to increase greatly. In 1958 the postwar baby boom was beginning to reach the seventh grade.[2]

In September 1958 Congress passed the National Defense Education Act (NDEA). This Act provided funds for schools to improve instruction in mathematics, science and foreign languages. Additionally, the Act gave impetus to the expanded use of educational media. Although favoring this support for education, school people and other citizens had mixed feelings about some aspects of NDEA. In particular, they were critical of the narrow focus on particular categories and its possible influence on the shape of local school programs.[3] By the time the 1964 version was passed changes had been made. The 1964 version not only supported more subject fields but it also included special funds for the training of teachers of the disadvantaged. For 1965 allocations under this Act totaled approximately $270 million. About $20 million was earmarked for science and mathematics curricula.[4]

In the years 1958 and 1959, journals, newspapers and book-publishing companies, stimulated by the Sputnik furor and the consequent increase in criticism of the schools, greatly increased the publication of materials relating to public education. Among

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[1] Douglass, p. 14.

[2] Ibid.

[3] Krug, p. 141

[4] Inlow, pp. 115-6.

the influential books was James Conant's book, The American High School Today.[1] This book provided a list of twenty-one recommendations for change in the secondary schools. In addition, it presented a method for evaluating a comprehensive high school and for conducting an academic inventory to determine the extent to which the top students in the school were being prepared for college. "While the Conant report generated discussion and debate, it was, in the main, non-controversial."[2] Nevertheless, it did have two important impacts. Its resolute support of the comprehensive high school did much to blunt the sentiment expressed by Admiral Hyman Rickover and others favoring the establishment of selective academic high schools. Additionally, it offered a ready-made plan of action for the spending of NDEA funds.[3]

In a survey of the changes occurring from 1949 to 1961, the changes were summarized as follows:

> During the period of this survey, education reacted quickly to changes in the culture brought about by the cold war, the defense program and new social developments. It moved from a trend to extend upward the child development concept of the elementary school, which had existed for some 20 years, to what was, in effect, an extension downward of the college program and preparation for that program. From offerings aimed at meeting the needs of individual boys and girls, the secondary school began to emphasize a program oriented to the academic subjects.[4]

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[1] James B. Conant, The American High School Today (New York: McGraw-Hill Book Co., 1959).

[2] Goodlad, p. xiii.

[3] Ibid.

[4] Subject Offerings and Enrollments in Public Secondary Schools, quoted in Alexander, p. 198.

New Instructional Techniques and Methodology

At the same time that the movement toward an academic emphasis was taking place, movements related to changes in instructional practices were emerging. In March 1951 the Federal Communication Commission reserved 209 channels for educational broadcasting.[1] This was to result in extensive experimentation to develop programs for direct instruction to children.

The use of teaching machines and programmed texts, based on Skinner's machine, which was first available in 1954, expanded to the point that 11 percent of school systems sampled in 1961 were using some form of programmed instruction.[2] The use of teacher aides, as introduced in Bay City, Michigan in 1952, was increasing. A national sample indicated that 9 percent of elementary schools and 18 percent of secondary schools were using aides during 1960-61.[3]

Team teaching, as exemplified by the "Trump plan" set forth by the Committee on Utilization of Staff of the National Association of Secondary Principals, showed an even more rapid expansion and use.[4] The "Trump plan" consisted of scheduling students for independent study, large-group instruction and small-group instruction. The term team teaching, however, was applied to a wide variety of forms of cooperative teaching and planning by teachers. From the first

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[1]Council of Chief State School Officers, Education in the States, p. 253.

[2]Miles, p. 7.

[3]Ibid.

[4]J. Lloyd Trump and Dorsey Baynham, Focus on Change (Skokie, Ill.: Rand McNally & Co., 1961).

formal foundation support of a team teaching proposal in 1957, it had grown to where 12 percent of a sample of secondary schools were using team teaching in 1960-61 and 31 percent of the principals expected to be using it by 1965-66.[1]

The NEA was active with its Project on Instruction initiated in 1959. In its attempts to provide direction in this period of change it issued publications such as: Education in a Changing Society, Deciding What to Teach, and Planning and Organizing for Teaching.[2]

In August 1964 a national effort to attack poverty, which was to rely heavily on education and training, was undertaken with the signing by President Lyndon B. Johnson of the Economic Opportunity Act. Major features of this Act were programs for youth, including the Job Corps and its provisions for camps and training centers; and the beginnings of plans for the Head Start Programs. The efforts in this war on poverty were continued in the Elementary and Secondary Education Act of 1965. This Act recognized the needs of children from low-income families and provided the means for the schools to compensate for some of the developmental experiences they have missed.[3] Title I of the Act established a program for financial assistance to local educational agencies for the education of

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[1]Miles, p. 7.

[2]National Education Association of the United States Project on the Instructional Program of the Public Schools, Deciding What to Teach, Planning and Organizing for Teaching and Education for a Changing Society (Washington, D.C.: National Education Association, 1963)

[3]Council of Chief State School Officers, Education in the States, p. 267.

children in low-income families. Title II authorized federal grants for the acquisition of school library resources, textbooks, and other instructional materials. Title III authorized federal grants for supplementary educational centers and services to stimulate and assist in the provision of vitally needed educational programs to serve as models for regular school programs. The funds available to local school districts under this Act have remained an important source of funds for change and innovation to the present time.

Assessment and Evaluation

In 1967 the National Assessment of Educational Progress (NAEP) was initiated. This project which is sponsored by the Education Commission of the States has as its purpose the measurement of the results of American education by means of criterion-referenced tests administered to large samples of the population at different age levels. While the immediate effect of the results of this project are not clear, the results have received widespread publicity and as data are gathered it may provide the first real basis for measuring changes in educational attainment on an organized longitudinal basis.

The NAEP is representative of several trends of long standing. The first of these is the attempt to state educational objectives in behavioral terms so that they provide for the subsequent evaluation of the curriculum. Such objectives, which are needed for the development of criterion-referenced tests used by NAEP, have been emphasized strongly since the early 1960s when publications such as

Preparing Instructional Objectives by Mager made their appearance.[1] Governmental agencies and foundations supporting projects and innovations have supported this movement through their requirements for systematic evaluation and behaviorally stated objectives in the projects which they fund.

A second trend represented by NAEP is the systematic assessment of educational programs on a level broader than the local district. In Michigan the Michigan Educational Assessment Program (MEAP) was instituted during 1969-70. This program, starting in 1973-74, employed the use of criterion-referenced tests and as such reinforced the use of behavioral objectives and criterion-referenced testing in local districts. As a part of this program the State Department of Education prepared sets of Minimal Performance Objectives covering either grades K-9 or K-12 in twelve separate subject areas.

Individualized Instruction

The period between 1962 and 1972 has been characterized as a decade of experimentation and innovation in the schools.[2] During this period the greatest amount of funding from foundations and the United States Office of Education was attracted by innovations involving: team teaching, modular scheduling, nongraded schools, programmed learning, individualized instruction, computer-assisted

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[1]Robert F. Mager, Preparing Instructional Objectives (Palo Alto, Cal.: Fearon Publishers, 1962).

[2]The National Commission on the Reform of Secondary Education, Reform of Secondary Education, p. 6.

instruction, independent study, learning centers, open plan schools, language laboratories, behavioral objectives and differentiated staffing.[1] While this list contains "individualized instruction" as a separate item, most of the items listed are attempts to provide for individual differences. Such attempts are of long standing. In the 1940s, at the elementary level, ". . . the most general solution to the problem of individual difference was for the classroom teacher to organize for instruction subgroups of children in reading, arithmetic, and perhaps spelling and to differentiate assignments for children in the other areas of the curriculum while instructing them as a total group."[2] The many movements already described in this section such as, Life Adjustment Education, the Advanced Placement Program and Conant's recommendations for the comprehensive high school, all had at their base the provisions for individual differences even though these differences were reflected in their concerns for given segments of the total school population.

During the early 1970s the forces for the provision of individual differences brought about a change at the secondary school level. This was the development of alternative schools. While not directly effecting the vast majority of the school population these schools represent a reaction of the educational system to the student dissent, unrest and discord of the late 1960s. These schools have accommodated such diverse objectives

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[1] Ibid., p. 7.

[2] G. Wesley Sowards, "Elementary Education," in Encyclopedia of Educational Research, 4th ed., ed. Robert L. Ebel (New York: Macmillan Co., 1969), p. 424.

as: aid to dropouts, challenge to able students, advancement of intercultural integration, avoidance of recent desegregation, individualized instruction and multilingual education.[1]

Career Education

A movement in response to other forces during the 1970s has been a concentration of the schools on Career Education. The focus of the career education movement was expressed by the superintendent of the Dallas Schools in 1973.

> The nation must change the value that it places on employment-oriented education. The aspect of our secondary program which is most damaging to young people is the stigma that we have attached to employment-oriented education. Everyone agrees that vocational education is extremely important. It receives top priority so long as it is for our neighbor's child rather than our own. If we are going to help our young people to learn how to catch their own fish rather than to line up at the welfare cafeteria for handout filets, then we must change the value which we place on employment-oriented education.[2]

The United States Office of Education has been a prime mover behind the Career Education concept and stated,

> The fundamental concept of career education is that all educational experiences, curriculum, instruction, and counseling should be geared to preparation for economic independence and an appreciation for the dignity of work.[3]

The implementation of this program has been proposed in three phases. Phase one is a program in career awareness which

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[1]Alexander, p. 263.

[2]Nolan Estes quoted in The National Commission on the Reform of Secondary Education, Reform of Secondary Education, p. 51.

[3]Department of Health, Education, and Welfare, Publication No. (OE) 72-39 quoted in The National Commission on the Reform of Secondary Education, Reform of Secondary Education, p. 52.

is instituted at the elementary school level. Phase two is a program of career exploration often directed at students in the junior high age category. The final phase of career training is directed toward high school age youth and is designed to concentrate on the acquisition of specific skills related to their occupational choices. The total impact of this movement on the curriculum is not yet clear. Within it, however, do exist elements which may cause major shifts in the content organization in many subject areas.

Events and Forces in Mathematics Curriculum Development

In the early 1900s mathematics education in grades 9-12 consisted of algebra, geometry, and possibly trigonometry. Each of these subjects was commonly taught in a memorize the rule and apply it manner. Likewise, in grades K-8 arithmetic was taught in the same manner. As the enrollment of the secondary schools began to increase, it became apparent that these courses did not meet the needs of all students and decreasing percentages of high school students enrolled in courses such as algebra and geometry.[1] From this base the mathematics program of the 1940s and early 1950s was to be shaped in keeping with the recommendations and reports emanating from several national committees and groups.

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[1]Alan R. Osborne and F. Joe Crosswhite, "Forces and Issues Related to Curriculum and Instruction, 7-12," in A History of Mathematics Education in the United States and Canada, Thirty-second Yearbook of the National Council of Teachers of Mathematics (Washington, D.C.: the Council, 1970), pp. 157-162.

Committee and Commission Reports

An important early group was the National Committee on Mathematics Requirements appointed by the Mathematical Association of America in 1916. Its appointment was the result of concern over the increasing failure rates and decreasing enrollments in mathematics courses, an increasing recognition of and concern for individual differences and criticisms of instruction based on drill and non-understood manipulation.[1] The reports of this group, often called "The 1923 Report," were published in a volume entitled The Reorganization of Mathematics in Secondary Education.[2] This report had five major areas of impact:

1. it contained a careful attempt to define and defend the purpose of mathematics in secondary education,
2. it rejected the concept of mental discipline in favor of the more sophisticated idea of transfer,
3. it recognized the function concept as the one idea best adapted to unify the study of mathematics,
4. it stated content requirements for college entrance which were accepted and used by the College Entrance Examination Board,
5. it offered model curricula.[3]

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[1] Ibid., p. 197.

[2] The National Committee on Mathematical Requirements, The Reorganization of Mathematics in Secondary Education (Buffalo, N.Y.: The Mathematical Association of America, 1923).

[3] Osborne and Crosswhite, p. 202.

The recommendations from this report pertaining to the high schools were not quickly adopted. "By contrast, the new junior high schools seized on the committee's recommendations for the seventh, eighth, and ninth grades."[1] The report had recommended that junior high schools put less emphasis on the teaching of elaborate arithmetic processes. Instead, the inclusion of informal geometry, the elements of right-triangle trigonometry and more business applications of mathematics were recommended. At the ninth grade two programs, algebra and general mathematics were to be included. When textbook publishers quickly prepared texts to match these recommendations they were widely adopted.[2]

Two other major reports which were significant in the shaping of the mathematics curriculum of the 1940s appeared in 1940. They were Mathematics in General Education, a report of the Progressive Education Association (PEA) Committee on the Function of Mathematics in General Education, and The Place of Mathematics in Secondary Education, which was the product of the Joint Commission of the Mathematical Association of America (MAA) and the National Council of Teachers of Mathematics (NCTM).[3]

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[1] Myron F. Rosskopf, "Mathematics Education: Historical Perspectives," in The Teaching of Secondary School Mathematics, Thirty-third Yearbook of the National Council of Teachers of Mathematics (Washington, D.C.: the Council, 1970), p. 19.

[2] Ibid.

[3] Commission on the Secondary School Curriculum of the Progressive Education Association, Mathematics in General Education (New York: Appleton-Century Co., 1940); and Joint Commission of the Mathematical Association of America and the National Council of Teachers of Mathematics, The Place of Mathematics in Secondary Education, Fifteenth Yearbook of the National Council of Teachers of Mathematics (New York: Bureau of Publications, Teachers College, Columbia University, 1940).

The goal of the PEA committee had been to examine "the study and teaching of mathematics for their values in relation to the whole process of general education."[1] The report identified seven conceptual areas of a general nature and stated that these would be applicable to problem solving in a wide variety of situations. These areas were: (1) formulation and solution, (2) data, (3) approximation, (4) function, (5) operation, (6) proof and (7) symbolism. The report made no specific recommendations of subject matter.

The Joint Commission developed a list of objectives stated in terms of the following abilities and attitudes: (1) the ability to think clearly in gathering and organizing data, representing data, drawing conclusions, and establishing and judging claims of proof; (2) the ability to use information, concepts, and general principles; (3) the ability to use fundamental skills; and (4) desirable attitudes, such as respect for understanding, social-mindedness, and open-mindedness.[2] This report offered two programs for grades 7-12. The design was for a two-track program with each track providing six years of courses. One track was to be for the college-preparatory students and the other for the non-college bound.

The reports of the Commission on Post-War Plans of the NCTM were the final reports of the mathematics community which were to support and reinforce the functional concept of mathematics as

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[1]Commission on the Secondary School Curriculum, Mathematics in General Education, p. vi.

[2]Rosskopf, p. 22.

a tool subject prior to the reform movements of the 1950s.[1] Within the first report was a position which held that the school should ensure mathematical literacy for all who can possibly achieve it. As a method of doing this a tentative proposal for a three-track program was included. These three tracks were to provide for: (1) the college-bound, (2) students entering industry, and (3) the slow learner in mathematics.[2] The second report was more specific and offered thirty-four theses for improving instruction in grades 1-14. The third report contained twenty-nine specific objectives defining functional competence which were appropriate for junior high school mathematics.[3]

School Mathematics of the 1940s

The reports of these committees which appeared between 1923 and 1947, provided the basis for the mathematics program as it existed in the secondary schools in the late 1940s and early 1950s. In grades 7 and 8 nearly all pupils followed the same program which provided a continuation of the work of grades 1-6. The

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[1]Commission on Post-War Plans of the National Council of Teachers of Mathematics, "First Report of the Commission on Post-War Plans," The Mathematics Teacher 37(May 1944): 225-32; Commission on Post-War Plans of the National Council of Teachers of Mathematics, "Second Report of the Commission on Post-War Plans," The Mathematics Teacher 38(May 1945): 195-221; and Commission on Post-War Plans of the National Council of Teachers of Mathematics, "Guidance Report of the Commission on Post-War Plans," The Mathematics Teacher 40(July 1947): 315-39.

[2]Osborne and Crosswhite, p. 244.

[3]Commission on Post-War Plans of the National Council of Teachers of Mathematics, Guidance Report, pp. 318-19.

subject matter was built around a few broad categories such as: computation, simple geometric facts, graphs, an introduction to formulas and equations, and social, personal and business applications. The objectives of such a program stressed developing a mathematical foundation for intelligent citizenship, providing "practical" applications and to a lesser extent preparation for subsequent mathematics courses.

At the ninth grade level many schools offered two courses: general mathematics and elementary algebra. General mathematics was most often an extension of topics studied in grades 7 and 8 and served the purpose of a terminal course in mathematics. Elementary algebra in the 1950s had a fairly standard content which followed closely a course as described in the 1940 report of the Joint Commission.[1]

In grades 10-12 the mathematics program was generally oriented toward the college-bound student. Some schools, however, did offer a second year of general mathematics and consumer mathematics for the twelfth grade was not uncommon, particularly in large cities.[2] In grade 10, plane geometry was taught and "Except for a reduction in the number of required theorems and the incorporation of some plane trigonometry, the content outlined in the 1923 Reorganization of Mathematics in Secondary Education was

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[1]The Joint Commission, The Place of Mathematics, pp. 89-90.

[2]E. Glenadine Gibb, John R. Mayor and Edith Treuenfels, "Mathematics," in Encyclopedia of Educational Research, 3rd ed., ed. Robert L. Ebel (New York: Macmillan Co., 1960), p. 799.

almost identical with that found in most textbooks in use in 1950."[1] Much the same type of standardization had taken place in the content for grades 11 and 12, although course titles and the sequence of topics might differ from school to school. The courses were most often called: intermediate (and/or advanced) algebra, plane trigonometry and solid geometry.[2]

The arithmetic program of the elementary schools was also relatively stable in its content during this period.

> Both the advocates of social utility and the advocates of a logical, intellectual organization seemed to agree that the content of elementary-school mathematics centered around the four basic operations with whole numbers and positive rational numbers and appropriate applications.[3]

Two theories of arithmetic instruction were strongly influential at this time. These were the meaning theory and the readiness theory. The meaning theory, which was strongly advocated by William A. Brownell, he explained in the following manner.

> According to the meaning theory the ultimate purpose of arithmetic instruction is the development of the ability to think in quantitative situations. . . . Children must be able to analyze real or described quantitative situations.[4]

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[1] John J. Kinsella, Secondary School Mathematics (New York: Center for Applied Research in Education, 1965), p. 7.

[2] Ibid., pp. 8-9.

[3] Stephen S. Willoughby, "Mathematics," in Encyclopedia of Educational Research, 4th ed., ed. Robert L. Ebel (New York: Macmillan Co., 1969), p. 769.

[4] William A. Brownell, "Psychological Considerations in the Learning and the Teaching of Arithmetic," The Teaching of Arithmetic, Tenth Yearbook of the National Council of Teachers of Mathematics (New York: Bureau of Publications, Teachers College, Columbia University, 1935), p. 28.

The other influential theory was the readiness theory which developed from the studies of Gesell and other child development psychologists. This theory, as applied by Leo J. Brueckner, took the position that children would not learn and hence should not be taught until they are ready for learning each particular skill and concept.[1]

Pressures for Change

By the late 1940s a number of powerful forces were building which were to bring about the extensive activity in mathematics education during the next twenty years. Inadequacies in the high school mathematics curriculum had been recognized during World War II when a high percentage of inductees failed the arithmetic sections of the selective service examinations. The stress on upgrading these men and the high school program, together with new uses of mathematics in quality control, aerodynamics, operations analysis and communication theory, had a vitalizing effect which helped return mathematics to a prestige that it had not held for several years. These needs and the additional forces of the postwar period such as: a generally recognized manpower problem in mathematics related fields, a concern for superior students, a general attack on the professional education establishment and a changed view of mathematics and its utility were all pressures

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[1]Leo J. Brueckner, "The Development of Ability in Arithmetic," in Child Development and the Curriculum, Thirty-eighth Yearbook of the National Society for the Study of Education, pt 1 (Bloomington, Ill.: Public School Publishing Co., 1939), pp. 275-98.

for change.[1] About 1950 these pressures manifested themselves in growing dissatisfaction with both the content and the pedagogy of the secondary school mathematics program.[2] It was felt that not enough students were studying mathematics. No special considerations were made for superior students. Manipulation and memory received emphasis rather than meaning and understanding. General mathematics was viewed as a dumping ground. The interrelationships of arithmetic, algebra and geometry, with respect to structure, were ignored.

During the early 1950s there also developed, within the community of mathematicians, concern for the fact that while mathematics had grown rapidly since 1800, little or none of this growth was reflected in the content of the secondary schools. Saunders Maclane wrote in 1954 concerning the impact of modern mathematics on the high schools, "My subject is vacuous; the lively modern development of mathematics has had no impact on the content or the presentation of the secondary school mathematics."[3]

The Mathematics Education Projects of the 1950s

The University of Illinois Committee on School Mathematics (UICSM) which began near the end of 1951 is identified as the first

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[1]Philip S. Jones and Arthur F. Coxford, Jr., "Mathematics in the Evolving Schools," in A History of Mathematics Education in the United States and Canada, Thirty-second Yearbook of the National Council of Teachers of Mathematics (Washington, D.C.: the Council, 1970), p. 68.

[2]Kinsella, p. 13.

[3]Saunders Maclane, "The Impact of Modern Mathematics," The Bulletin of the National Association of Secondary School Principals 38(May 1954): 66.

clearly modern mathematics project. UICSM developed as a result of the dissatisfaction of the College of Engineering with the mathematical preparation of entering freshmen. This project with Professor Max Beberman as its director was initally funded by the University of Illinois but later received support from the Carnegie Foundation, the NSF, and the United States Office of Education.[1]

According to the members of the staff, the work of the project was developed in terms of five theses:[2]

1. that a consistent exposition of high school mathematics is possible,
2. that high school students are greatly interested in ideas,
3. that acquiring manipulative skill and understanding basic concepts are complementary activities,
4. that the language of text and teacher should be made as unambiguous as possible,
5. that the discovery of generalizations by the student be encouraged and fostered.

The UICSM established a pattern of curriculum revision that stressed not only significant changes in mathematical content but also the development of a teaching philosophy consistent with the new mathematical emphasis. In recognition of the dependence upon

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[1]Osborne and Crosswhite, p. 251.

[2]William T. Hale, "UICSM's Decade of Experimentation," The Mathematics Teacher 54(December 1961): 613-19; and M. Eleanor McCoy, "A Secondary School Mathematics Program," The Bulletin of the National Association of Secondary School Principals 43(May1959): 12-18.

well trained teachers, until 1958, the UICSM made its textbooks available in classroom sets only to teachers who had received special training in their use. The product of this initial effort was a program for grades 9-12 which consisted of eleven units. These materials were later modified and published in commercial form. Following this initial work the focus of the project shifted to developing materials designed for: teaching fractions to seventh and eighth grade low-achievers; a junior high school informal geometry course and a vector geometry course for high ability students. In addition, a related program for the elementary school, University of Illinois Arithmetic Project was formed in 1958 with David Page as its director.[1]

The Commission on Mathematics of the College Entrance Examination Board (CEEB) was appointed in 1955 to make a comprehensive study of the secondary school mathematics curriculum and to make recommendations for its "modernization, modification, and improvement."[2] This commission was formed because of a fear on the part of the CEEB that its testing program might serve as a deterrent to curriculum revisions and because it felt its testing program was no longer fully adequate for some of the experimental work being done in the foremost public and private secondary schools. Professor Albert W. Tucker of Princeton University was appointed chairman and Dean Albert E. Meder, Jr. of Rutgers University served as the first executive director. The membership of the Commission

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[1]Osborne and Crosswhite, p. 255.

[2]Rosskopf, p. 23.

spanned all levels of secondary and college mathematicians and mathematics teachers.

In 1959 the Commission published its proposals in a two volume report.[1] Within the first volume the Commission presented the case for curriculum change, outlined its program for college-capable students in grades 9-12, recommended improvements in the education of high school teachers, and argued for closer articulation of high school and college courses.[2] Many of the recommendations involved minor changes in content but important changes in the point of view and emphasis in teaching. The nine-point 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 in Grade 11 of fundamental trigonometry--centered on coordinates, vectors, and complex numbers;
8. Emphasis in Grade 12 on elementary functions (polynomial, exponential, circular);
9. Recommendations of additional alternative units for Grade 12: either introductory probability with statistical applications, or an introduction to modern algebra.[3]

Specific examples in the teaching of algebra, geometry and trig-

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[1]Commission on Mathematics, Program for College Preparatory Mathematics (New York: College Entrance Examination Board, 1959); and Commission of Mathematics, Appendices to the Report of the Commission on Mathematics (New York: College Entrance Examination Board, 1959).

[2]Kinsella, p. 31.

[3]Ibid.

onometry were supplied in the Appendices. The final major publication of the Commission was a sample text for its course in introductory probability.[1]

The Ball State experimental program began in 1955 with the development of text materials in plane geometry. During the years following 1955 text materials were written extending both up and down from this 10th grade geometry course until in the middle 1960s text materials were commercially available for grades 7-12. This project was the work of Professor Merrill Shanks of Purdue University and Professor Charles Brumfiel and Robert Eicholz of Ball State Teachers College.

The objectives for the program appeared in the form of statements concerning particular courses. Concerning the eighth grade, "The primary objective here is to lay a foundation for the continuing study of mathematics."[2] The statement concerning algebra was, "Our goal at the end of the ninth-grade work in algebra is a student who has firm techniques and the ability to deduce most of these techniques, using numerical examples, from the postulates and definitions."[3] Overall this program was characterized by its emphasis on the axiomatic structure of mathematics. Perhaps its

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[1]Commission on Mathematics, Introductory Probability and Statistical Inference for Secondary Schools An Experimental Course, Preliminary Edition (New York: College Entrance Examination Board, 1957).

[2]Charles Brumfiel, Robert Eicholz, and Merrill Shanks, "The Ball State Experimental Program," The Mathematics Teacher 53(February 1960): 76.

[3]Ibid., p. 78.

most radical departure from the traditional program was in geometry where it used a modified version of the Hilbert postulates.[1]

The University of Maryland Mathematics Project (UMMaP) originated in the fall of 1957 with John R. Mayor as its director. According to M. L. Keedy one of the associate directors,

> The primary goal of the project has been to determine maturity levels at which certain mathematical concepts can be appropriately taught, and to prepare course materials for a teaching sequence in grades seven and eight that is mathematically and psychologically sound, and appropriate to modern day needs.[2]

The project developed and tested course materials for both the seventh and eighth grades during the three years of its project activities from 1957 to 1960. As basic principles in this development, the following ideas were used: there should be no distinction between arithmetic and algebra; unifying concepts would be stressed; understanding would be stressed and ideas would be clarified by altering the language and making it more precise. The influence of this project was to be reflected strongly in the later work of the School Mathematics Study Group (SMSG). After 1960 UMMaP concerned itself with the preparation of elementary school teachers and with studies in the learning of mathematics.

The projects thus far described were all begun prior to the launching of Sputnik I but were greatly helped in their acceptance by the furor created by this event. In 1958 SMSG, which was to be the largest and most influencial of the project groups, was formed. A set of objectives for SMSG was formulated by its Advisory

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[1]Osbourne and Crosswhite, p. 269.

[2]Mervin L. Keedy, "Mathematics in Junior High School," Educational Leadership 17(December 1959): 157.

Committee indicating that three things were required.

> First, we need an improved curriculum which will offer students an improved curriculum which will offer students not only the basic mathematical skills but also a deeper understanding of basic concepts and structure of mathematics. Second, mathematics programs must attract and train more of those students who are capable of studying mathematics with profit. Finally, all help possible must be provided for teachers who are preparing themselves to teach these challenging and interesting courses.[1]

The basic project undertaken by SMSG was the writing of a series of sample texts which illustrated a proposed curriculum for grades 7-12. By 1960 texts suited to college preparatory students in these grades had been written, tested in classrooms and were available for distribution. These texts were intended by SMSG to serve as sample texts for the type of curriculum which it hoped to see adopted in the schools. The seventh and eighth grade materials were closely related to those of UMMaP. The materials for grades 9-12 followed the guidelines which had been developed by the Commission on Mathematics with the one exception that the geometry course did not follow the more radical suggestions of the Commission.[2]

By 1960 SMSG had also started the development of sample texts for grades K-6. These elementary texts were published in 1962. By 1966 SMSG had completed what it considered to be a first round of text writing. At that time, in addition to its complete set of sample texts for grades K-12, it had published several specialized sets of materials:

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[1] School Mathematics Study Group, Newsletter No. 1 (Yale University, March 1959), p. 4.

[2] Osborne and Crosswhite, p. 278.

1. Texts for less able junior high school students were published in 1962.
2. A set of Spanish translations was made available in 1962.
3. Materials for culturally disadvantaged children at grades kindergarten and one were published in 1966.
4. Senior level courses on analytic geometry, calculus and computer mathematics were published in 1964, 1965, and 1966, respectively.

SMSG continued to be active in the writing of sample materials until the project was discontinued at the end of 1972.

During its existence the SMSG also sponsored the National Longitudinal Study of Mathematical Abilities (NLSMA) which was a five-year investigation for the purpose of identifying and measuring variables associated with the development of abilities in mathematics. Briefly the findings with regard to textbooks indicated that: (1) the variability of means associated with textbook groups seemed to decrease as grade levels increased; (2) the SMSG textbook groups often scored higher then conventional textbook groups on comprehension, application and analysis but not on computation; and (3) some of the more formal and rigorous texts seemed to produce low results in all four areas.[1]

The first of the projects to take the elementary school as its starting point for reform was the Greater Cleveland Mathematics

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[1]Donald J. Dessart and Henry Frandsen, "Research on Teaching Secondary School Mathematics," in Second Handbook of Research: A Project of the American Educational Research Association, ed. Robert M. W. Travers (Chicago: Rand McNally & Co., 1973), p. 1190.

Program (GCMP) which was organized in 1959 to develop a planned and sequential thirteen-year program. The program was designed with objectives stated for each unit of work and learning opportunities organized in a spiraling sequential fashion with topics continually reappearing and gradually increasing in complexity.[1] By 1965 materials for grades K-6 were available in commercially published editions and by 1970 the program was complete through the junior high school program.

In addition to the projects which have been described there were many other similar projects which had varying degrees of influence upon the modernization of mathematics instruction at both the elementary and secondary levels during the 1960s.

The Advanced Placement Program

The one program which originated in the 1950s and did not have as a goal the modernization of mathematics and which has been a strong influence in mathematics education at the secondary level is the Advanced Placement Program. In mathematics the committee appointed in 1952 to outline the original program was chaired by Professor H. W. Brinkman of Swarthmore College.[2] This committee designed a three-year high school program which terminated in a full year of college calculus with analytic geometry. In order for the schools to meet this objective, the committee recommended redesigning the high school program by deleting or de-emphasizing

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[1]Goodlad, p. 27.

[2]Pieters and Vance, p. 202.

parts of the standard high school mathematics program. This course was called Advanced Placement Mathematics and its content was described in the syllabus which the committee wrote for the program.[1]

To determine achievement in Advanced Placement Mathematics standardized examinations based on the syllabus have been administered in May of each year since 1955. From 1955 to 1968 the content of the course and the basis for the tests remained constant. For 1968-69 the syllabus was rewritten to offer the choice of two courses in Calculus, Calculus AB and Calculus BC, and two tests were administered.[2] The difference in these two courses is that Calculus BC is both a more intensive and more extensive course than Calculus AB.

Grades on the Advanced Placement Examination are reported on a scale of 1 to 5 with 5 being the maxium score obtainable. In general grades of 3, 4, or 5 qualify a student for advanced placement and/or credit in college although each college reserves the right to interpret the scores in its own way.[3]

Interest and participation in the Advanced Placement Mathematics program increased steadily following its inception. The

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[1]College Entrance Examination Board, Advanced Placement Program Descriptions (New York: the Board, 1960), pp. 103-13.

[2]College Entrance Examination Board, 1968-70 Advanced Placement Course Descriptions (New York: the Board, 1968), pp. 150-55.

[3]Daniel T. Finkbeiner, John D. Neff, and S. Irene Williams, "The 1969 Advanced Placement Examination in Mathematics--Complete and 'Unexpurgated'," The Mathematics Teacher 63(October 1971): 499-501.

data presented in table 1 show the number of schools and number of students participating in the test since 1956.

TABLE 1

SCHOOLS AND STUDENTS PARTICIPATING IN THE ADVANCED PLACEMENT PROGRAM AND ADVANCED PLACEMENT EXAMINATIONS IN MATHEMATICS FROM 1956 TO 1975

Year	Schools	Students	Examinations in Mathematics		
			Calculus AB	Calculus BC	Total
1956	104	1,229	-	-	386
1957	212	2,068	-	-	724
1958	355	3,715	-	-	1,177
1959	560	5,862	-	-	1,870
1960	890	10,531	-	-	2,908
1961	1,126	13,283	-	-	3,609
1962	1,358	16,255	-	-	4,190
1963	1,681	21,769	-	-	5,858
1964	2,086	28,874	-	-	7,710
1965	2,369	34,278	-	-	9,021
1966	2,518	38,178	-	-	9,630
1967	2,746	42,383	-	-	10,703
1968	2,863	46,917	-	-	11,623
1969	3,095	53,367	10,280	3,674	13,954
1970	3,186	55,442	10,273	4,106	14,379
1971	3,342	57,850	10,468	4,205	14,673
1972	3,397	58,828	10,611	4,575	15,296
1973	3,240	54,778	9,871	4,439	14,310
1974	3,357	60,863	11,213	4,825	16,038
1975	3,498	65,635	11,106	4,879	15,985

SOURCE: College Entrance Examination Board, Advanced Placement Examination Grade Reports (Princeton, N.J.: the Board, 1956-75).

Other Forces and Influences

An integral part of the reforms of the sixties were changes in methodology. These changes in a large measure resulted from the attention given by psychologists to areas such as intrinsic interest, the importance of structure in learning, the role of discovery teaching and a new view of transfer of learning.[1] The work of Jean Piaget and his views of the stages in the development of mathematical concepts, of "conservation" and "reversibility" and of the ages at which children are ready for them, significantly influenced the approaches to numerical, geometrical and logical ideas in many texts.[2]

Robert Gagne, who served as a consultant for UMMaP, also influenced texts and research in mathematics education. Gagne holds that knowledge is organized psychologically in hierarchies of principles and that subordinate concepts and principles must be learned before principles of higher order can be learned. Within his theory he also stresses the role of instruction on learning.[3]

Another psychologist whose work influenced the mathematical community was Jerome Bruner. He was a strong supporter of the "discovery" approach to teaching. His statement that, ". . . any subject can be taught effectively in some intellectually honest form to any child at any stage of development." was an often quoted and often misused phrase during this period.[4]

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[1]Jones and Coxford, p. 87.

[2]Ibid., p. 83.

[3]Ibid., p. 84.

[4]Jerome S. Bruner, The Process of Education (Cambridge: Harvard University Press, 1960), p. 33.

The fourth psychologist whose work had an impact was David Ausubel. Ausubel disagrees with the emphasis often placed on discovery teaching. He suggested that verbal exposition supplemented by appropriate problem-solving experience is the most meaningful and efficient method for teaching mathematics at the secondary school level.[1] He recommended that instruction take place using "advanced organizers" which would provide a basis by which students could relate their learning of specific skills and concepts to a larger and more general concept.

A major influence throughout the entire period from 1945 to 1975 was the National Council of Teachers of Mathematics. Through its officers, its publications, The Mathematics Teacher and The Arithmetic Teacher, and its yearbooks this organization both reflected and directed much of the activity in mathematics education. In particular its yearbooks, Insights into Modern Mathematics and The Growth of Mathematical Ideas, Grades K-12, which appeared in 1957 and 1959 respectively, were instrumental in explaining the intent and direction of the "modern mathematics" movement.[2]

Even as the impact of the mathematics curriculum reforms were beginning to reach the schools and before evaluation of the

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[1]David P. Ausubel, "Some Psychological and Educational Limitations of learning by Discovery," The Arithmetic Teacher 11(May 1964): 296.

[2]National Council of Teachers of Mathematics, Insights into Modern Mathematics, Twenty-third Yearbook (Washington, D.C.: the Council, 1957) and National Council of Teachers of Mathematics, The Growth of Mathematical Ideas: Grades K-12, Twenty-fourth Yearbook (Washington, D.C.: the Council, 1959).

new curricula was complete there was a call for further revision. In 1963 the Cambridge Conference on School Mathematics compiled and published recommendations for future reforms.[1] Its report was developed and designed with a long-range view. The immediate effect of the report, however, was to arouse much debate and controversy. The report presented an overview of topics for the various grades and also suggested some means of presenting the topics which included a strong emphasis on the use of the spiral approach. The content recommendations moved much content into lower grade levels than those at which material had normally been taught.

Individualized Instruction

During the middle part of the sixties the problem of individual differences again became crucial as it became evident that much of the new curricula did not adequately provide for the students with lower ability.[2] One of the approaches to this problem focused on the development of behaviorally stated objectives and individualized instructional schemes. In general, these schemes provided an organizational system through which all students would study the same materials but at a pace in keeping with their individual abilities and motivation. Many textbooks of the late sixties and early seventies included statements of behavioral objectives and authors wrote individualized units or programs to

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[1] Goals for School Mathematics: The Report of the Cambridge Conference on School Mathematics (Boston: Houghton-Mifflin Co., 1963).

[2] Osborne and Crosswhite, p. 296.

be used as supplements to the regular text materials. The use of behavioral objectives, the place of individualized instruction and more broadly the overall objectives for mathematics education have remained under discussion to the end of this period.[1]

Computers and Calculators

Throughout the period from World War II to 1975 the development of high speed digital computers and more recently of hand calculators have been technical advances related to mathematical computation. This development, while it was a force in the revolution in mathematics, was not an integral part of the "modern mathematics" reforms.[2]

The first articles describing a high school course involving computers appeared in The Mathematics Teacher in 1958.[3] Over the next several years numerous articles of a similar type appeared. Some of these described the use of computers at the junior high school level.[4]

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[1]Max S. Bell, "What Does 'Everyman' Really Need from School Mathematics?," The Mathematics Teacher 67(March 1974): 196-202; and Herbert J. Greenberg, "The Objectives of Mathematics Education," The Mathematics Teacher 67(November 1974): 639-43.

[2]G. Baley Price, "Progress in Mathematics and Its Implications for the Schools," in The Revolution in School Mathematics (Washington, D.C.: The National Council of Teachers of Mathematics, 1961), p. 4.

[3]Aaron L. Buchman, "A High School Digital Computer Program," The Mathematics Teacher 51(March 1958): 176-180; and Mina Rees, "Impact of the Computer," The Mathematics Teacher 51(March 1958): 162-8.

[4]Lowell T. Van Tassel, "Digital Computer Programming in High School Classes," The Mathematics Teacher 54(April 1961): 217-9; and Elliot Pierson, "Junior High Mathematics and the Computer," The Mathematics Teacher 56(May 1963): 298-301.

During the 1960s, two problems effected the expansion of computers into the secondary schools. One problem was that of obtaining access to computers. For most districts the cost of purchase was prohibitive and access to computers in colleges and businesses for instructional purposes was often not possible. The other problem was that of obtaining teachers trained in the use of computers. By 1970, however, most major computer companies had developed time sharing plans by which schools could plug into a common computer by telephone and share the cost.[1] Also, larger numbers of teachers had received some training in the use of a computer.

The Stanford Program in Computer-Assisted Instruction, which began in 1963, did attempt to develop a program to utilize computers at three teaching levels--drill and practice, tutorial, and dialogue.[2] In addition mathematics courses on logic and algebra for use with the computer were developed as a part of this project.

About this same time publications concerning computers and related instruction appeared from the National Council of Teachers

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[1]William M. Fitagerald and Irvin E. Vance, "Other Media and Systems" in The Teaching of Secondary School Mathematics, Thirty-third Yearbook of the National Council of Teachers of Mathematics (Washington, D.C.: the Council, 1970), p. 112.

[2]Eugene D. Nichols, "The Many Forms of Revolution," in The Continuing Revolution in Mathematics (Washington, D.C.: National Council of Teachers of Mathematics, 1968), p. 16.

of Mathematics and the National Science Teachers Association.[1] By the middle 1970s the use of computers for Computer-Assisted Instruction and the teaching of course in computer related mathematics were accepted parts of many secondary school programs. The Mathematics Teacher devoted most of the January 1973 issue to articles on the use of the computer in secondary schools.[2]

In 1975 the use of hand held calculators in mathematics classes at both the elementary and secondary levels is an unsettled issue. As the cost of these calculators has decreased the pressure to include them in the mathematics curriculum has increased. Presently, however, little real evidence exists to refute or support the use of these calculators as an aid to developing mathematical understanding at any level.

Metrics

The movement toward the use of the metric system and its possible acceptance as the standard for the United States has been a force during the 1970s. The Arithmetic Teacher devoted an entire issue to the topic in 1973.[3] The major impact of this movement seems to be at the elementary and junior high school levels. Activity has been focused on bringing the teaching of

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[1]National Council of Teachers of Mathematics, Computer Oriented Mathematics (Washington, D.C.: the Council, 1963); and Vincent S. Darnowski, Computers--Theory and Uses (Washington, D.C.: National Science Teachers Association, 1964).

[2]The Mathematics Teacher 66(January 1973).

[3]The Arithmetic Teacher 20(April 1973).

the metric system to a level comparable to that of our present standard units of measure and on preparing materials and teachers for a total change to the metric system.

Local Curriculum Development

Local Change and Innovation

Although the local school district is the main adopting agency for educational changes and innovations little research has been reported upon the manner in which the local system reacts to the forces imposed upon it in a specific subject matter area such as mathematics. On the other hand, the effect of national projects on the mathematics curriculum has been documented by studies on both a state and national basis. These studies have tended to study the school system as the adopting unit. However, as Carlson, whose study considered the leadership patterns of school superintendents in the adoption of "modern math", states:

> The startling fact is that even though research has taken the school system as the adopting unit, very limited attention has been paid to concepts related to organizational theory. . . The fact that school systems are organizations has generally been overlooked.[1]

In keeping with the comments in the literature concerning local system reaction, only a limited number of studies could be found which examined the changes in specific subject matter fields over a period of time and had attempted to relate these changes to forces operating either internally or externally to the school

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[1]Richard O. Carlson quoted in Everett M. Rogers, Communication of Innovations (New York: Free Press, 1971), p. 61.

system.[1] Studies which attempted to do this were identified in the fields of social studies and industrial arts.[2] In mathematics education only one study was located which traced the development of the mathematics curriculum of a particular school system for an extended period of time.[3] The emphasis of this study was upon the long term changes which took place in the Chicago Public Schools but not upon the organizational aspects of the system which influenced these changes.

Forces Effecting Change

In more general studies a number of forces have been identified which are often responsible for the changes implemented within a school system. A representative list of such forces includes: legal precedents, national curriculum projects, tradition, accreditation, colleges and universities, public opinion, special-interest groups, authors and publishers, critics of education,

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[1]Richard O. Carlson, "Barriers to Change in Public Schools," in Change Process in the Public Schools (Eugene, Ore.: University of Oregon Press, 1965); Matthew B. Miles, "Planned Change and Organizational Health," in Change Process in the Public Schools (Eugene, Ore.: University of Oregon Press, 1965); and Everett M. Rogers, Communication of Innovations (New York: Free Press, 1971).

[2]Wentworth Clarke, "The Development of the Social Studies in the Omaha Public Schools, 1900-1963," Dissertation Abstracts 25(April 1965): 5710; George William Genevro, "A History of Industrial Arts in the Long Beach City Schools," Dissertation Abstracts 27(September 1967): 651; and Ruth H. Grossman, "Development of the Elementary Social Studies Curricula in The Public Schools of New York City and San Francisco: 1850-1952," Dissertation Abstracts 25(May 1966): 6367.

[3]Betty I. Stubblefield, "The Development of the Mathematics Curriculum in the Chicago Public Schools from 1856 to 1962" (Ed.D. dissertation, Northwestern University, 1964).

testing programs, educational research, and the education profession.[1] Writers on curriculum have stressed the importance of a cooperative approach to the decisions which are made in respect to curriculum. Saylor and Alexander state, "Effective curriculum planning for the school and school system is, we believe, always cooperative planning involving the persons who are responsible for the curriculum of the school and system, or their representatives."[2]

It has been contended that there is an over emphasis on the properties of particular innovations and the manner in which they have been spread across systems but that there has not been a corresponding emphasis on the internal functioning of systems which have implemented innovations.[3] Miles listed several aspects of change situations which a seminar group in which he participated felt were important.[4] Included in this list were these questions:

1. Where does the change come from--is it external or internal to the system?
2. What is its timing in relation to other changes or events in the system?
3. What general attitude toward innovation and change exists in the particular organization?

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[1]Galen J. Saylor and William M. Alexander, Curriculum Planning for Modern Schools (New York: Holt Rinehart & Winston, 1966), p. 18; and Kimball Wiles, The Changing Curriculum of the American High School (Englewood Cliffs, N.J.: Prentice-Hall, 1963), p. 331.

[2]Saylor and Alexander, p. 405.

[3]Miles, Planned Change, p. 12.

[4]Ibid., p. 79.

This group also mentioned the importance of financial support. It was indicated that those changes which people were paid to carry out were not only installed but were accompanied by enthusiastic attitudes. The awarding of scholarships and fellowships for teachers to attend NSF institutes during the 1960s is illustrative of the use of such financial considerations to promote the adoption of new programs and techniques.

Innovations and Innovators

Generalizations related to innovations and innovators are numerous. Rogers identified the following three:[1]

1. Innovators are generally young and are likely to be viewed as deviants by their peers and by themselves.
2. Teachers who attend out-of-town educational meetings are more innovative.
3. Changes and adoptions of innovations within the system are directly related to the existance of persons whose responsibility is to promote change.

It was noted by Cass that most local changes appear to involve adoption or adaption rather than direct invention.[2] This may reflect a limitation on the time and resources available for innovation in local districts. It may also reflect the fact that

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[1]Everett M. Rogers, "What Are Innovators Like?," in Change Process in the Public Schools (Eugene, Ore.: University of Oregon Press, 1965), pp. 58-61.

[2]James M. Cass et al., "Changes in American Education in the Next Decade: Some Predictions," in Innovation in Education, ed. Matthew B. Miles (New York: Bureau of Publications, Teachers College, Columbia University, 1964), p. 615.

a local district must be willing to answer to the public when a program fails and thus may tend to institute only those programs or innovations which have a high probability of success.

The length of tenure of individuals has also been recognized as effecting innovation and change. The longer the tenure of individuals the more stable the patterns of interaction become, thus making change and innovation more difficult.[1] In a similar manner the stability of school systems has an effect on change and innovation. Miles indicates that the size and growth of a system tend to force adaptive changes and increase the concern for innovation.[2]

Commercial firms are also identified as having a distinct impact on the rate of educational change and innovation. The speed or slowness with which firms are able to produce and distribute relevant materials and to gain regular profit from them directly influences the rate of change.[3]

Administrators and Innovations

The role of the administrator was examined by both Atwood and Carlson.[4] Each of them indicated that the administrator as an

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[1] M. S. Atwood, "Small-scale Administrative Change: Resistance to the Introduction of a High School Guidance Program," in Innovation in Education, ed. Matthew B. Miles (New York: Bureau of Publications, Teachers College, Columbia University, 1964), pp.71-2; and Daniel E. Griffiths, "Administrative Theory and Change in Organizations," in Innovation in Education, ed. Matthew B. Miles (New York: Bureau of Publications, Teachers College, Columbia University, 1964), p. 434.

[2] Miles, Some Generalizations, p. 645. [3] Ibid., p. 643.

[4] Atwood, pp. 75-6; and Richard O. Carlson, "School Superintendents and Adoption of Modern Math: a Social Structure Profile," in Innovation in Education, ed. Matthew B. Miles (New York: Bureau of Publications, Teachers College, Columbia University, 1964), p. 341.

authority figure is crucial in introducing innovations--particularly those which involve structural change.

The role of the administrator in changing and improving mathematics programs was delineated by the Joint Project on the Administration of Mathematics Programs. This group had as its purposes:

> . . . to identify the kind of organization that enables the implementation, coordination, and administration of good mathematics programs; to outline general principles of curriculum planning and revision; and to define the responsibilities of various school personnel in the revision process.[1]

The activities reported by this group fell into four broad categories: (1) planning for change, (2) organizing the curriculum, (3) implementing the curriculum, and (4) evaluating the curriculum. These descriptions of the roles of the individuals follow closely the descriptions of the involvement of individuals within systems where extensive innovation has actually taken place.[2]

The educational diffusion of "modern math" as it related to communication among school administrators in Pennsylvania and West Virginia was studied by Carlson.[3] He correlated the adoption to innovativeness and certain perceived characteristics of the school superintendent. As with many studies, this research treated innovations as if they were individual decisions even though in many cases they may have involved collective decisions. This treatment

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[1]National Council of Teachers of Mathematics, Administrative Responsibility for Improving Mathematics Programs (Washington, D.C.: the Council, 1965), p. 3.

[2]Miles, Some Generalizations, pp. 639-42.

[3]Carlson, Superintendents and Modern Math, pp. 329-42.

conflicts with the idea that innovations precede within a system at several levels. Owens contends that teachers themselves can make three kinds of instructional changes without the participation of the administrator: (1) changing classroom practice, (2) reallocation of existing curriculum content, and (3) the introduction of single courses at the high school level.[1] Further he feels that the principal plays a minor role.

> Very few of the significant educational developments of recent decades can be credited to the leadership of school principals. The general pattern of change in schools has been to adopt--with modification--a program already being undertaken by others.[2]

Implementing and Evaluating Change

While a well planned and systematic procedure for change and the introduction of innovations is espoused by most writers on curriculum, Miles in summarizing the experiences of many systems indicates that the actual process used to bring about change does not seem to fit the well planned procedures that have been advocated.

> The rationalistic high-involvement model of curriculum change long advocated by some educators seems seriously inadequate as a model of actual innovative processes. The sequence is not that of careful school-wide or system-wide assessment of the pros or cons of an innovation, accompanied by various forms of rational persuasion and missionary fervor, culminating in a general decision to 'go ahead'. Rather, there is a decision (usually administrative) to add particular equipment or materials on a modest (pilot study) scale. Consultant help and special training are then employed to teach teachers to handle the innovation effectively.[3]

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[1]Robert G. Owens, Organizational Behavior in Schools (Englewood Cliffs, N.J.: Prentice-Hall, 1970), p. 132.

[2]Ibid.

[3]Miles, Some Generalizations, p. 653.

Writing in the mid 1960s Miles described the evaluation of change and innovation to be equally unplanned and unsystematic.[1] Failure occurs when an advocated innovation is rejected or discontinued by the target system members. Adoption and continued use of the innovation or change persumably represents the basic criteria for judging the adequacy of the effort. Other criteria seem to include the use of the innovation to accomplish broader purposes than originally envisioned or simply the retention of portions of the innovation. Since the time at which Miles described evaluation in this manner, federally supported projects such as those funded under NDEA have required the inclusion of systematic evaluation components. It is likely, however, that the unsystematic procedures as described by Miles still exist in most locally planned efforts.

Rogers reports little study has been done on the consequences of innovations.[2] He reports that an analysis of publications devoted to describing and supporting the spread of innovations indicated that of nearly 1500 studies only 38 investigated the consequences of innovations. Such investigation requires longitudinal study rather than the survey research used in many diffusion studies which have focused on changes at a particular point in time.

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[1] Ibid., p. 652.

[2] Rogers, Communication of Innovations, p. 324.

Studies of Change in Mathematics Education

Those studies which have examined the mathematics curriculum, either at the system level or across systems, have in general tended not to focus on the interrelationships of forces which bring about changes. The study of the Chicago Public Schools by Stubblefield examined the changes that had taken place in the mathematics curriculum from 1856 to 1962.[1] These changes were related to the trends in the development of the secondary mathematics curriculum in the United States during this period. The courses that were taught, shifts in content and the emphasis on computational aspects of mathematics were examined during various periods of the study. Also, special programs such as courses for the gifted were identified. While these changes were related to the national trends in mathematics education, no examination of the local factors which brought about these changes at the local level was planned in the study.

A study of academic mathematics in New York City indicated that significant changes had taken place in the mathematics program and identified the interactions that had taken place between various state and local personnel as having resulted in the development of a continuing, coordinated program.[2]

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[1] Stubblefield.

[2] Ruth Grabenheimer, "Academic Mathematics in New York City Public Schools Since 1930," Analysis of Research in the Teaching of Mathematics, eds. Kenneth E. Brown and Theodore L. Abell (Washington, D.C.: United State Government Printing Office, 1965), pp. 48-9.

A study of the curriculum development of ten major city school systems from their establishment through 1936 was reported by Lawson.[1] The emphasis of this study was on the changes that occurred in all curricular areas, the purposes of these changes and the factors which influenced these changes. The factors identified by Lawson comprise most of the list of forces identified by Saylor and Alexander.[2]

Within the past decade several studies of a survey nature were completed concerning the introduction of materials and programs in mathematics education. Barto studied the development of the mathematics program in sixty junior high schools during the period from 1958 to 1965.[3] He reported that most of the curriculum revision had taken place as the result of mutual agreement by administrators and teachers. Hodgin reported on change in mathematics as it was perceived by fifty teachers in a total of twenty-one secondary schools in Alabama.[4] Personal feelings and abilities of teachers, including their dissatisfaction with existing situations, increased knowledge and enthusiasm were identified as the impetus for change. Additionally, increased skill and competency of the

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[1]Douglas E. Lawson, Curriculum Development in City School Systems (Chicago: University of Chicago Press, 1940).

[2]For this list see p. 60 above.

[3]Allan Joseph Barto, "The Mathematics Program in Selected Junior High Schools, 1958-1965," Dissertation Abstracts, 27(April 1967): 3244.

[4]Katharine Wyatt Hodgin, "A Study of Aspects of Curriculum Change in Mathematics as Perceived by Selected Mathematics Teachers in Alabama Secondary Schools," Dissertation Abstracts, 27(March 1967): 2733.

teacher were perceived as important factors while the lack of skill, competency, and time were perceived as making change difficult.

Several status studies on mathematics education were also completed on either a local or a national level. In the late 1950s Bruns and Frazier surveyed thirty-six large city districts and reported that there was general agreement on basic requirements and the placement of beginning algebra and plane geometry but that beyond this level no uniform pattern was present.[1] They also reported a strong movement to enrich and extend the high school mathematics program. Rudnick completed a similar study comparing programs during the academic years 1957-58 and 1960-61 in a selected group of cities.[2] The results showed growth in the Advanced Placement Program, in the offering of special courses at the senior level and a movement of elementary algebra into the eighth grade. Other similar studies were conducted by Recker, who studied the status and trends in mathematics in Ohio secondary schools, and by Schaefer who made an analysis of the mathematics programs in selected Catholic secondary schools.[3]

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[1]Richard F. Bruns and Alexander Frazier, "Sequence and Range of High School Mathematics," The Mathematics Teacher 50 (December 1957): 562-6.

[2]Jesse A. Rudnick, "A Study of the College Preparatory Mathematics Curriculum of Public Secondary Schools in Selected Cities of the United States in the Academic Years 1957-58 and 1960-61," Analysis of Research in the Teaching of Mathematics, eds. Kenneth E. Brown and Theodore L. Abell (Washington, D.C.: United States Government Printing Office, 1965), p. 78.

[3]Frank William Recker, "Status and Trends in Mathematics in Ohio Secondary Schools," Dissertation Abstracts 27(August 1967): 333; and Sister May Geralda Schaefer, "Revision of Secondary Mathematics in a Selected Number of Schools," The Mathematics Teacher 61(February 1968): 157-161.

Summary

The period from 1945 to 1975 was one of great change and innovation in education. The build up of economic, social and technical forces as the result of World War II generated changes in society which were rapidly reflected in the educational system. During this period federal involvement in the educational process increased greatly as a result of the establishment of the NSF and the provision of funds through the NDEA and the Educational Acts. The resulting funds, added to those provided by various foundations, provided the support for the curriculum revision projects which were active throughout this period and for those local districts who were interested in implementing innovations and changes.

During the 1950s and early 1960s curriculum revision reflected a highly academic orientation. The result was to emphasize the inclusion of new and modern content with a highly structured organization in the curriculum of the elementary and secondary schools. In the later 1960s the emphasis shifted from content to the learner. The problems of the disadvantaged student, the problem of the slow learner and concerns for individual differences became the primary focus of educational efforts. In the last few years of this thirty year period an emphasis on the provision of career education began to appear.

Throughout the entire period technological innovations, new organizational patterns for schools, and different instructional methodologies were tried. Often these innovations were introduced in combination with new content.

In mathematics education the same forces were felt that affected the rest of the curriculum. The reaction of the mathematics community occurred earlier than in most areas and resulted in the establishment of several reform projects in the early 1950s. Nearly all of these projects, as well as those of the next decade, took as a starting point the revision of the content of school mathematics so that it would contain more "modern" content presented in a more organized and logically correct format. Following the initial work of many of these projects and the development of the first sets of sample materials, which were oriented toward the college preparatory students, the groups moved to the development of materials for the slow learner and for the disadvantaged.

Two factors during this period which were important did not reflect the concern with "modern" content. One was the development of a program for gifted students, the Advanced Placement Program, and the other was a technological advancement, the development of high speed digital computers. Each of these was a factor effecting the acceptance of new content in mathematics at the secondary school level.

Certain psychologists and learning theorists were influencial during the period. The organization of material and the methodology advocated by some of the projects was directly related to the work of such individuals. During the later 1960s the emphasis on individualized instruction and the related use of behavioral objectives had an impact on mathematics education.

Study of local curriculum change during this period indicates several generalizations that one might expect to find in

the examination of any district involved in change and innovation during this period.

1. The districts with a high rate of change and innovation were relatively rapid growing, with staff who had not been in their positions for long periods of time and had persons assigned to positions where they were responsible for promoting change.
2. The changes were not as organized, well planned and evaluated as has been advocated in the literature.
3. Pilot studies, on a limited scale, and the provision of special training for teachers were often a part of the process employed to introduce innovations.

Studies of the status of mathematics education during this period of reform and revision found that school districts were moving to implement the changes in content which were advocated by the groups exerting efforts at a national level. This included both the increased use of "modern mathematics" and the adoption of the Advanced Placement Program.

CHAPTER III

THE DEVELOPMENT AND GROWTH OF THE LIVONIA SCHOOL SYSTEM

The Region and the City

The City of Livonia, Michigan is thirty-six square miles in area and lies three miles directly west of Detroit, Michigan. It is one of the many cities which developed around Detroit during and following World War II and which make up the Detroit metropolitan area.

Although the City of Livonia was not incorporated until 1950, the region has a long history. In 1835, when Livonia Township officially came into existance, the area already had been largely transformed from wilderness to farmland.[1] The area remained primarily agricultural until 1925 when the first subdivision was built.[2] Even in 1940 and through World War II, Livonia was still a typical rural township. It was following the end of the war that Livonia entered a period of economic growth and a corresponding population expansion. Table 2 shows population growth figures for Livonia from 1940 to 1975.

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[1]Richard L. Darling, "Livonia USA (excerpts)," Livonia, Mich., October 1959.

[2]Leslee J. Bishop, Livonia, Michigan (Livonia, Mich.: Livonia Public Schools, 1964), p. C1.

TABLE 2

POPULATION OF LIVONIA

Year	Population	Percentage Change from Prior Date
1940	8,728	-
1950	17,534	100.9
1960	66,702	280.4
1970	110,109	65.1
1975	118,000 (est.)	7.2

SOURCE: Livonia Planning Department, Statistical Data (Livonia, Mich.: The Planning Commission, 1971)

During the years of 1948 and 1949, three major constuction projects marked the beginning of the transition from a rural township to a modern urban center.[3] These were the construction of: (1) a Hydromatic transmission plant by General Motors Corporation; (2) a central parts dept by Ford Motor Company; and (3) the Detroit Race Course by the Michigan Racing Association. As result of the industrial expansion typified by these three projects and the enactment of a state law which specified that a township could not receive money from the track but that a city could receive up to $500,000 per year in taxes, a movement began to incorporate the township as the City of Livonia. On February 6, 1950 the people of the township voted to incorporate as the City of Livonia.

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[1] Leonard Servetter, Our City Livonia, Michigan (Livonia, Mich.: Livonia Public Schools, n.d.), p. 69.

Because of the relatively sparse population at the time of incorporation and the development of a master plan which restricted the major industrial development to a mile wide strip of land running the length of the city, the major portion of the city developed into residential areas dominated by medium priced homes.[1] In 1970, 96.2 percent of all homes were single family units and 92.9 percent of the occupied units were occupied by the owner.[2] These conditions resulted in attracting a population of above average income. According to the 1960 census, the typical family in Livonia had an average income of $8,243 as compared to median family incomes of $6,256 for all Michigan residents and $6597 for all Wayne County residents.[3] Similarly in 1969, 64.2 percent of Livonia familes reported an income in excess of $10,000 as compared with 42.7 percent of Wayne County families and 38.5 percent of all Michigan families.[4]

The support of the community for education has varied as is shown by the record of votes on operational millage contained in table 3. In several instances where a millage was defeated cutbacks in programs and personnel were implemented by the school system. Until the 1970s, however, when Livonia's school age population began to decrease and a new method of allocating state aid was adopted,

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[1]Bishop, p. C17.

[2]Livonia Planning Commission, Statistical Data (Livonia, Mich.: the Planning Commission, 1971), p. 12.

[3]Bishop, p. C4.

[4]Livonia Planning Commission, Statistical Data, p. 7.

an expanding tax base helped to offset these losses. Projections for the period from 1975 to 1980 indicate there will be a need for increased local millage to offset additional, anticipated losses of funds from the state.

TABLE 3

RESULTS OF LIVONIA PUBLIC SCHOOLS
OPERATIONAL MILLAGE VOTES

Date	Mills Requested	Result of Vote	Date	Mills Requested	Result of Vote
8/45	--	Pass	6/63	6.00	Fail
7/47	5.00	Fail	8/63	3.00	Fail
6/52	5.00	Pass	1/64	1.50	Pass
6/52	3.00	Fail	1/66	9.00	Fail
5/54	8.00	Pass	5/66	5.00	Pass
3/56	3.00	Pass	9/68	7.00	Pass
9/57	4.00	Fail	9/68	4.00	Fail
3/58	2.50	Pass	4/69	4.00	Fail
6/58	1.00	Pass	3/71	3.50	Fail
4/59	7.00	Fail	6/71	3.50	Pass
6/59	1.00	Pass	3/74	7.50	Fail
6/60	1.00	Pass	3/74	0.75	Pass
6/61	4.50	Fail	6/74	8.30	Pass
9/61	3.50	Pass	6/75	4.00	Pass
3/62	7.00	Pass			

The School System

Until 1944 the educational facilities in Livonia were provided by seven separate school districts. Each district owned and operated its own building which housed a program through the eighth grade. Students who continued their education beyond this grade attended high school in one of the surrounding disticts.

In 1942, after several years of discussion, Carson Johnston, a member of the Township Zoning Board, wrote to one of these districts, the Elm-Rosedale District, proposing that some action be taken toward building a high school.[1] This letter initiated action which resulted in consolidation. On 22 April 1944 an election was held and the seven school districts--Briggs, Elm-Rosedale, Livonia Center, Newburgh, Pierson, Stark, and Wilcox--voted to consolidate. On 1 May 1944 they elected a single board of education. The newly formed district had a total of eight buildings and forty-four teachers only five of whom had college degrees.

Harry O. Johnson was hired as the first superintendent in June 1944. During the first two years of operation, the seventh and eighth grade students were housed at the Livonia Center and Newburgh Schools and all other buildings were used to house grades K-6. For these two years all students in grades 9-12 continued to attend schools in surrounding districts.[2]

In 1945 land was acquired to build the first high school in the district. After the passing of millage and the receipt of

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[1]Dominic P. Paris, Footpaths to Freeways: The Story of Livonia (Livonia, Mich.: n.p., 1975), p. 94.

[2]Ibid., p. 95.

federal aid, the school, to be named George N. Bentley High School after a distinguished member of the community and member of the new school board, was started in May 1947. In anticipation that the new building would be ready for occupancy in the fall of 1947, ninth grade students were taught within the district in 1946. For that year seventh grade students attended Newburgh School and eighth and ninth grade students attended Livonia Center School.

In September 1947, even though the building was far from completion, the eighth, ninth and tenth grade students were placed at the new high school and the seventh grade was moved to Livonia Center School.[1] During the next three years rooms were added to Bentley High School until in January 1950 the entire junior and senior high school population was conatined in this one building. In June 1950 Livonia's first senior class, ninety-two in number, graduated from Bentley High School.

Bentley continued to operate as a seventh through twelfth grade school until 1954. An addition on the site that year allowed the school to function as two separate administrative units. These units were a junior high school, designated as Riley Junior High School, containing grades seven and eight and the high school containing grades nine through twelve.

In 1953 a decision was made that the district would move toward an organizational plan in which elementary schools would contain kindergarten and grades one through six; junior high schools

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[1]Bentley High School Alumni Association, The First 25 Years: 1947-1972 (Livonia, Mich.: the Association, 1972), p. 4.

would contain grades seven through nine and senior high schools would contain grades ten through twelve. In keeping with this decision, Whitman Junior High School opened as a 7-9 building in 1956 and at the same time Riley became a 7-9 unit. Two additional junior high school buildings were opened in the fall of 1958 and Riley moved into one of these new buildings. The Bentley site then contained only the high school which housed grades ten through twelve.

At the elementary school level the district, except for closing the one-room Briggs School, used the buildings of the original seven districts until 1954 when Harrison and Wilson Elementary Schools were constructed. From that time through 1969-70 the construction of new schools was a continuous part of the educational picture in Livonia. At that time a peak of 49 buildings was reached as is shown in table 4. During the first half of the 1970s, several of the original buildings which were still in operation were closed and either torn down or converted to uses other than regular classroom facilities. By 1974-75 only Rosedale Elementary School of the original school buildings was still in use as a regular classroom facility.

The school population of Livonia, as is shown in table 5, increased steadily from the formation of the district through 1971-72. The increases were the result of both the normal growth of the city and the annexation of several additional districts. From 1971-72 through 1974-75 the population decreased and predictions made in 1975 call for the decrease to continue until at least 1980. This decrease has resulted from lower birth rates,

TABLE 4

SCHOOL BUILDINGS IN THE LIVONIA PUBLIC SCHOOLS

Year	Elementary	Jr. High	Sr. High	Total
1944-45	6	2	0	8
1945-46	5	2	0	7
1946-47	6	2	0	8
1947-48	6	1	1	8
1948-49	6	1	1	8
1949-50	7	0	1	8
1950-51	7	0	1	8
1951-52	7	0	1	8
1952-53	7	0	1	8
1953-54	7	0	1	8
1954-55	9	1	1	11
1955-56	10	1	1	11
1956-57	15	2	1	18
1957-58	17	2	1	20
1958-59	19	3	1	23
1959-60	22	3	1	26
1960-61	22	4	1	27
1961-62	26	5	1	32
1962-63	26	5	2	33
1963-64	28	6	2	36
1964-65	29	6	2	37
1965-66	29	7	3	39
1966-67	31	8	3	42
1967-68	31	9	3	43
1968-69	31	9	4	44
1969-70	36	9	4	49
1970-71	35	9	4	48
1971-72	35	10	4	49
1972-73	35	10	4	49
1973-74	34	10	4	48
1974-75	33	10	4	47

TABLE 5

ENROLLMENT OF THE LIVONIA PUBLIC SCHOOLS

Year	Elementary	Jr. High	Sr. High	Total
1944-45				
1945-46	DISTRICT RECORDS ARE INCOMPLETE FOR THE FIRST THREE YEARS OF OPERATION			
1946-47				
1947-48	1,408	497	106	1,911
1948-49	1,558	511	280	2,349
1949-50	1,660	511	417	2,588
1950-51	1,805	572	487	2,864
1951-52	2,061	721	478	3,260
1952-53	2,342	786	542	3,670
1953-54	2,850	982	645	4,477
1954-55	3,540	1,096	761	5,359
1955-56	4,342	1,359	897	6,598
1956-57	5,405	1,678	992	8,075
1957-58	7,308	2,006	1,309	10,623
1958-59	8,674	2,208	1,702	12,594
1959-60	10,159	2,712	2,018	14,889
1960-61	11,791	3,382	2,242	17,415
1961-62	13,392	3,789	2,554	19,735
1962-63	14,976	4,064	3,294	22,334
1963-64	16,184	4,667	4,085	24,936
1964-65	17,688	5,481	4,691	27,830
1965-66	18,813	6,270	5,062	30,145
1966-67	19,496	6,945	5,720	32,161
1967-68	19,840	7,392	6,575	33,807
1968-69	20,041	7,978	7,362	35,381
1969-70	21,059	9,085	7,838	37,982
1970-71	20,253	9,349	8,468	38,070
1971-72	19,667	10,095	8,738	38,500
1972-73	18,372	9,872	9,116	37,360
1973-74	16,792	9,543	9,452	35,787
1974-75	15,530	9,008	9,689	34,227

an aging population in Livonia, and a resulting decrease in the number of children entering the Livonia schools in kindergarten as compared to the number of students graduating each year.

Between 1945 and 1975 the school district boundaries, which have never been coterminous with those of the City of Livonia, expanded with the annexation of the Cooper and Patchen school districts in 1957 and the annexation of a part of the Nankin Mills School District in 1969. Thus during the 1970s the school district consisted of a portion of the City of Westland and all of the City of Livonia except for a small portion of the northeast corner of Livonia which lies in the Clarenceville School District.

Administrative Organization and Personnel

Since its formation, the Livonia School District has operated under several different administrative organizational patterns which have resulted both from: (1) the growth of the district and the resulting need for increased supervisory personnel, and (2) attempts to change the organizational patterns to provide more efficient and direct leadership. This section describes that part of the central administrative structure of the system which included persons who may have exerted considerable influence on the mathematics program of the district.[1] It also describes the development of leadership positions, department chairmen and curriculum representatives, which were established within the teaching staff and

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[1]See appendix B for diagrams of the organizational patterns relating to mathematics education for each different period from 1944 to 1975.

remained separate from the administrative structure. The position of building principal is not formally treated in this section but it is recognized that the principals have always been influential in effecting curriculum changes both at the building and district levels.

Following the formation of the district a series of persons were appointed by Superintendent Johnson to serve in a supervisory position for the elementary schools. Helen Graves was appointed to the position of Elementary Supervisor in August 1944 and held this position for two years. In 1946 William McCann was appointed to the position of Elementary Curriculum Coordinator. He served in this capacity until he resigned in November 1948. At that time Lynn Brown was appointed to fill the renamed position of Elementary School Supervisor--Curriculum Coordinator. The chief function of this position was, ". . . to serve as supervisor of elementary schools and consultant to the secondary schools for the purpose of coordinating the education activities including music and art, of the Livonia Township School System."[1] He filled this position until June 1952. In November 1952 Bernice Roberts, a classroom teacher in the system, was appointed to fill the position and held it for the next ten years.

From 1953 to 1955 the superintendency changed hands several times. Harry Johnson left in June 1953 and Karl Olsen was appointed Acting Superintendent. In March 1954 Cole Brembeck became Super-

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[1]Livonia Public Schools, Minutes of Meetings of the Board of Education, Meeting of 22 February 1949.

intendent and served until July 1955 when he resigned. Benton Yates was then appointed Superintendent and held the position until 1969, a period of fourteen years.

Eino Michelson had become Assistant Superintendent in September 1953 and when Benton Yates became Superintendent, his title was changed to Assistant Superintendent and Director of Education. In this capacity he was given the direct supervision of the educational programs in elementary, junior high, senior high, adult education and summer school.[1] Michelson continued in this position until June 1957.

In September 1959, Paul Johnson was hired as Assistant Superintendent in Charge of Instruction, a position which, with various changes in title, he held through 1974-75. At the time of this appointment in 1959 he became head of the Division of Instruction. Working within this division were the Coordinator of Elementary Education and coordinators in the areas of: special services, libraries, art, vocal music, physical education, reading, adult education and foreign language.[2]

In 1960 two new positions were added to the Division of Instruction. Leslee Bishop was appointed Coordinator of Secondary Education and Paul Ploutz was appointed Coordinator of Science Instruction. While Ploutz's primary responsibility was in the area of science, it was stated that, "In the closely related field

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[1] The Livonian, 12 August 1955.

[2] Paul E. Johnson, Instruction and Its Supervision (Livonia, Mich.: Livonia Public Schools, September 1960), p. ix.

of Mathematics, the science coordinator serves in a liaison and coordinating role."[1]

Also, during 1960, the position of General Elementary Resource Teacher was established. For each of the next three years either two or three persons were assigned to this position. The description of this position stated, "As a supervisory position, it is consistent with the self-contained classroom organization for instruction in that the resource teacher is competent in all aspects of the elementary school program and able to assist teachers in planning their entire program and in working toward improvement in all subject areas."[2] While the job description called for the Resource Teacher to work in all areas, in practice, priorities were generally established in the following order: (1) work with new teachers, (2) reading, and (3) mathematics.[3] With the large number of new teachers entering the district at this time, it meant that the resource teachers were not able to provide much help in the area of mathematics instruction.

For two years the central office responsibilities for supervision of mathematics remained stable. When in June 1962 Bernice Roberts and Paul Ploutz left the system, Henry Heusner was appointed Director of Elementary Curriculum. The position of Coordinator of Science Instruction, however, was not refilled.

By the spring of 1964 it was recognized that with the rapid changes that were taking place in mathematics and science education,

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[1]Ibid., p. 5

[2]Ibid., p. 6.

[3]Esther Heusner, interview held at the Livonia Public Schools Department of Curriculum Offices, Livonia, Mich., 17 September 1975.

more direct supervision was needed in these areas. In March 1964 the position of Elementary School Science/Mathematics Resource Teacher was posted. The functions described for this position were to:

1. Provide on the job assistance to classroom teachers.
2. Give consultative help to principals and staffs working in curriculum development and inservice activities in sceince and mathematics.
3. Demonstrate teaching techniques and materials.
4. Keep the professional staff aware of promising new trends.
5. Establish and maintain a science/mathematics center.[1]

William Kumbier, who had been a junior high school mathematics/science teacher in the system, was appointed to fill this position. During the following year the title of this position was changed to that of Coordinator of Elementary Mathematics and Science.

In May 1964 the position of Coordinator of Secondary Mathematics and Science Instruction was posted. The job description for this position stated:

> The Coordinator of Mathematics and Science Instruction has responsibility for coordinating the planning, organization, and appraisal of instructional programs in these subject areas in the junior and senior high schools. In conjunction with curriculum study research and development, the providing of in-service education and other professional growth opportunities for teachers and administrators will be given major emphasis. The coordinator serves as a resource person to individual teachers and groups in areas of his own professional strengths and arranges for the use of outside resource assistance when this is needed. In addition to responsibilities for horizontal

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[1] Livonia Public Schools, Notice of Vacancy: Elementary School Science/Mathematics Resource Teacher (Livonia, Mich.: Livonia Public Schools, 20 March 1964).

> coordination of programs in mathematics and science, he provides leadership in continuing efforts to articulate better the instructional programs vertically between the various grade levels.[1]

Charles Zoet, a high school mathematics teacher from the system, was appointed to this position.

In the spring of 1965 the Division of Instruction was reorganized to delineate more clearly the responsibilities of its members. This reorganization had minimal effect on the responsibilities for the supervision of the mathematics program. The two coordinators continued to be directly responsible to the Directors of Elementary and Secondary Education and they in turn continued to report to the Assistant Superintendent in Charge of Instruction.[2]

In June 1965 Donald Friedrichs, principal at Bentley High School, was named to replace Bishop as Director of Secondary Education. For the next five years the administrative structure and the personnel within the Division of Instruction with supervisory responsibility for the mathematics program remained the same.

Roland Upton replaced Benton Yates as Superintendent of Schools in 1969. Following his appointment, a major restructuring of the administrative organization was planned and implemented during the summer of 1970.[3] The positions of Director of Elementary

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[1]Livonia Public Schools, Notice of Vacancy: Coordinator of Secondary Mathematics and Science Instruction (Livonia, Mich.: Livonia Public Schools, 25 May 1964.

[2]Paul E. Johnson to the Administrative Staff, "Proposed Reorganization of the Division of Instruction," Notice No. DI-576, Livonia Public Schools, 20 April 1965.

[3]Livonia Public Schools, School District Table of Organization (Livonia, Mich.: Livonia Public Schools, 1970).

Education and Director of Secondary Education were eliminated. Their responsibilities were then divided on a geographical rather than grade level basis. The district was divided into two regions identified as the Bentley/Stevenson Region and the Franklin/Churchill Region. Each region was served by a separate administrative and curriculum staff. Henry Heusner was appointed Director of the Bentley/Stevenson Region with Dean Waldfogel as his assistant and with William Kumbier as Mathematics/Science Coordinator K-12. Donald Friedrichs was appointed Director of the Franklin/Churchill Region with Lawrence Nichols as his assistant and with Charles Zoet as Mathematics/Science Coordinator K-12. It was planned that these two regions would be free to determine their own instructional programs and materials within broad guidelines laid down by the Board of Education.

This regional structure continued until December 1974. During its existance several changes in leadership positions occurred. In June 1973 Henry Heusner left the system and Lawrence Nichols became Director of the Bentley/Stevenson Region. At the same time, Arthur Domalske and Clyde Jack, elementary principals from the system, were appointed as assistant directors for the two regions. A temporary change effecting mathematics supervision also occurred when Charles Zoet was given a sabbatical leave during the second semester of 1971-72. Allan Edwards, mathematics department chairman at Stevenson High School, was appointed Acting Coordinator of Mathematics/Science for the Franklin/Churchill Region.

In June 1974 George Garver replaced Roland Upton, who had resigned, as Superintendent of Schools. Under Garver's direction and based on dissatisfaction with the regional structure, which had developed since its inception in 1970, a new administrative structure was implemented in January 1975.[1] The two regions were dissolved and the positions of Director of Elementary Education and Director of Secondary Education were re-established. Additionally, a new department, the Department of Curriculum Development, was formed and Esther Heusner was appointed Acting Director. The coordinators of subject matter areas were placed in this department and their duties were realigned. Charles Zoet was appointed Coordinator of Mathematics K-12 and William Kumbier was appointed Coordinator of Science K-12. Thus starting in January 1975, Livonia, for the first time, had a person with full time responsibility for the coordination of the mathematics program.

In addition to establishing administrative positons with responsibility for various curricular areas, the Livonia Public Schools established a number of leadership positions in which the appointees remained a part of the teaching staff. In the secondary schools this position was that of department chairman.[2]

Prior to 1962 each department in the high schools elected a member to represent the department in meetings with the principal

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[1]George E. Garver and Paul E. Johnson to the Administrative Staff, "Clarification of Roles under the New Plan of Central Administration," Notice No. SO-5, Livonia Public Schools, 7 January 1975.

[2]For a list of all junior and senior high school department chairmen for mathematics see appendix C.

and to oversee departmental business. This job tended to rotate among the department members on a yearly basis. In the spring of 1962 the faculties of Bentley and Franklin High Schools completed a study of this position and submitted recommendations to the Superintendent and Board of Education that it be made an officially appointed and compensated position. On 24 May 1962 the Board approved the appointment of two department chairmen at each of the high schools for the school year 1962-63. One of the chairmen appointed at Bentley High School was in the mathematics department. By 1964 there were nine officially recognized department chairmen with extra-duty pay and released time at each high school.[1] Among the functions assigned to the department chairmen were:

1. Work with the principal and department members in the development of departmental policies.

2. Provide leadership to members of the department in curriculum development, including:
   a. the organization of new courses
   b. the evaluation of courses
   c. the selection of materials for courses
   d. the review and adoption of textbooks

3. Work with the Coordinator of Secondary Education and the secondary principals to relate junior high, senior high, and junior college curriculums.

4. Interpret the departmental program, prepare written information on departmental plans, projects and progress for use with parents and the general public.

5. Responsibility for setting up an orientation program for new teachers in the department, which may include workshops, etc.[2]

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[1]Donald E. Friedrichs, "The Role of the Department Chairman in Livonia Secondary Schools," Livonia Public Schools, n.d.

[2]"The High School Department Chairman," Livonia Public Schools, n.d.

In the junior high schools prior to 1965, subject area chairmen were elected to conduct curriculum day activities and to coordinate related meetings. For the 1965-66 school year, two department chairman positions, Language Arts/Social Studies and Mathematics/Science, were recognized as extra-duty pay positions at each junior high school.

The contracts with the Livonia Education Association (LEA) for 1966-67 and 1967-68 recognized department chairmen as extra duty pay positions and granted one period of released time for duties. In the following two contracts the released time for department chairmen was removed and extra-duty pay was substantially increased. This loss of time by the department chairmen for leadership in instructional improvement was expressed as a concern by both the teachers and the administration.[1] As a result, a joint Board of Education-LEA committee on "The Role of the Department Chairman" was formed in January 1970. Based on the report of this committee, all contracts from 1970-71 through 1974-75 contained time, usually about the equivalent of five periods per day for the high schools and three periods per day for the junior high schools, to release department chairmen or other teacher leadership personnel for instructional improvement activities.

In the elementary schools a pilot study was conducted during 1966-67 in which classroom teachers possessing strength in selected areas, either mathematics/science or language arts/social studies, were identified and given responsibilities within their building in

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[1]Friedrichs, "Role of Department Chairman."

these areas without removing them from a major portion of their classroom responsibilities. As a result of this pilot study, all elemenatry schools were authorized to select two curriculum representatives in these areas for the school year 1967-68.[1]

The job description for this position stated that they were, "To work under the direction of the principal as part of the local leadership and resource team in the improvement of the instructional program of the school."[2] The duties and responsibilities assigned to this position included:

1. To periodically meet with the system coordinator for the purpose of gaining new insights and knowledge of innovations in teaching techniques to share, in turn, with local school personnel. This may be done through workshops, demonstration classes, conferences with individual teachers, etc.

2. To assist classroom teachers in local buildings with planning instructional units and to act as an easily-accessible resource person to his staff.

3. To aid the principal and the system-coordinator in organizing workshops and/or demonstrations for the representative's own staff.

4. To be knowledgeable in matters of building equipment and materials, assisting in making them available, arranging for their maintenance, and assisting in the selection of new materials or replacement items.[3]

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[1]Department of Elementary Education, "Curriculum Representatives for all Schools in 1967-68," The Coordinate, vol. 4 (Livonia, Mich.: Livonia Public Schools, 1 September 1967), p. 3.

[2]Norman L. Whisler to All Elementary Teachers, "Local School Representative in Curriculum," Livonia, Mich., Livonia Public Schools, 7 May 1968.

[3]Ibid.

The position of elementary school curriculum representative continued in this same form through the 1974-75 school year.[1]

A third type of teacher leadership position established by the system, which directly effected the mathematics program development, was that of Teacher Specialist in Computer Education. This position was established in February 1968 as a half-time position and was filled by Kenneth Knipschild who was a teacher of computer mathematics at Bentley High School. The duties assigned to this position included:

1. Coordinating and conducting the instruction of Livonia High School students in the 1440.
2. Conducting appropriate computer training sessions for interested faculty members.
3. Developing and identifying materials for use in computer education.
4. Working with the Coordinator of Secondary Mathematics and Science Instruction in curriculum developments related to computer education.[2]

Knipschild served in this capacity until June 1969. The position then remained unfilled for a period of six months until Lary Smith, a teacher of computer mathematics and physics in the system was appointed. He served in a half-time capacity until June 1973. At that time, the additional time required because the system was leasing its own computer rather than renting computer time and the increased enrollments in computer courses caused the position to

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[1]For a list of all teachers who served in this position for mathematics/science see appendix C.

[2]Charles J. Zoet to Donald Friedrichs, "A Proposal for Educational Uses of the IBM 1440," Livonia, Mich., 20 December 1966.

be changed to a full-time position. The general job description for the position at that time stated:

> The computer education specialist has the primary responsibility for developing and implementing the use of computers in instruction. He is responsible to the Deputy Superintendent of Instruction for ceveloping and coordinating the instructional programs in that area. He serves in an advisory capacity to the regional offices and appropriate committees. He also serves a liaison function to the director of data processing.[1]

Lary Smith filled this position for two years. He then left to take a similar position with the Wayne County Intermediate School District. At the time he left, it had been decided that the position would return to a half-time position for the 1975-76 school year.

Summary

The growth of both the City of Livonia and the Livonia Public Schools was characterized by a rapid increase in population during the 1950s and 1960s. Beginning about 1970 this growth leveled off and while the city continued some slight increase, the student population of the school district began a decline which is not expected to end until 1980. Corresponding to the growth of the population of the school district there was a parallel growth in the physical facilities and the professional staff of the district.

As the teaching staff of the district increased the staff assigned to the supervision and leadership of curriculum also

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[1]William K. Kumbier and Charles J. Zoet to Donald Friedrichs and Larry Nichols,"Recommendations Related to the Position of Computer Education Specialist," Livonia, Mich., 21 June 1973.

grew in size and in specialization. From 1944 to 1964 there was no person directly assigned to the supervision of mathematics education. Responsibility for this area belonged to the Assistant Superintendent for Instruction and the Directors of Elementary and Secondary Education. During the early 1960s an attempt was made to provide some leadership through the positions of Coordinator of Science Instruction and General Elementary Resource Teachers. In 1964 coordinators positions were created at both the elementary and secondary levels to provide leadership in mathematics and science for grades K-6 and 7-12, respectively. These positions which were under the supervision of the Directors of Elementary and Secondary Education existed for a period of six years.

The division of the district into two geographical regions in 1970 caused the realignment of the responsibilities of the two mathematics/science coordinators. During the existance of the regions each coordinator was responsible for all mathematics and science in grades K-12 for a single region. The regional organization existed until January 1975. When the regions were dissolved, the new structure which was implemented included a separate Department of Curriculum Development. Separate Coordinators of Mathematics and Science were appointed with responsibilities for the K-12 program in a single discipline. Thus, in 1975, the Livonia Public Schools had, for the first time, a person whose full time responsibility was mathematics education.

In addition to the coordinators, persons in other positions who were influencial in the development of the mathematics program were Mathematics Department Chairmen at the junior and senior

high schools, Mathematics/Science Curriculum Representatives in the elementary schools and the Teacher Specialist for Computer Education. The persons who filled these non-administrative positions were the major teacher voice in curriculum development following the establishment of the positions: Senior High Department Chairmen (1962), Junior High Department Chairmen (1964), Elementary Curriculum Representatives (1967), and Teacher Specialist for Computer Education (1968).

CHAPTER IV

THE DEVELOPMENT OF THE MATHEMATICS PROGRAM

1944 to 1958

Following the formation of the new Livonia School District all administrative decisions, including those regarding curriculum and textbooks, which had been made by the seven separate districts now had to be made by a single district. It was during the first several years that many policies were established that were to effect curriculum development practices for twenty years or more. One early decision related to texts was made in July 1944 when the Board adopted a policy of supplying free texts to all students in grades K-8.[1]

The Elementary Program

The opening of school the first year, 1944, was scheduled for 5 September. At the request of the Detroit Board of Health the date was moved to 18 September because of an epidemic of poliomyelitis in the area.[2] During this two week period teachers, who were under contract for the year, were invited to participate in a workshop. Superintendent Johnson, with the advice of the principals of the individual schools, appointed an elementary steering

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[1] Livonia Public Schools, Minutes of Meetings of the Board of Education, Meeting of 10 July 1944.

[2] Ibid., Meeting of 28 September 1944.

committee composed of teachers to plan this workshop. A description of this workshop written in 1958 viewed it as having been a very positive factor in the curriculum development of the district.

> During that two week workshop tremendous progress and decision was effected. Each area of the curriculum was reviewed, textbooks were studied and recommendations were made for adoption. Never since have studies moved with such rapidity and decision effected with so much dispatch.[1]

An elementary steering committee such as the one which had planned the first workshop continued to be appointed on a yearly basis through 1961. This committee consisting of one representative from each elementary school was the channel through which elementary teachers voiced their opinions concerning curriculum throughout the period from 1944 to 1961. The committee was headed by the Elementary Curriculum Coordinator and additional administrative direction was provided by principals who had interest in specific curricular areas.[2]

Following the original adoption of texts the first specific study of textbooks in arithmetic took place by a subcommittee of the Elementary Steering Committee in 1952-53. This committee was chaired by Joseph Melton a teacher at Stark Elementary School. No record of the proceedings of this committee exist. They did, however, recommend that Winston Arithmetics by Brueckner, Merton and Grossnickle be adopted and used in grades 1-6.[3]

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[1]"The Livonia Elementary Steering Committee," Livonia Public Schools, 1958.

[2]Robert Kellogg, interview held at the Livonia Public Schools Department of Curriculum Offices, Livonia, Mich., 25 August 1975.

[3]Leo J. Brueckner, Elda L. Merton, and Foster E. Grossnickle, Winston Arithmetics (Philadelphia: John C. Winston Co., 1952).

During the period of this study of arithmetic textbooks, there was a brief flurry of interest on the part of PTA groups in the teaching of arithmetic. In February 1953 both the Wilcox and Stark-Newburg PTAs held meetings at which the discussion of arithmetic was the major topic. At the Wilcox PTA Gerald Erspamer, the principal, explained how arithmetic textbooks were chosen and each teacher discussed the arithmetic taught in her grade.[1] At the Stark-Newburg meeting, Jean Hamilton gave a talk on arithmetic and showed a film on the use of visual aids in the teaching of arithmetic.[2] In October 1953 Bernice Roberts spoke on "Readin' Writin' 'n Rithmetic" at the Pierson PTA meeting and in November she presented a program on "Arithmetic" at the Rosedale PTA meeting.[3] Her talk at Rosedale compared the old psychology of teaching arithmetic with newer methods and led into a talk by Richard Massingill, a teacher at the school, who explained the process used in choosing arithmetic textbooks. The interest in arithmetic reflected in these meetings did not appear again until the introduction of "modern mathematics" in the 1960s.

Following this 1953 adoption, the Elementary Steering Committee directed its attention to other areas of the curriculum. Systemwide study of the elementary mathematics program did not take place again until 1960.

Records of specific classroom procedures and mathematics curriculum activities during the period prior to 1959 are very scarce. However, brief mentions do exist. An article in the local

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[1] The Livonian, 20 February 1953.

[2] Ibid.

[3] Ibid., 30 October 1953.

newspaper in December 1952 noted that Jean Judnick had introduced a plan to solve students' troubles in mathematics and it did not matter whether they were fast, slow or average students.[1] Her plan was to let the quicker students move ahead more rapidly than other students in the class.

In the October 1955 minutes of the Elementary Steering Committee, it was indicated that a bulletin on the making and using of manipulative aids was being prepared.[2] It was also noted that, "The 'Arithmetic Corner' is fast becoming a standard in the Livonia school teachers classroom. It is desired that the 'corner' will soon be found in every room."[3]

In 1958 a listing of "Twenty Methods for Improving Problem Solving in Arithmetic" was gathered and distributed by the curriculum coordinator.[4] This was followed by the distribution of a set of materials which provided an outline for evaluation an arithmetic program. This set of materials was prefaced with a statement which was in keeping with the viewpoint of the materials being used at the time.

> Every elementary school should provide experiences so that children develop understanding and skill in quantitative relationships. Not only should children develop adequate understanding of our number system, they should also develop skill in computation and problem-solving. Practical quantitative problems in living such as measuring, weighing, buying

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[1] Ibid., 19 December 1952.

[2] Livonia Public Schools, Minutes of Meetings of the Elementary Steering Committee, Meeting of 4 October 1955.

[3] Ibid.

[4] Bernice Roberts, "Twenty Methods for Improving Problem Solving in Arithmetic," Livonia, Mich., 25 September 1958.

> wisely, making change, and budgeting time and funds should all be included in the experiences which are provided.[1]

The extent to which either of these sets of materials or other similar materials distributed by the Elementary Curriculum Co-ordinator were used by individual teachers or schools cannot be determined.

The Secondary Program

The mathematics program of the secondary schools in the system was established on a year by year basis for grades 9-12. Each year as a new grade was added the courses to be added to the program were determined and the selection of texts for these courses was done by the members of the mathematics department. In 1949-50, when the first class graduated from Bentley High School, the course offerings in mathematics were those shown in table 6.

The class structure established for grades seven and eight was a block structure in which a teacher had the same group of students for instruction in both mathematics and science. This remained the basic instructional pattern for these two grades until the late 1960s. The study of mathematics in grades seven and eight has always been a required part of every student's program. During 1946-47 mathematics was required for all students in grade nine. However, during the period that the ninth grade was contained at Bentley High School, there is no record of any requirement that mathematics be elected beyond the eighth grade. This lack of a mathematics requirement was in keeping with the pattern of most

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[1]Bernice Roberts, "Plan for Making a Survey of Instruction in Arithmetic," Livonia, Mich., 29 September 1958.

TABLE 6

COURSE OFFERINGS IN MATHEMATICS
1949-50 THROUGH 1955-56

Course Title	Grade Offered*	Units of Credit
7th Grade Mathematics	7	1
8th Grade Mathematics	8	1
Algebra	9	1
General Mathematics	9	1
Plane Geometry	10	1
Algebra, Advanced	11	1
Solid Geometry	12(1st sem.)	½
Trigonometry	12(2nd sem.)	½

*It was possible for students above the ninth grade to elect courses offered at an earlier grade.

Michigan high schools during that period. A North Central Association survey in 1951 showed that 58 percent of the schools in the state responding to the survey had no mathematics requirement for graduation.[1]

In the period from 1954 to 1958 changes were made in all of the mathematics textbooks originally adopted for grades 9-12.[2] The first changes took place in the fall of 1954 in Plane Geometry and Advanced Algebra as the result of publishing companies having changed

[1]Michigan State Committee of North Central Association, Requirements for Graduation in Michigan North Central Secondary Schools (Ann Arbor, Mich.: Bureau of School Services, University of Michigan, November 1951).

[2]The specific texts used in each course are identified and discussed in chapter 5.

to new editions. The mathematics committee developed a score sheet to be used in the selection process. This score sheet was adapted from those used by several other systems. The committee indicated that, "Since subject matter presented in texts on any given subject is nearly standard, the score sheets concentrate on determining the desirability of the manner in which the material was presented, the adaptability and the basic philosophies indicated by this presentation."[1] A special emphasis in the selection of the text for plane geometry was given to providing for a "continuous review of algebra."[2] During 1954-55 a similar evaluation was done for textbooks in Solid Geometry and General Mathematics and in 1955-56 Algebra I and Trigonometry were examined for a new adoption.

Concerns of the Bentley mathematics department starting in 1953-54 seemed to focus on the program for the lower ability mathematics students and the placement of students into proper classes. A year-end report in 1954 contained recommendations to: (1) limit the size of mathematics classes to a maximum of thirty, since some enrollments had been in excess of forty-five during the past year; (2) restrict students from enrolling in General Mathematics if they had already received credit in Algebra I; and (3) examine the overloading of General Mathematics classes and reduce these class sizes to give students an opportunity to develop their mathematical skills.[3] At the preschool conference held the following

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[1]Bentley High School Mathematics Department, "Mathematics Committee Report," Livonia, Mich., June 1954.

[2]Ibid. [3]Ibid.

fall, the discussion of these same problems continued. Recommendations from these meetings were that: (1) Algebra Prognosis Tests be administered to all eighth grade students and the results be made available to and be used by the ninth grade teachers; (2) class profile charts be prepared by the counselors; (3) consideration be given to forming a senior level consumer mathematics course; and (4) teachers seek all means at their disposal to supplement the visual aid material available to them.[1]

During the 1954-55 school year, proposals were made to the principal for the inclusion of two new courses in the program for 1955-56. These were for a ninth grade remedial mathematics section and for a course in consumer mathematics for senior students. Approval was given for a section of ninth grade remedial mathematics to be taught on a pilot basis. The recommendation for the consumer mathematics course was not accepted. From the students who elected General Mathematics for 1955-56, a group was screened into one section of remedial mathematics. This course was still called General Mathematics but the content was focused at a lower level of achievement than in the other sections. Officially, only mathematics teachers, counselors and administrators were aware of the difference in the class.

During this year a study of student success in all ninth grade mathematics classes was conducted by the guidance department.[2]

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[1]Bentley High School Mathematics Department, Minutes of Meetings of the Mathematics Department, Meeting of 8 September 1954.

[2]Bentley High School Guidance Department, "Study of Teacher Recommendations for Placement of Ninth Graders in Proper Mathematics Subjects," Livonia, Mich., 12 April 1956.

This study indicated that 63 percent of the ninth grade mathematics students were enrolled in algebra, 24 percent in general mathematics and 13 percent in remedial mathematics. Of those students recommended for General Mathematics approximately equal numbers enrolled in Algebra I and General Mathematics. The percentage of success, a grade of A, B or C, reported for these two groups was 24 percent and 35 percent, respectively. This study reported no conclusions but the results were given to the mathematics department for use in their deliberations concerning changes in the mathematics program.

The work of the mathematics and counselling departments during the year resulted in a proposal to discontinue General Mathematics. Instead, it was recommended that the courses offered at the ninth grade should consist of Basic Math, Applied Math I, and Algebra I. Basic Math was to be a remedial course, limited to students recommended by their eighth grade teacher. It was to have as its purpose, ". . . to strengthen students in the use of the fundamental facts and to progress to solving simple problems."[1] Applied Math I was designed for those students who had a good understanding of the fundamentals but were not interested in higher mathematics. A second course, Applied Math II, was also recommended as an addition at the tenth grade. This course, together with Applied Math I, was to provide a student with sufficient algebraic background that he could enroll in Plane Geometry without first taking Algebra I. It was hoped that in this way the program

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[1]Mathematics Curriculum Study Group Bentley High School, "Mathematics Curriculum Summary," Livonia, Mich., n.d.

could better provide continuity for many students who did not recognize the need for algebra and plane geometry until part way through their high school program. At the time that these recommendations for course changes were made, the mathematics department also recommended that a graduation requirement of one year of mathematics in high school should be instituted. The graduation requirement was not implemented. In the fall of 1956, however, the other recommended course changes were implemented.

At the start of the 1956-57 school year, the ninth grade was separated from the high school and attached to the junior high schools. As a result of this transition, Basic Math and Applied Math I were taught at the junior high schools and the high school offerings in mathematics for 1956-57 were reduced to Algebra I, Plane Geometry, Advanced Algebra, Solid Geometry and Trigonometry.

When the program resulting from these new courses at the ninth grade was completely implemented in 1957-58, a student had three choices in mathematics at the ninth grade and could then follow a sequence of three more years of mathematics in high school. These sequences are shown in table 7. Throughout the planning stages for the changes which are reflected in table 7, both Cecil Alford, principal at Bentley High School, and Eino Michelson, Assistant Superintendent, were actively involved with the mathematics teachers.

In 1956-57 the high school mathematics teachers turned their attention toward planning for gifted mathematics students. Possibly this focus arose from the limited program offered in the

TABLE 7

MATHEMATICS COURSE SEQUENCES IN GRADES 9-12
AS OF 1957-58

Grade 9	Grade 10	Grade 11	Grade 12
Algebra I	Plane Geometry	Advanced Algebra	Solid Geometry and Trigonometry
Applied Math I	Applied Math II	Plane Geometry	Advanced Algebra
Basic Math I	Basic Math II*	Applied Math II	Plane Geometry

*Applied Math I and Basic Math II were the same course but were assigned different names at the junior and senior high schools. In place of Basic Math II a student could take Algebra I with the recommendation of a teacher.

high school during this year. This focus was in keeping with developing national concerns regarding the lack of programs for the gifted. The concerns and planning at Bentley resulted in a group of fifteen, eleventh grade students being placed in a special enriched algebra class during the second semester of 1956-57. The results of this grouping proved satisfactory and the same procedure was used the following year to form special enriched classes in both Advanced Algebra and Trigonometry. Based on the experience gained from these two years of work the decision was made to institute an accelerated mathematics program consisting of three full years of work. The Advanced Placement Program which concluded with the study of calculus in the twelfth grade was selected to provide the content for the

program.[1] In 1958-59 a group of twenty-four, tenth-grade students were placed in the first year of this three year course. At the same time, full year enriched courses were provided for eleventh and twelfth grade students.

During 1955-56 Livonia's high school students participated in a national mathematics contest for the first time. A policy of having students participate in such contests was established and was encouraged in all high schools. After 1958, participation was changed from national contests to the Michigan Mathematics Prize Competition. Participation in this contest was seen as desirable for all students enrolled in the Advanced Placement classes and for all students who continued in a mathematics sequence through their senior year. Since 1958 the Livonia School System has had one two-time gold medal winner, several silver medal winners and has generally placed several students among the top one hundred in this competion each year.

In-service Training

During the first several years of the district's existance in-service training for teachers occurred in three ways. The first way, which had been established with the delayed opening of school in 1944, was to have teachers report to school four or five days prior to the start of school and to use this time for curriculum discussion and training.[2] The second way of providing in-service

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[1]See chapter 6 for a discussion of the Advanced Placement Program in Livonia.

[2]Livonia Public Schools, Minutes of Meetings of the Board of Education, Meeting of 11 September 1947 and Meeting of 15 June 1948.

training was started in 1948 following a plan developed by William McCann, Curriculum Coordinator.[1] Under this plan schools were dismissed early one day per month, on what was called curriculum day, for teachers and principals to attend in-service training programs. This provision of released time on curriculum days continued in the district until the late 1960s. The third way in which teachers received in-service training was through attendance at regional or areawide meetings. The first indication of special approval by the district for teacher attendance occurred when the School Board granted formal approval for teachers to attend the annual School Masters Meeting at The University of Michigan on 23 March 1948.[2] Throughout the period from 1944 to 1954 teachers also attended the county sponsored institutes as required by law. In 1955 Livonia held its own District Spring Institute. The meetings scheduled for the institute included a mathematics section co-chaired by Charles Zoet, Bentley High School mathematics teacher, and Richard Massingill, Rosedale Elementary School sixth grade teacher.[3]

In 1955-56 the high school mathematics department requested the school district to pay the expenses of four teachers to attend the May 1956 meeting of the Michigan Council of Teachers of Mathematics (MCTM) and to pay the expense of one teacher to attend the

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[1] Ibid., Meeting of 13 October 1947.

[2] Ibid., Meeting of 19 April 1948.

[3] Livonia News, 24 March 1955.

annual meeting of the NCTM in Washington, D.C. during December 1955. The expenses for the four members of the department to attend the MCTM meeting were paid by the district. Charles Zoet's expenses at the NCTM meeting, however, were not paid by the district. These payments were in keeping with the policy that had been established in paying the expenses of other teachers to state meetings starting in 1953.[1] For the next two years the same policies, with respect to the payment of expenses for conference attendance, were applied. Both the junior and senior high school mathematics departments submitted requests for attendance at the MCTM and NCTM meetings and the district paid expenses for both groups of teachers to the MCTM meetings. In 1958-59 a request for expenses to attend the NCTM meeting in Dallas, Texas was granted and two members of the high school mathematics department, Wilma Kuhls and Thomas Hartsig, were sent at Board expense. In all cases the reports of the teachers attending these MCTM and NCTM meetings indicated that they had gained useful information and that they had gained increased enthusiasm for the work that they were doing.[2]

During the late 1950s, teachers in the district were also beginning to look for additional training opportunities outside the school system. This desire for additional training arose from the interest generated by attendance at state and national meetings and

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[1]Livonia Public Schools, Minutes of Meetings of the Board of Education, Meeting of 13 April 1953.

[2]Bentley High School Mathematics Department, "Report on Conference of Michigan Council of Teachers of Mathematics," Livonia, Mich., n.d. and Bentley High School Mathematics Department, "Report on Conference of National Council of Teachers of Mathematics," Livonia, Mich., n.d.

from a recognition of the changes beginning to take place in mathematics education. As a result, several teachers started applying to the newly established NSF institutes. Among the first Livonia teachers to attend these institutes were William Kumbier and Charles Zoet, both of whom were later to serve the district as Mathematics/Science Coordinators. By 1960 and 1961 as many as 10 or 12 teachers per year from Livonia were attending NSF summer institutes in mathematics. At the same time, other teachers from the system were attending in-service institutes at local universities.

Summary

From 1944 through 1958 the mathematics program of the Livonia Public Schools was defined largely in terms of the textbooks which were used. There were no locally developed syllabi. Since the texts used were standard texts of this period, the content of the mathematics courses in Livonia did not differ from that of most other schools of this period. The emphasis of the program through eighth grade was on the development of basic skills in arithmetic, and geometry, the use of graphs and the practical applications of these skills. In grades 9-12 the major emphasis in mathematics was on the college preparatory sequence of classes although general mathematics classes were offered in grades 9 and 10.

Two significant changes in the Livonia mathematics program occurred near the end of this period. The general mathematics courses were revised and the Advanced Placement Program was adopted for grades 10-12. The revised general mathematics classes, Applied Math I and II, which were introduced in 1956-57 and 1957-58, in-

cluded algebraic content equivalent to first year algebra and were designed to satisfy the prerequisite for Plane Geometry. The changes in these courses while not reflective of the "modern mathematics" movement, represented the beginnings of a trend toward providing a stronger algebraic background for all students which reached its peak both locally and nationally during the adoptions of new programs in the 1960s.

The implementation in 1958-59 of a tenth grade course which was designed to lead to the completion of an Advanced Placement course in calculus, followed several years of work with special classes for the more mathematically gifted students in grades eleven and twelve. The implementation of this program reflected the concerns for the education of the gifted which were prevalent nationally during the middle 1950s. Livonia was one of the first school districts in Michigan to introduce the Advanced Placement Program.

A district commitment to the provision of in-service activities for teachers began during this period. The activities established were pre-school conferences and monthly "curriculum days" which were designated for in-service purposes. In the last half of the 1950s, funds were also provided for teachers to attend conferences and mathematics teachers used these funds to attend meetings of the MCTM and NCTM.

The Elementary Mathematics Program: 1959 to 1964

The hiring of Paul Johnson as Assistant Superintendent for Instruction in August 1959 marked the beginning of a more systematic and structured program of curriculum development in the Livonia Public Schools than had previously existed. As he indicated,

> The Livonia Public Schools have, during the past few years, changed from a small school system to a larger one which is rapidly growing. In consequence, many of the informal procedures which all small institutions enjoy are, of necessity, having to give way to a more carefully planned organization.[1]

During 1959-60 a plan for a systematic, cyclic examination of subject matter areas in the elementary program was established for the district.[2] The sequence established was primarily determined by the order of the last adoption of new materials in each area. This plan placed mathematics second on the list and established the review of the program for the spring of 1961.

Pilots of Pre-modern Materials

The major activity in mathematics education during 1959-60 involved the planning of several pilot activities. These programs which were initiated in the fall of 1960 represented the first attempts to establish new programs in mathematics in the elementary schools since the 1953 text adoption. One activity undertaken was the use of the arithmetic series Seeing Through Arithmetic by

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[1]Paul E. Johnson, Organizational Plan for Study, Appraisal, and Revision of the Instructional Program (Livonia, Mich.: Livonia Public Schools, 18 August 1961), preface.

[2]Paul E. Johnson to Members, Elementary Principals' Advisory Committee, "Meeting of Advisory Committee on December 11, 1959," Livonia, Mich., 30 December 1959.

Hartung and others on a pilot basis in several classrooms.[1] This series saw only limited use and was rejected in favor of more traditional materials when a new adoption was made the following year.

Another program introduced in 1960 was the "Numberaid" program developed by Arthur Schott. This program which involved extensive use of an abacus by children in early elementary grades and the related introduction of large numerical values in the early grades was introduced at Coolidge Elementary School. In preparation for this program the teachers from Coolidge and a similar number of teachers from Jefferson Elementary School spent a week in August in workshops. The Coolidge teachers spent the week learning to use the "Numberaid" program and the Jefferson teachers spent time planning for the most effective use that they could of the materials presently adopted by the system. The children taught by the Jefferson teachers were to serve as a control group for the "Numberaid" program. No record exists that a formal evaluation did occur. The program, because of its differences from the regular program, generated a negative community reaction in the Coolidge area. As a result of this reaction, one of the districts elementary resource teachers made a presentation at a PTA meeting to explain both this program and the regular arithmetic program of the district.[2] In the following years the program at Coolidge reverted to the regular district

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[1]Maurice L. Hartung et al., Seeing Through Arithmetic (Glenview, Ill.: Scott Foresman, 1958).

[2]Esther Heusner, interview held at the Livonia Public Schools Department of Curriculum Offices, Livonia, Mich., 17 September 1975.

program but because of the commitment of the principal at Coolidge to the "Numberaid" program, it continued to be used in conjunction with the regularly adopted program for a period of five years. While some of the ideas of the program were tried in other buildings in Livonia, at no time did the program make a significant impact on any building other than Coolidge.

A New Text Adoption

For 1960-61 one of the major responsibilities of the Elementary Steering Committe was, ". . . the study and appraisal of information obtained through several efforts in various schools to try out newer instructional materials and methods in arithmetic."[1] The overall study and evaluation was directed by Bernice Roberts. For guidance in the study an outline of Arithmetic, Its Structure and Concepts by Mueller was sent to each school, as well as a guide for judging arithmetic textbooks prepared by Roberts.[2] This guide, as well as providing a list of specific grade level questions to examine, listed ten general points to be considered.

1. Development of concepts and enough practice sessions (drill, etc.)
2. Thorough attention to place value (checks for each grade).
3. Diagnostic inventories.
4. Presentation of unit concepts in textbooks, and separate material (low, average, superior).

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[1]Johnson, Instruction and Its Supervision, p. 46.

[2]Francis J. Mueller, Arithmetic: Its Structure and Concepts (Englewood Cliffs, N.J.: Prentice-Hall, 1956).

5. Exercising in estimation and sufficient methods. Attempt to have most efficient methods and most efficient examples presented in quantity.

6. More reference to basic principles (check out in books).

7. Story problems at readability of each grade level. Thought provoking and realistic. Emphasis on process and solving of a problem.

8. Supplementary books and answers. Other materials such as mathematical puzzles and games.

9. More attention to basic principles.

10. Check out attention to social purposes.[1]

The textbook recommendation committee that was appointed consisted of six teachers, four principals and the Coordinator of Elementary Education.[2] This committee recommended that a new elementary text series by the authors of the current textbooks, Brueckner, Merton and Grossnickle, be adopted and implemented for the 1961-62 school year.[3]

As the first step in implementing this change in texts, a two week workshop for thirty elementary teachers, designed to include representation from each school, was held in August 1961.[4] This workshop was planned to, ". . . review materials selected for

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[1]Bernice Roberts, "Elementary Arithmetic Study for 1960-61," Livonia, Mich., 21 March 1961.

[2]For membership lists of all mathematics committees from 1959 to 1975 see appendix D.

[3]Leo J. Brueckner, Elda L. Merton, and Foster E. Grossnickle, Ready to Begin Numbers; Using More Numbers; Making Number Discoveries; Reaching Number Goals; Using Number Ideas; and Gaining Number Power (New York: Holt, Rinehart and Winston, 1961).

[4]For a summary of in-service activities of the district see chapter 7.

teaching arithmetic, to identify new emphases and prepare suggestions for other teachers and to explore implications for elementary school instruction of the changes in the mathematics curriculum under way in the junior and senior high schools."[1]

Additional in-service help was provided for teachers through a workshop held during the last week of October.[2] This workshop was conducted by an arithmetic consultant from the Winston Publishing Company. Either one or two specific grade levels were covered each day during a period from 3:30 P.M. to 5:00 P.M.

In September of the same year an Instructional Guidebook for for Elementary Teachers was published.[3] This guidebook contained for each subject matter area a complete listing by grade of: (1) teacher materials, (2) areas of emphasis for planning learning experiences, and (3) pupil materials. The listing for mathematics at each grade level, as well as providing an outline of content reinforced the use of Arithmetic, Its Structure and Concepts as a reference for teachers.[4]

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[1]Livonia Public Schools, "Summer Workshops for In-service Education and Curriculum Materials Production: Summer 1961," Livonia, Mich., 29 March 1961.

[2]Bernice Roberts to all Elementary Principals, "Notes on Meeting of the Elementary Principals, September 26, 1961," Notice No. DI-175, Livonia Public Schools, 3 October 1961.

[3]Bernice Roberts, Instructional Guidebook for Elementary Teachers (Livonia, Mich.: Livonia Public Schools Department of Elementary Education, August 1961).

[4]Mueller, Arithmetic: Its Structure and Concepts.

Preparations for "Modern Mathematics"

The year of 1962-63 was devoted to intensive study of "modern mathematics" by a group of elementary teachers and administrators. In October Henry Heusner, who was now Coordinator of Elementary Education, met with five elementary principals and William Kumbier, an administrative intern and former junior high school mathematics and science teacher, to discuss the implications of "modern mathematics" and more particularly of SMSG materials for the elementary schools. This group established a position that while they could anticipate SMSG concepts finding their way into almost all standard arithmetic textbooks in a few years, they were not willing to wait for this to happen.[1] They felt that teachers would need considerable in-service preparation and that textbook publishers would have to aim their initial preparation at the mediocre teacher in order to assure sufficient market for their products. As a result of this meeting, weekly meetings were planned for interested teachers on Wednesday mornings prior to the start of school with Kumbier serving as leader for the group. After three meetings, the membership of the group was formally established. It consisted of thirty-seven voluntary non-paid participants: twenty-four classroom teachers, seven elementary principals, two administrative interns, two resource teachers, the Elementary Curriculum Coordinator and the group leader.

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[1]Henry Heusner to Dr. Bateman, et al., "Report of Initial Meeting of the Elementary Modern Mathematics Study Committee," Livonia, Mich., 3 October 1962.

The plan for the Elementary Mathematics Study Group (EMSG), as this group came to be called, consisted of three phases. The first was an orientation period designed to acquaint participants with the uniqueness, characteristics, concepts and vocabulary of "modern mathematics." This was done through an examination of materials from: SMSG, GCMP, the Boston College Mathematics Program, UMMaP, and commercially prepared texts and workbooks. The second phase was one for analyzing and comparing similar concepts in the "modern' and "traditional" approaches to mathematics. The third phase involved reaching value judgements and making recommendations for further activities. Starting in January 1963 a newsletter, The E.M.S. G-Whiz!, was published to summarize and supplement the main points covered in each of the committee sessions.[1]

As an outgrowth of their work in this group, several teachers began to experiment with new materials in their classes. Three teachers in grades one, two and three at Lincoln Elementary School used the GCMP materials during the second half of the year. Teachers from other schools used Mathematics Enrichment by Spooner, a series of programmed books, as supplementary materials.[2] One teacher at Collidge, Mary McNair, prepared a plan to use SMSG materials with her fifth grade class for 1963-64.

The final discussions of EMSG concerning the future of "modern mathematics" in Livonia included the following points:

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[1] E.M.S. G-Whiz!, No. 1 (Livonia, Mich.: Livonia Public Schools, 9 January 1963).

[2] George Spooner, Mathematics Enrichment (New York: Harcourt, Brace & Worlds, 1962).

> Because of the changing concepts in mathematics teaching, it is necessary for elementary teachers to at least be familiar with the so-called "modern" programs.
>
> In-service training should continue in mathematics . . .
>
> Initial contact of separate staffs with the modern mathematics program can be of the nature of exposure to another teacher who is specially qualified and/or interested in presenting some of the basic concepts and philosophy to arouse their interest.
>
> When study groups have been formed, the first sessions should be fairly formal until some general, basic ideas have been covered.
>
> Teachers want latitude in the extent to which they use materials.
>
> As we have mentioned in earlier discussions, CONTINUITY is extremely important. Teachers in our group and principals both recognize grouping and other problems that may arise. The general consensus seems to be to not let mathematics be the tail that wags the entire curriculum, yet include special emphasis whenever possible.
>
> There was a suggestion for more work between early and later elementary teachers to share knowledge of what's going on at these levels.
>
> The time allotted for study groups like ours needs careful scrutiny. The 45 minutes are not really adequate. We discussed briefly, but made no recommendations, the possibility of summer workshops for this purpose.[1]

The beginnings of a concurrent movement in elementary mathematics in Livonia, whose major effects were not to occur until several years later, were indicated in a letter from Henry Heusner to Joseph Payne of The University of Michigan in the fall of 1962. This letter stated that, "An attempt has been made by sixth grade teachers in two of our schools to plan a program that could be

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[1] E.M.S. G-Whiz!, No. 12 (Livonia, Mich.: Livonia Public Schools, 9 January 1963).

termed 'individualized approach to arithmetic instruction.' This planning has followed rather successful efforts by the same teachers on a plan for individualized reading."[1] These efforts were the forerunners of more formalized attempts to introduce individualized mathematics programs into the curriculum in the late 1960s.

While the adopted Winston series remained the text used by most schools in the system, in 1963-64 several pilot trials of materials were introduced and a change was made in the materials for grades one and two. Revised editions of the adopted Winston series were introduced at these two grades.[2] This change was made because it was felt that it was important to move into more use of "modern mathematics" concepts; these texts began to place greater emphasis on structure; the changes in these texts were not so great that teachers could not adapt to them with a minimal amount of assistance; and since the materials at these two grade levels were consumable, the change could be effected at no increase in cost.[3] At Lincoln the use of the GCMP materials was expanded to five teachers. At Coolidge the "numberaid" program continued to be used in the lower grades and one section of SMSG was taught in the fifth grade. The Wilson Elementary School staff

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[1]Henry Heusner to Joseph Payne, Livonia, Mich., 25 October 1962.

[2]Leo J. Brueckner, Elda L. Merton, and Foster E. Grossnickle, Moving Ahead in Arithmetic (New York: Holt, Rinehart and Winston, 1963).

[3]Henry Heusner to Elementary Principals, "New 1963 revisions of the Winston Arithmetic(consumable) for grades one and two," Livonia, Mich., 29 March 1963.

examined several sets of new materials as a part of a year-long building study of "modern mathematics."

During that year in order to support the modifications being introduced, as well as to prepare for anticipated future changes, teachers were provided with an opportunity to attend a course on "modern mathematics." This course was designed and taught by four members of the junior high school mathematics departments, Buddy McCalla, Eldon Price, Anthony Aquino and James Carey, all of whom had received extensive training at NSF institutes. This non-credit class was held after school, one day a week for a period of twelve weeks from October to January. Five sections of this course were taught with a total initial enrollment of over 150 teachers and administrators. The State of Illinois handbook, Number and Operations was used as the instructor's syllabus.[1] The booklet Major Concepts of Elementary Modern Mathematics by May was provided on the basis of one for each two teachers.[2] In addition, quantities of SMSG materials and materials from other publishers were provided for each group.[3]

A kindergarten study committee was established during the year to study the feasibility and desirability of teaching selected mathematical concepts at the kindergarten level. Included in this

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[1]Henry Heusner to Anthony Aquino, James Carey, Buddy McCalla, and Eldon Price, "Summary of Planning Meeting for Math 'Short' Course," Livonia, Mich., 11 October 1963.

[2]Lola J. May, Major Concepts of Elementary Modern Mathematics (Wilmette, Ill.: John Colburn Associates, 1962).

[3]Heusner, "Summary of Planning Meetings."

study was the try-out of activities from the Kindergarten Teachers Guide of the GCMP.[1] This committee's recommendations were that this guide should be supplied to all kindergarten teachers as a resource and that a minimum concept list should be compiled for future use at the kindergarten level in Livonia.

A booklet published by the district in 1964, Elementary Education in Livonia, delineated the total program of the elementary schools.[2] It contained a general discussion of all aspects of the elementary program and provided a statement of time emphasis in the content fields which remained unchanged through 1975. The percentage of instructional time alloted to each subject is shown in table 8. These time allotments were provided to serve as a mental check list to help insure contacts with each of the areas and to help contribute balance to the curriculum. To the extent that teachers followed them, they are one of the parameters under which the mathematics program in Livonia elementary schools functioned.

This period of time saw increasing interest on the part of parents, at both the elementary and secondary levels, in the changes taking place in the mathematics program. Stark Elementary School held "modern mathematics" workshops for approximately two hundred parents during the year.[3] Other schools were providing similar

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[1]Henry C. Heusner, Annual Report for the School Year 1963-64 (Livonia, Mich.: Division of Instruction, Livonia Public Schools, July 1964), p. 27.

[2]Livonia Public Schools, Elementary Education in Livonia (Livonia, Mich.: Livonia Public Schools, June 1964).

[3]Heusner, Annual Report, p. 28.

TABLE 8

RECOMMENDED PERCENTAGE OF TIME ALLOTTED TO SUBJECT AREAS IN PRIMARY AND MIDDLE GRADES OF LIVONIA SCHOOLS

Subject Area	Primary Grades	Middle Grades
Language Arts	50	35
Social Studies	10	15
Science & Health	10	15
Mathematics	10	15
Music, Art, P.E., etc.	20	20

SOURCE: Livonia Public Schools, Elementary Education in Livonia (Livonia, Mich.: Livonia Public Schools, June 1964), pp. 16-18.

experiences for parents through PTA meetings and special workshops. In addition, "Modern Mathematics for Parents" had become a standard offering in the adult education program offered by the district.

By the close of the 1963-64 school year, the district had reacted to an increased need for leadership in the mathematics curriculum at the elementary level by appointing William Kumbier to the position of Elementary School Science/Mathematics Resource Teacher for the 1964-65 school year.

Summary

In the development of the Livonia elementary mathematics program the period from 1959 to 1964 can best be described as one of preparation for the introduction of "modern mathematics." The first materials which represented movement in this direction were introduced on a trial basis in 1960.

In accordance with a schedule developed in 1959-60 a new text adoption occurred in 1961-62. This adoption took place prior to any district commitment to "modern mathematics." As a part of the implementation process for this text series, Livonia held a summer workshop for representatives from each elementary school and provided a series of in-service sessions during the school year. This established a pattern regarding the adoption of new text materials for elementary mathematics which has continued to the present.

In 1962-63, following the availability of early editions of elementary materials from SMSG and GCMP, a group of teachers and administrators was formed to undertake an in-depth study of "modern mathematics" and its probable effect on the elementary program. As a result of this study and the recognition of movements taking place across the country, the question as to what direction the elementary mathematics program should take in Livonia was decided fairly rapidly in favor of "modern mathematics."

During 1963-64, the district conducted a course in the content of "modern mathematics" which enrolled approximately 150 elementary teachers and administrators. Also, at the end of this year, the position of Elementary School Science/Mathematics Resource Teacher was established. Thus, at a time when many districts were adopting "modern mathematics" programs without having a high level of teacher readiness, Livonia was in a different situation. The system had conducted some preliminary pilot studies, it had provided a large segment of its elementary staff with training, and had appointed a person who would have direct responsibility for guiding the adoption and implementation of a "modern mathematics" program.

The Secondary Mathematics Program: 1959 to 1964

Program Redefinition

Under the guidance of Paul Johnson, the new Assistant Superintendent in Charge of Instruction, 1959-60 was a year of reappraisal, redefinition and reorganization of the curriculum at the secondary school level. During the first semester, Johnson and the secondary school principals devoted considerable time to the consideration of the general structure of the junior high school curriculum and its relationship to the senior high school and elementary school programs. A major intent of this study was to arrive at agreements regarding the general structure of the program for all junior high schools. The report presented to the Board of Education in February 1960 contained listings of: (1)junior high school required and elective courses, (2) new junior high school courses, (3) senior high school graduation requirements, and (4) new senior high school courses.[1] The program, accepted by the Board, required one year of mathematics at both seventh and eighth grades and required that students take either Basic Math, Applied Math or Algebra I in the ninth grade. No requirement for mathematics was included in the high school graduation requirements but two new courses were added to the mathematics program at the high school. These were Applied Math III and Senior Math.[2]

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[1]Paul E. Johnson, Recommendations to the Board of Education Regarding the Secondary Curriculum (Livonia, Mich.: Livonia Public Schools, 11 February 1960).

[2]Livonia Public Schools, Minutes of Meetings of the Board of Education, Meeting of 11 February 1960.

Applied Math III was a one semester course designed primarily to provide a course in mathematics for those students who had failed Plane Geometry or Advanced Algebra during first semester. The inclusion of this course was a direct result of dissatisfaction with the program that had been provided for these students. By general agreement within the high school, each department was expected to provide courses during second semester for those students who had failed courses in that department first semester. For several years a class of first semester Plane Geometry had been offered during the second semester for students who had failed. This arrangement required students to take the second semester of the course during summer school or to postpone it until the second semester of the following year. Neither of these alternatives had proved satisfactory. In establishing Applied Math III it was felt that such a course should contain content different from that in other courses and that there should be a reasonable expectancy that students would be successful in this course. The content selected for the course was numerical trigonometry and the first description of the course indicated that it was, "Open to all students who have completed one year of algebra, interested in trigonometry computation dealing with the solution of triangles, with special emphasis on the applications to shop work and industry."[1] Based on past experience with students who failed Plane Geometry it was anticipated that a majority of the students in

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[1]Bentley High School, Catalog of Courses, Revised (Livonia, Mich.: Livonia Public Schools, February 1960), p. 15.

this course would be boys and it was felt that this content would be appropriate to meet their needs. When the course was established, no text was adopted and for several years the course was taught from teacher prepared materials.

The Senior Math course was approved by the Board as a full year course although the course was designed as a one semester course which was to be offered each semester of the school year. Students enrolled in the course were to be seniors and were required to have achieved a certain, unspecified proficiency level on a standardized mathematics test. The course description for students stated,

> Informal discussions about our number systems and the laws of operation which govern our number systems. Solution of linear equations. Graphical representation of data. Mathematics of home and business.[1]

As a result of the discussions leading to the report to the School Board, teacher committees were established at both the junior and senior high schools to write unit outlines for courses in all curicular areas. The outlines developed by these committees were compiled and made a part of two documents: (1) General Curricular Structure and Course Outlines for the Junior High Schools and (2) Bentley High School Course Description and Curriculum Outlines.[2] Each of these documents contained a list of goals and objectives as well as an outline for every course.

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[1] Ibid., p. 16.

[2] Division of Instruction, General Curricular Structure and Course Outlines for the Junior High Schools (Livonia, Mich.: Livonia Public Schools, 12 July 1960); and Bentley High School, Bentley High School Course Descriptions and Curriculum Outlines (Livonia, Mich.: Livonia Public Schools, 5 May 1960).

The mathematics section of the junior high school document stated that the teacher should be guided by these objectives:

1. Develop ability to perform mathematical skills efficiently, accurately, and understandingly.
2. Develop disirable attitudes toward mathematics.
3. Develop the ability to use the language of mathematics and mathematics as a language.
4. Develop an understanding of the principles of number systems with an emphasis on those in common use and an appreciation of their historical development.
5. Develop an awareness of mathematical relationships with other subject areas.
6. Develop the ability to perform mathematical operations within a logical framework.
7. Develop an understanding of the relationships of mathematical concepts.[2]

The corresponding section for the high school stated that as much mathematics as was necessary to provide a success experience to any student at any ability level should be offered by the high school. In order to meet this goal a list of six general objectives of the mathematics department were stated:

1. To insure that each student understands and is competent in the basic mathematical ideas and concepts that every citizen needs, and to explain the essential character of mathematics.
2. To emphasis [sic] at all levels of instruction, pupil discovery and reasoning reinforced by precision of expression.
3. To provide students certain types of learning experiences that serve not only to enhance their understanding of mathematics, but also enliven their interests and increase their appreciation of mathematics.

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[1]Division of Instruction, General Curricular Structure, p. 23.

4. To provide a mathematics program such that a student may successfully pursue a continuous mathematics program at his ability level.

5. To create an awareness of the role of mathematics in modern life.

6. To promote an appreciation of mathematics as a cultural subject through the study of its historical development.[1]

Neither of these sets of objectives made any overt recognition of the introduction of "modern mathematics." The expressions, "language of mathematics" and precision of expression" may possibly have indicated some recognition of the changes which were to occur as a part of the district movement toward "modern mathematics."

The result of this systemwide study and delineation of the secondary school curriculum was a mathematics program that for 1960-61 consisted of the courses shown in table 9.

As a part of the curriculum study during 1959-60 and in reaction to the book The American High School Today by Conant, an academic survey similar to that which Conant recommended was conducted at Bentley High School.[2] This study selected the students in the graduating class who ranked in the upper 15 percentiles on a standardized ability test and examined the program which they had taken in high school. Bentley then compared its students to those from the schools reported by Conant to offer a six-period day comparable to Bentley's six-period day. The results of the comparison for mathematics are shown in table 10. The conclusions

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[1]Bentley High School, Course Descriptions, p. 56.

[2]Conant, The American High School.

TABLE 9

ADOPTED COURSE OFFERINGS IN SECONDARY MATHEMATICS
IN THE LIVONIA SCHOOLS FOR 1960-61

Course Title	Grade Offered*	Units of Credit
7th Grade Mathematics	7	1
8th Grade Mathematics	8	1
Algebra I	9	1
Applied Math I	9	1
Basic Math I	9	1
Basic Math II	10	1
Applied Math II	10	1
Applied Math III	10	$\frac{1}{2}$
Plane Geometry	10	1
Advanced Algebra	11	1
Trigonometry	12	$\frac{1}{2}$
Solid Geometry	12	$\frac{1}{2}$
Advanced Placement Math I	10	1
Advanced Placement Math II	11	1
Advanced Placement Math III	12	1
Senior Math	12	$\frac{1}{2}$

*It was possible for students above the ninth grade to elect a course which was offered at an earlier grade.

contained in this study stated that Bentley compared favorably in all categories of comparison for mathematics but in particular compared very favorably for girls. As a result of this favorable comparison, there was no attempt to bring about changes in the mathematics program of the high school that can be attributed to this study.

TABLE 10

PERCENTAGE OF STUDENTS IN UPPER 15 PERCENTILES ENROLLED IN 3 OR 4 YEARS OF MATHEMATICS BENTLEY VS CONANT

	3 Years		4 Years	
	Conant	Bentley	Conant	Bentley
Boys	80	87	65	68
Girls	40	52	15	39

SOURCE: Bentley High School, Research Bulletin No. 7 (Livonia, Mich.: Bentley High School, 25 April 1960).

Preparations for "Modern Mathematics"

Where the school year 1959-60 had been devoted largely to defining and consolidating the program structure and curriculum of the secondary schools, the next several years were devoted to change, innovation and experimentation. During the summer of 1960, a small group of junior high school teachers met in a study, planning and production workshop to consider implementing new programs and providing enrichment for the junior high mathematics program. Among the recommendations from this group were several that indicated the need for increased knowledge on the part of all junior high school

mathematics teachers concerning the changes taking place in mathematics education.[1] They also recommended that, as new programs were implemented, careful consideration should be given to the areas of evaluation and public relations.

Based on the results of this study and the background obtained by those teachers who had received training in either SMSG or UMMaP materials at NSF-institutes during or prior to the summer of 1960, a total of thirteen pilot sections of these materials were introduced into the junior high schools.[2] Parents of the students to be enrolled in the pilot classes were informed about these classes by a letter which described the materials to be used. During the year the eight teachers who conducted the pilot classes met to share ideas and to evaluate both teacher and pupil progress in the various sections. The sections, as listed in table 11, were categorized according to the average ability of the group for the purposes of the evaluation of the materials. The result of the study was a favorable evaluation of both sets of materials. Teachers concluded that there was considerable similarity between the SMSG and UMMaP materials.

In the fall of this year, since there was no formal structure for secondary mathematics study, Charles Zoet called a meeting of

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[1] "Recommendations from Study, Planning and Production Project," Livonia, Mich., n.d.

[2] Paul E. Johnson to All Principals, "Enclosed 'Resume' of a Number of Major Curriculum Studies and Other Instructional Improvement Efforts in Process," Notice No. DI-121, Livonia Public Schools, 13 February 1961.

TABLE 11

PILOT SECTIONS IN JUNIOR HIGH MATHEMATICS FOR 1960-61

Materials Used	Grade Level	Class	Ability Grouping
UMMaP	7	7th Math	Above Average
UMMaP	7	7th Math	Average
UMMaP	7	7th Math	Superior
UMMaP	7	7th Math	Average
SMSG	7	7th Math	Above Average
UMMaP	8	8th Math	Above Average
UMMaP	8	8th Math	Superior
UMMaP	8	8th Math	Superior
UMMaP	8	8th Math	Average
SMSG	8	8th Math	Superior
SMSG	9	Applied Math	Average
SMSG	9	Applied Math	Below Average
SMSG	9	Algebra	Average

junior and senior high school teachers to discuss current developments in the field. He described his motivation as:

> Stimulated by the LEA (Livonia Education Association) program which encourages teachers to actively participate in the improvement of instruction in Livonia, I called a meeting of a committee of Livonia Mathematics Teachers who were alumnae of National Science Foundation Institutes in Mathematics. It was attended by six Junior High Teachers and three Senior High Teachers.[1]

[1]Charles J. Zoet to Dr. Les Bishop, "Modernization of the Livonia Public School Math Program," Livonia, Mich., 17 November 1960.

The discussions of this group, which contained many of the teachers who had been involved in the summer workshop, resulted in the formation of several recommendations which were conveyed to the members of the Division of Instruction and to the secondary principals.[1] Among the recommendations were: (1) the Livonia system should seriously consider adopting the SMSG courses as its basic mathematics program, and (2) the Livonia system should train its mathematics teachers in its use. A program was outlined which would provide this training. This program was to be similar to NSF institutes and was to consist of a six-week summer course, was to be taught by a university instructor and was to pay a stipend to teachers who attended.

In February 1961, the School Board did approve plans for a five-week workshop to involve a total of twenty-five teachers and allocated funds to pay both the teachers and the instructor.[2] The purpose of the workshop was to facilitate a partial transition from a "traditional" to a "modern mathematics" program. The workshop was planned by a committee of teachers and administrators. In the process of this planning the decision was made that SMSG materials would be used in the mathematics curriculum as the vehicle for the introduction of modern concepts. Eugene Smith, Professor of Mathematics Education at Wayne State University, conducted the workshop which, in its final form, was reduced to four

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[1] Ibid.

[2] Livonia Public Schools, Minutes of Meetings of the Board of Education, Meeting of 23 February 1961.

weeks in length. In addition to the training provided during the workshop, the participants evaluated the SMSG materials to determine the strengths and weaknesses of the materials.[1] Among the strengths identified by the workshop group were: (1) strong emphasis on the language of mathematics, (2) emphasis on "informal proof," (3) concept of sets ties mathematical ideas together, (4) the structure of mathematics is emphasized throughout, and (5) there is a spiral approach to new ideas and an integration of mathematics rather than a strict compartmentalization. The weaknesses identified included: (1) reading level is above average, (2) content appears to be quite difficult, (3) traditional training of teachers does not facilitate the use of these materials, and (4) the texts are not constructed for long term use.

The training provided for the teachers in this workshop facilitated an increase to approximately seventy sections of mathematics with a modern approach in the junior high schools in 1961-62. Most of these sections used SMSG materials. Some classes, however, were taught using Modern Mathematics by Rosskopf and others.[2] In addition, at Riley Junior High School, Roger Rood taught one selected group of students an accelerated course in algebra using the text Algebra I by Brumfiel, Eicholz and Shanks.[3]

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[1]Paul F. Ploutz and Charles J. Zoet, "The Transition to Modern Mathematics, Grades 7-12," Livonia, Mich., n.d.

[2]Myron F. Rosskopf et al., Modern Mathematics for Junior High School (Morristown, N.J.: Silver Burdett Co., 1961).

[3]Charles F. Brumfiel, Robert E. Eicholz, and Merrill E. Shanks, Algebra I (Reading, Mass.: Addison-Wesley Publishing Co., 1962).

While much of Livonia's efforts in mathematics education during 1960-61 were devoted to the introduction of "modern mathematics" at the junior high school level, other changes were being considered and implemented at the senior high school. Two program additions were proposed and accepted by the Board of Education.[1] A second semester of Senior Math was developed to extend this course to a full year. Also, a new course, Modern Topics in Mathematics, whose content was based on the study of probability and statistics, was added. This course was one semester in length and was an elective course for any student who had completed the equivalent of Plane Geometry. The planning for this course had developed through the use of Introductory Probability and Statistical Inference for Secondary Schools as a supplementary text in both Advanced Algebra and the enrichment classes which had been offered prior to the adoption of the Advanced Placement Program.[2]

In March 1961, Dr. Charles Brumfiel spent one day in the system as a consultant from the Michigan Bureau of School Services.[3] During that day, he met with the high school mathematics department to discuss changes in the Livonia Advanced Placement Program and possible changes in the program for the slow learner in mathematics. He also met with the total group of secondary mathematics teachers

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[1]Livonia Public Schools, Minutes of Meetings of the Board of Education, Meeting of 22 December 1960.

[2]Commission on Mathematics, Introductory Probability.

[3]Allan A. Edwards to Dr. Leslee Bishop, "Math consultant from Mich. Bureau of School Services," Livonia, Mich., n.d.

to discuss concerns about the transition from "traditional mathematics" to a "modern mathematics" curriculum.

In the spring of 1961 three proposals concerning the high school mathematics program were submitted to the administration for trial implementation during the 1961-62 school year. The first of these was a plan for the equipping and staffing of a mathematics-science center.[1] This proposal, which was made jointly by the library staff and the mathematics and science departments was received favorably by the administration. It was not implemented because of the overcrowded conditions which resulted from the combind enrollment of 2540 Bentley and Franklin High School students in the building during 1961-62. The basic idea, as presented at this time, was later implemented at Franklin and Stevenson High Schools in 1966 and 1967 in connection with the establishment of modular scheduling.

A second proposal, which was also received favorably by the administration but was not implemented because of the scheduling difficulties arising from the overcrowding, was for an experimental class in trigonometry.[2] It was proposed that one trigonometry class be conducted on the basis of only three days per week of required attendance. The other two days of attendance would be optional. If the proposal had been adopted, the course would have been scheduled either first or last period of the day so that

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[1]Donald E. Friedrichs to Ray Olson et al., "Plans for the Equipping and Staffing of the Math-Science Study Center," Livonia, Mich., 21 February 1961.

[2]Bentley High School Mathematics Department to Dr. Friedrichs, "Experimental Program in Trigonometry," Livonia, Mich., n.d.

students could be absent from the building on the two optional days. The proposal for this structure was based on a need communicated by former Bentley students for the high schools to provide students with situations which would do more to orient students to college procedures.

The third proposal, which was implemented in 1961-62, was for the trial use of programmed learning materials.[1] For first semester, an Algebra I class was assigned to use the TEMAC Algebra program developed by Britannica Films.[2] Letters were sent to the parents of all students placed in this class and an opportunity was provided for students to be transfered to another algebra class if they choose not to participate in this class. It was hoped that the use of these materials might provide at least a partial solution to the relatively low proportion of students who experienced success in Algebra I at Bentley. Students were allowed to complete this course at their own rate. Students who were unable to complete the course during the regular school year were allowed to complete it during the summer school session. Those students who completed the course before the end of the year were allowed to continue with more advanced sets of programmed materials or were provided with enrichment experiences by the instructor. The first year evaluation of this course consisted of several questionnaires completed by

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[1]Bentley High School Mathematics Department to Dr. Friedrichs, "Use of Programmed Learning in the Mathematics Department," Livonia, Mich., n.d.

[2]Daniel P. Murphy, TEMAC Programmed Learning Materials: First Year Algebra (n.p.: Encyclopedia Britannica Films, 1961).

the students and a comparison of grades of the students enrolled in this class with those of students enrolled in classes taught in a traditional manner. On the student questionnaire, "being able to work at one's own rate" was the most positive aspect identified and the most negative aspect was, "the work becomes boring or monotonous at times."[1] Overall, about two-thirds of the students were positive in their response to the material and the course. The use of this material in the Algebra I class at Bentley continued for 1962-63 but was dropped following that year. The reasons given for dropping the material were the inability of the department to overcome the boredom of students and the traditional nature of the material which was not in keeping with the movement of the system toward "modern mathematics."

A second aspect of the use of TEMAC materials was the establishment during second semester of 1961-62 of a section of mathematics in which were enrolled students who had failed, during the first semester, any one of algebra, plane geometry, advanced algebra or trigonometry.[2] These students all worked in the programmed materials within a single class. As with the algebra class, provisions were made for these students to complete the materials during summer school if they desired. This use of the materials was also dropped after a two year trial because of the traditional

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[1] "Results of Student Questionnaire on TEMAC Algebra," Livonia, Mich., n.d.

[2] Bentley High School Mathematics Department to Dr. Friedrichs, "Use of Programmed Materials," Livonia, Mich., n.d.

content of the course and a relatively limited level of success on the part of students. For several years following these pilot classes some use of the materials continued but only on an individual basis.

Recommendations for Revision

The school year 1961-62 was devoted to the most intensive study of the secondary mathematics curriculum to take place in Livonia. Its results shaped the changes in the secondary mathematics program throughout the 1960s and provided the outline of changes which occurred over ten years later.

In October 1961, in recognition of the need to provide direction for the developing changes in mathematics education, the Director of Secondary Education sent a letter to Charles Zoet and Allan Edwards, mathematics teachers at Bentley High School, asking them to take leadership in the establishment of a study of the secondary mathematics curriculum.[1] A Committee on Secondary Mathematics with representation from all junior and senior high schools was established and Charles Zoet was elected chairman. The charge to this committee indicated that they were to review progress to date and to make recommendations relative to the following:

1. The extent to which the present mathematics program is incorporating "modern" mathematics.
2. The extent to which our present staff is qualified to teach materials incorporating the essence of "modern" mathematics.

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[1]Leslee J. Bishop to Charles Zoet and Allan Edwards, "SMSG Evaluation," Livonia, Mich., 3 October 1961.

3. Teacher evaluation of the strengths and weaknesses of SMSG and similar materials.

4. Recommendations relative to the future development of the mathematics program
   a. Systemwide articulation
   b. Textbook selections
   c. Teacher training
   d. Program improvement[1]

With the charge to this committee the Director of Secondary Education included the recommendations of the Commission on Mathematics.[2]

The committee met biweekly from November 1961 until the close of the school year. One of the initial tasks of the committee was to prepare a survey to determine the extent to which teachers were prepared to teach "modern mathematics" and to determine the actual number of sections of mathematics which were being taught using modern materials and content.[3] The results of the survey conducted by the committee are summarized in table 12. While only 69 percent of the junior high school teachers were classified as being trained or oriented to modern mathematics, as compared to 93 percent of the high school teachers, by far the greatest impact of "modern mathematics" in the system in 1961-62 was at the junior high school level. In the junior high schools, 53 percent of the mathematics sections were taught from a modern orientation as compared to only 25 percent of the sections at the high school.

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[1]Committee on Secondary Mathematics, "Initial Report," Livonia, Mich., 12 March 1962.

[2]Commission on Mathematics, College Preparatory Mathematics.

[3]Committee on Secondary Mathematics, Final Report and Recommendations of the Committee on Secondary Mathematics (Livonia, Mich.: Livonia Public Schools, June 1962).

TABLE 12

TEACHER AND COURSE ORIENTATION TO MODERN MATHEMATICS IN LIVONIA SECONDARY SCHOOLS 1961-62

	Teacher Preparation		Course Orientation	
	Modern	Traditional	Modern	Traditional
Jr. High	35	16	72	63
Sr. High	13	1	11	32
Total	48	17	83	95

SOURCE: Committee on Secondary Mathematics, Final Report and Recommendations of the Committee on Secondary Mathematics (Livonia, Mich.: Livonia Public Schools, June 1962), appendix A.

Prior to the initial report of the committee in March 1962, as agreements were reached on the first recommendations of the committee, these recommendations were communicated to the appropriate groups or departments within the school system; i.e., the secondary school principals or the personnel department. The final report of the committee which was presented in June 1962 contained a proposal for a revised mathematics sequence in grades 7-12, as well as specific recommendations concerning course content, selection of texts, teacher training, conference attendance, teacher selection and the need for a part-time Mathematics Coordinator.[1]

The proposed mathematics sequences, outlined in table 13, were designed to provide at least three distinct routes to a college preparatory minor in mathematics; the possibility of a four year sequence of mathematics for any student in grades 9-12 and to provide

[1] Ibid.

TABLE 13

MATHEMATICS SEQUENCES PROPOSED FOR LIVONIA SECONDARY SCHOOLS BY COMMITTEE ON SECONDARY MATHEMATICS

<table>
<tr><th>Grade 7</th><th>Grade 8</th><th>Grade 9</th><th>Grade 10</th><th>Grade 11</th><th>Grade 12</th></tr>
<tr><td rowspan="2">Modern Math</td><td rowspan="2">Modern Math</td><td rowspan="2">Accelerated Algebra</td><td rowspan="2">Plane & Solid Geometry</td><td>Advanced Plac Alg & Trig</td><td colspan="2">Calculus</td></tr>
<tr><td>Enriched Alg & Trig</td><td>Math Analysis</td><td>Prob & Stat</td></tr>
<tr><td>Modern Math</td><td>Modern Math</td><td>Algebra</td><td>Plane Geometry</td><td>Advanced Algebra</td><td colspan="2">Trig & Math Analysis</td></tr>
<tr><td>Modern Math</td><td>Modern Math</td><td colspan="2">Algebra Credit
Intro to Algebra | Algebra | Applied Geom</td><td>Applied Trig</td><td colspan="2">Senior Math</td></tr>
<tr><td></td><td></td><td>Ninth Grade Math</td><td>Tenth Grade Math</td><td></td><td colspan="2">Refresher Math</td></tr>
</table>

SOURCE: Committee on Secondary Mathematics, Final Report and Recommendations of the Committee on Secondary Mathematics (Livonia, Mich.: Livonia Public Schools, June 1962), p. 3.

a full year of mathematics study beyond the traditional four-year program for the gifted student. It was anticipated that approximately 20 percent of the ninth grade students would be eligible for accelerated algebra and approximately 20 percent would be appropriately placed in ninth grade mathematics.[1] The Committee also felt that it would be desirable to permit some students to be excused from the one-year requirement for mathematics in the ninth grade and for these students to fulfill this requirement at some time during grades 10-12. Although no immediate course changes were implemented for 1962-63, the sequences proposed were non-controversial except for the sequence including accelerated algebra at the ninth grade. When the proposed program was presented to the junior high school principals in April 1962, this group accepted most of the plan. They did, however, recommend that the implementation of accelerated algebra be postponed and instead that the best ways of providing advanced training be provided in regular algebra classes.[2] They also indicated that scheduling problems made the inclusion of the course in the junior high program impossible at that time.

In the Committee report course content recommendations were outlined for: Introduction to Algebra, Accelerated Algebra and Basic Math. The report stated that such outlines for the other new courses proposed: Mathematics (Tenth Grade), Applied Geometry

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[1] Ibid., p. 4.

[2] Leslee J. Bishop to Junior High School Principals, "Junior High School Principals' Meeting of April 11, 1962," Notice No. DI-226, Livonia Public Schools, 7 May 1962.

and Mathematical Analysis, would have to be completed during the following year.

Recommendations were made for the selection of new texts in seventh and eighth grades and Algebra I for 1963-64 and for Plane Geometry and Advanced Algebra for 1964-65. During the years preceding the adoptions, it was recommended that either SMSG materials be used or that pilots of commercial texts take place in these courses. In 1962-63, two sets of materials were piloted in grades seven and eight and five different algebra texts were piloted. Based on the results of these pilots, new texts were then adopted for the 1963-64 school year. In Plane Geometry, the high school had piloted four classes of SMSG Geometry during 1961-62 and for both 1962-63 and 1963-64 used this as the basic text for Plane Geometry.[1] In Advanced Algebra four classes of SMSG Intermediate Mathematics were piloted in 1962-63 and then this text was used as the basic text for the year 1963-64.[2] Following the use of these SMSG materials, new texts were adopted for both of these courses for 1964-65.

The Committee made two recommendations with regard to teacher training. They recommended that a summer workshop, similar to the one held during the summer of 1961, be established during 1962. The workshop would focus on the content of "modern mathematics" and

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[1]School Mathematics Study Group, Geometry, Parts I & II, rev. ed. (New Haven: Yale University Press, 1961).

[2]School Mathematics Study Group, Intermediate Mathematics, Parts I and II, rev. ed. (New Haven: Yale University Press, 1961).

would be for those teachers in the system who had not attended the previous workshop. They also recommended the establishment of a series of weekly after school classes for teachers to be held during the 1962-63 school year. The recommendation for a workshop was accepted and a two-week workshop was established for August 1962. George Calder and James Carey, junior high school teachers with training in "modern mathematics," were selected to conduct this workshop. The first week of the workshop was devoted to the study of the structure and vocabulary of "modern mathematics" using an outline developed by the instructors.[1] The content consisted of fourteen lessons: (1) Set notation, (2) Set relations, (3) Set operations, (4) Whole numbers, (5) Integers, (6) Rational numbers and real numbers, (7) Number systems, (8) Numeration systems, (9) Solving number sentences, (10) Graphing, (11) Primes, divisibility, GCF, LCM, (12) Non-metric geometry I, (13) Non-metric geometry II, and (14) Measurement. The second week of the workshop was spent by the teachers in grade level groups studying the texts from which classes would be taught during 1962-63. The workshop involved a toatl of thirty-four participants from among the junior high school teachers. Twenty-two of these teachers attended both weeks and twelve attended only the second week. In addition, five high school teachers attnded for both weeks.

The weekly classes during the school year, which the committee had recommended, were not established. This may have occurred

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[1]George A. Calder and James A. Carey, Introduction to Modern Mathematics (Livonia, Mich.: Livonia Public Schools, August 1962).

because the instructors of the summer workshop recommended that they not be established. They instead recommended that, ". . . each school handle its own training sessions in materials and methods of teaching, and that system-wide meetings should be set up only on curriculum days."[1]

The other recommendations made by the Committee on Secondary Mathematics were that:

1. Conference attendance by teachers was important and that the system should pay expenses for all teachers to attend the MCTM yearly conference and that the expenses of at least one teacher from the system should be paid for the NCTM annual meeting.
2. Priority should be given to hiring mathematics teachers whose training prepared them to participate in a modern mathematics program.
3. The system should employ a part-time Mathematics Co-ordinator to have general responsibility for the conduct of the mathematics program.
4. The efforts of the committee should be extended into the following year with particular attention to be given to the non-college preparatory student.

The two year period of 1962-63 and 1963-64 was one during which much effort occurred in refining the recommendations of the

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[1]James A. Carey and George A. Calder to Mathematics Workshop Participants, Dr. Bishop, Dr. Johnson, "Evaluation of Workshop," Livonia, Mich., September 1962.

Committee on Secondary Mathematics and in implementing agreed upon changes. In September 1962, the Deputy Superintendent identified as a curriculum emphasis for 1962-63, "Final phase of change in junior high school mathematics program leading to basic commercial text adoptions incorporating 'modern mathematics' emphasis. Also, extension of program into senior high school . . ."[1]

During this year, the Secondary Mathematics Committee continued to operate and to refine the recommendations made the previous year. Its work led to a meeting in November with the junior high school principals for discussions concerning the proposed ninth grade mathematics program.[2] The intent of the meeting was to arrive at certain common understandings about the mathematics proposals and to identify problems and barriers to their implementation. The actions of the junior high principals were to table the idea of a three semester algebra course until further discussion could take place by the high school principals and to reject the accelerated algebra course. This rejection occurred through the acceptance of a motion which stated, ". . . grouping of Algebra students be carried out in accord with regular grouping policies and to the extent that other scheduling problems permit; regular basic

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[1]Paul E. Johnson to All Members of the Administrative Staff, "Curriculum and Supervision Emphases for 1962-63," Notice No. DI-260, Livonia Public Schools, 21 September 1962.

[2]Charles J. Zoet to Members of the Secondary Mathematics Committee, "Meeting with Junior High Principals," Livonia, Mich., 15 November 1962.

text materials should be used with such groups with consideration given to providing adequate supplementary materials."[1]

As a result of continuing discussions, a revised set of recommendations for the non-academic mathematics program was developed by the Secondary Mathematics Committee.[2] These revisions included keeping the Applied Math I and Applied Math II courses but increasing the algebraic content and including an increased amount of work in numerical geometry. Algebra credit would then be awarded to all students who completed the two year sequence. All other courses were to remain essentially the same except that a refresher mathematics course, which would be open to all students in grades 10-12, was to be added. This course would have as a specific objective, " . . . to strengthen the arithmetic skills which these students will need when they graduate."[3] It was indicated that students in this course should be graded only in terms of their effort and progress, that counseling for this course should be carefully done and that class size should be small. This set of recommendations was accepted by the senior high school principals for implementation by the 1964-65 school year. Prior to accepting the recommendations the principals had discussed extensively: the importance of mathematics as a tool subject; the

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[1]Leslee J. Bishop to Secondary Principals, "Joint Junior & Senior High School Principals Meeting December 12, 1962," Notice No. DI-306, Livonia Public Schools, 18 January 1963.

[2]Chairman of the Systemwide Secondary Committee on Mathematics to Dr. Leslee Bishop, "Recommendation for Non-Academic Mathematics Program," Livonia, Mich., 28 January 1963.

[3]Ibid.

importance of in-service training for teachers working with applied or other less theoretical mathematics courses and the need for orienting new teachers to the desirability of having a background in remedial as well as theoretical mathematics.[1]

During the year recommendations were completed for new texts in 7th and 8th Grade Mathematics, Basic Math I, Applied Math I and Algebra I. All of these were in keeping with the recommendation for a movement to "modern mathematics."[2] At the high school level adoptions were made for 10th Grade Advanced Placement, 11th Grade Advanced Placement and Applied Math III, all of which had been taught without officially adopted texts since the courses had been established.[3]

Problems and Further Changes

Beginning in 1962 and continuing through 1966, Livonia participated in the National Longitudinal Study of Mathematical Abilities. This participation was undertaken upon the recommendation of the Secondary Mathematics Committee with the hope that this would be an excellent opportunity to learn more about the students in the system and their progress in learning mathematics. While the system fulfilled its obligations to the study, teacher resentment

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[1]Leslee J. Bishop to Secondary Principals, "Note on Meeting of Senior High School Principals, February 8, 1963," Notice No. DI-323, Livonia Public Schools, 13 March 1963.

[2]James A. Carey to Dr. Paul Johnson, "Final Recommendations of the 9th Grade Mathematics Textbook Committee," Livonia, Mich., 22 May 1963.

[3]Thomas Hartsig to Dr. Bishop, "Text Book Adoption," Livonia, Mich., 2 May 1963.

of the participation increased as the study progressed. This resentment was based on the lack of immediate useful information and the disruption caused by the need to reform groups of students who had been tested in previous years.

At the beginning of the 1963-64 school year the Secondary Mathematics Committee was not reappointed, although it was indicated in the plans for the year that, "Secondary school committees will continue the appraisal of the new instructional programs in mathematics in the secondary schools particularly as represented in new basic textbook adoptions."[1] By October problems were being encountered in implementing the new adoptions and the increased emphasis on "modern mathematics" at the junior high schools. These problems involved a lack of a clear dividing line for the content of Applied Math I and II, how to best integrate the arithmetic and algebraic content in Applied Math I, and how to suit the increased algebraic emphasis in this course to the students' needs. At a meeting of the junior high school principals,

> Need was expressed to reconstitute the systemwide mathematics committee. This group would be charged with responsibility to: (1) appraise the problems re the use of new textbook materials 7-12, (2) appraise the adequacy of the training of teachers in connection with materials, and possible in-service needs, (3) cooperate with committees reviewing and rewriting the course outlines, and (4) study the particular problems of articulation in all areas, e.g. Applied Mathematics.[2]

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[1]Paul E. Johnson to All Members, Administrative Staff, "Curriculum Studies and Instructional Improvement Programs for 1963-64," Notice No. DI-392, Livonia Public Schools, 26 September 1963.

[2]Leslee J. Bishop to Secondary Principals, "Meeting of Junior High School Principals, December 11, 1963," Notice No. DI-425, Livonia Public Schools, 16 January 1964.

The Committee was reinstituted and for several months concentrated its efforts upon eliminating the problems which had appeared at the junior high schools. This process required clarification of the minimum algebraic content for Applied Math 1, discussion of grouping practices in different schools in the system, and improved communication between the Secondary Mathematics Committee and other mathematics teachers who were not on the committee.

in the high schools several changes were being suggested which were to lead to the first difference in course offerings in mathematics at Bentley and the newly opened Franklin High School. At Bentley for several years, the mathematics department had offered Senior Math and the business department had offered a course in Business Arithmetic. This Business Arithmetic course had to a large extent been remedial in nature. With the addition of Refresher Math to the program of the mathematics department for 1964-65, it was apparent that an excessive amount of duplication in course content would ensue. The solutions arrived at by the two high schools to eliminate this duplication were different.[1] At Bentley the mathematics department dropped Senior Math from its course offerings and the business department dropped Business Arithmetic and replaced it with Business Mathematics which was a consumer and business oriented course. At Franklin the mathematics department continued to teach the Senior Math course and the business department dropped its course. This represented the first

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[1]Donald Friedrichs, et al. to Dr. Bishop, "Proposed Changes in Mathematics and Business Department's Course Offerings," Livonia, Mich., 7 November 1963.

departure of the Livonia secondary schools from the same course offerings in mathematics other than on a pilot basis. This move, however, was in keeping with the "broken front approach" to curriculum development strongly advocated by members of the Division of Instruction. It was the forerunner, at the secondary school level, of the many individual building attempts at curricular change in mathematics education which were to follow.

The spring of 1964 was significant in that two events occurred which were to significantly effect the next period of development in Livonia's mathematics program. The first of these was a decision to purchase a computer for instructional purposes. In May 1963, a Committee on Implications of Electronic Data Processing for Instruction had been formed to provide the impetus for the inclusion of work with computers in the system.[1] During 1963-64, initial discussions had taken place in the Secondary Mathematics Commitee which had resulted in the development of lists of related topics presently being taught and topics, related to computers, which could be taught in mathematics classes.[2] Topics identified as being taught to some or all students were: number bases, logic, sets, computing short cuts, fundamental processes, boolean algebra, determinants, and numerical methods. It was indicated that more could be accomplished with: logic, truth

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[1]Committee on Implications of Electronic Data Processing for Instruction, "Report Summary," Livonia, Mich., 5 December 1963.

[2]Secondary Mathematics Committee, "Comments on the Role of Data-Processing in the Mathematics Curriculum," Livonia, Mich., n.d.

tables, related circuitry, teacher training, extra curricular clubs and projects, and the beginning concepts of linear programming. It was felt that the teaching of computer languages and the development of specific single courses could not be immediately accomplished.

By the end of the 1963-64 school year, a proposal had been developed and a Burroughs E-101 Computer was purchased for use in the high schools. During that summer four high school mathematics teachers, James Carey, Harold Jackson, Allan Edwards and Peter Moloney, were given training in the use of the computer.

The second significant event to occur that spring was the appointment of Charles Zoet as Coordinator of Secondary Mathematics and Science for 1964-65. His appointment in this position formalized the leadership role which he had played in the development of the Livonia secondary mathematics program during the preceding several years.

Summary

The period from 1959 to 1964 began with the development of a complete description of the Livonia secondary mathematics program and ended with the adoption of "modern mathematics" texts for the major courses in grades 7-12. During this period, Livonia both followed the national trend toward "modern math" and at the same time resisted this movement in specific areas. The adoption of new courses, Applied Math III and Senior Math, which were taught from a traditional point of view and stressed applications, were counter to the "modern math" movement. In the twelfth grade program there were also points of resistance. Trigonometry was re-

tained as a separate course in the twelfth grade rather than including it as a part of eleventh grade mathematics. The overall movement in the district, however, was toward "modern mathematics."

The introduction of "modern mathematics" in Livonia was characterized by a high level of teacher involvement and by a gradual introduction and experimentation prior to the adoption of a program or a text. A significant number of teachers had received training in NSF institutes by 1960 and this group formed a nucleus who provided direction for the system. Pilot sections of SMSG and UMMaP materials were introduced in grades 7-9 during 1960-61. These sections were extended for a second year and similar pilot sections were established in Algebra I, Plane Geometry, and Advanced Algebra, over the next four years and prior to the adoption of new texts for each course.

During 1961-62, an extensive teacher-directed study of the mathematics program occurred which established the plans for implementing "modern mathematics" and the development of the secondary program over the next decade. The high level of teacher involvement which occurred in this study characterizes the development of the mathematics program in Livonia. In many instances this extensive involvement helped teachers accept and work through problems which might have been approached with a more negative attitude if the original decisions had not included teacher input.

The district provided workshops during the summers of 1961 and 1962, of five and two weeks length, respectively, for teachers who had not received training in the teaching of "modern mathematics."

Thus, as with the elementary program, the change to "modern mathematics" in Livonia was accomplished through a planned pilot use of new materials, provisions for the training or retraining of teachers, and high levels of teacher involvement in decisions related to the proposed changes and adoptions of new materials.

Other events of this period which were to have significant effects on the mathematics program during the latter half of the 1960s were: (1) trial use of programmed materials for individualizing the pace of instruction, (2) the decision to appoint a Coordinator of Secondary Mathematics and Science, and (3) the initial study of the role of the computer in the secondary mathematics program.

The Elementary Mathematics Program: 1964 to 1970

The development of the mathematics program in the period from 1964 to 1970 was characterized by two factors. The first factor was the existence of administrative personnel with direct responsibility for the mathematics curriculum and the second was the division of responsibility for curriculum on an elementary school-secondary school basis. In the spring of 1964, the positions of Specialist in Mathematics and Science for Elementary Education and Coordinator of Mathematics and Science for Secondary Education had been filled. William Kumbier and Charles Zoet, both of whom had been very active in providing leadership during the previous several years, assummed these positions in August 1964.

Adoption of a New Program

By June 1964 the basic program in the elementary schools for 1964-65 had been established. The use of the revised Winston series was expanded to the third grade and teachers editions of the 4th, 5th and 6th grade revised texts were made available to teachers to supplement the regular editions which they continued to use.[1]

The most immediate concerns in this period were to prepare teachers for the changes in the teaching of elementary school mathematics which were occurring. In August 1964, a workshop under the direction of the Specialist in Mathematics and Science was held to prepare a corps of elementary classroom teachers to work with other classroom teachers at their grade level during the following year. The emphasis of this workshop was on the presentation of major mathematics concepts, the detailed analysis of the Winston materials being used in the system and the development and construction of teaching aids.[2] A topic which was also included in the workshop, but which had not been included in the original plans, was individualized instruction in mathematics. Following the workshop, the director identified more than half of the twenty-four teacher participants as being capable of conducting full-scale, grade-level in-service sessions during the ensuing school year. That fall a series of three grade-level meetings for grades 1-6, led by teachers from the workshop, was offered at four different

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[1]Brueckner, Merton, and Grossnickle, Moving Ahead in Arithmetic.

[2]William K. Kumbier, "Summary--Elementary Mathematics Workshop," Livonia, Mich., September 1964.

locations within the system. Attendance at these sessions averaged about 150 teachers.[1] The sessions were designed to strengthen teacher awareness of basic mathematics principles and to introduce materials and methods from texts, other than the adopted Winston series, which were being piloted during 1964-65.

In-service work for kindergarten teachers during the year was provided at a November workshop. Specific emphasis in this workshop was on the use of the kindergarten teacher's guide from the GCMP materials.[2]

In November of this year the first issue of MATSCI Notes was distributed.[3] This newsletter served as a periodic communication between Kumbier and the elementary principals and teachers for the next six years. The information contained in the newsletter generally consisted of: announcements of available materials suggestions of activities for the classroom, announcements of conventions and meetings, and the exchange of ideas being used by teachers in the system.

While the in-service training provided for teachers was coordinated and planned on a systemwide basis, much of the activity that was taking place in the schools was planned on a local building basis. This followed the philosophy of the system as stated

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[1]Elementary Math-Science Office, "Summary of In-service Center Activities," Livonia, Mich., n.d.

[2]Henry C. Heusner to All Kindergarten Teachers and Elementary Principals, "Plans for In-service and Curriculum Development Activities for 1964-65," Notice No. DI-510, Livonia Public Schools, 28 September 1964.

[3]William K. Kumbier, MATSCI Notes #1 (Livonia, Mich.: Livonia Public Schools, 18 November 1964).

by the Director of Elementary Education that,

> Other factors being equal, we feel that teachers working together at the local school level will most often offer the greatest possibility for meaningful involvement. It is for this reason, therefore, that we have been moving toward more of a decentralized, broken-front approach to curriculum planning and in-service activities, stressing central service and coordination, rather than central control and domination.[1]

During the year thirteen of the elementary schools were involved in some type of mathematics curriculum studies. Formal pilot programs were conducted using four sets of materials. At Lincoln the GCMP materials were used in grades one through five. At Wilson text series published by Laidlaw and by Addison-Wesley were piloted in grades one through six and the revised Winston materials were piloted in grades four through six.[2] At the other schools, more limited and informal uses were made of materials.

The planning of the pilot studies in mathematics for 1964-65 had left the direction of the studies to the Director of Elementary Education and the Specialist in Mathematics and Science. In recognition of the role that the building principals would play in piloting and in the final implementation of any proposed changes, an Elementary Steering Committee on Mathematics, consisting of these two men and four elementary principals, was appointed in October 1964. This committee was charged to serve as a planning coordinating and evaluating group for the pilot studies; to consider

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[1]Henry C. Heusner, "Our Changing Concept of Improving Instruction," The Coordinate 1 (Livonia, Mich.: Department of Elementary Education, Livonia Public Schools, 15 September 1964): 1.

[2]William K. Kumbier to Elementary Principals, Dr. Johnson, Dr. Heusner, Mr. Zoet, "Current Programs in Mathematics-Livonia Elementary Schools," Livonia, Mich., 24 November 1964.

factors related to improvement of the mathematics program in the elementary schools; and to advise regarding further study, needed in-service education and instructional materials.[1]

The committee devised a measure of teacher readiness for a "modern mathematics" program. This was a survey administered in January 1965. The results indicated that 55 percent of the elementary teachers favored the adoption of "modern math" while 12 percent opposed it and the remainder were uncertain.[2] A larger percentage, 64 percent, stated that they were ready to teach such a program if it were adopted. Only 18 percent, however, felt that they could teach such a program the first year without any special help. Based on this survey and input from the Elementary Principals Advisory Committee the Steering Committee concluded that, " . . . much further in-service efforts without a change in textbooks was undesirable psychologically, philosophically, and economically."[3] The committee therefore recommended that its membership be expanded by the addition of six teacher members and that the committee be recharged as a textbook selection committee. This was done and the new committee composed of six teachers and six administrators met throughout the spring of the year. The final recommendation of

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[1]Paul E. Johnson to All Members, Administrative Staff and Committee Chairmen, "Membership of Committees on Instruction for 1964-65," Notice No. DI-522, Livonia Public Schools, 16 October 1964.

[2]Henry C. Heusner, "Mathematics Survey--By Grade Level," Livonia, Mich., 12 February 1965.

[3]Henry C. Heusner to Paul Johnson, "Progress Report and Recommendations," Livonia, Mich., 16 February 1965.

this committee was for the adoption of Elementary School Mathematics by Eicholz, O'Daffer, Brumfiel, and Shanks.[1] The reasons given for choosing this series included: (1) the standard areas common to good mathematics were included, (2) there was a sequential development in a somewhat spiral approach, (3) provision was made in story-type problems for students with reading difficulties, and (4) several levels of student aiblity were recognized.[2] The committee further recommended careful implementation and carefully planned extensive use of in-service activity related to the implementation of this adoption.

Implementation of the New Program

In August 1965, six carefully selected teachers, representative of grades one through six, all of whom had received prior training in "modern mathematics," were ask to participate in a workshop for organizing the orientation of all teachers to the new adoption.[3] These participants used their background and experience to plan two sets of meetings. The first was a three hour pre-school orientation session for all teachers. Separate presentations were provided for grades one and two, grades three and four, and grades five and six. These presentations were designed to provide a brief overview of the program and some in-depth

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[1]Robert E. Eicholz et al., Elementary School Mathematics, Books 1-6 (Reading, Mass.: Addison-Wesley Publishing Co., 1964).

[2]Henry C. Heusner and William K. Kumbier, "Recommendations of the Elementary Mathematics Textbook Committee," Livonia, Mich., 24 May 1965.

[3]Henry C. Heusner, Annual Report for the School Year 1965-66 (Livonia, Mich.: Livonia Public Schools, August 1966), p. 31.

coverage of the first two units which teachers would teach in the new textbooks.[1] The second type of meetings planned was a series of four help sessions for each grade level to be spaced throughout the year. These meetings were designed to help keep the teachers four to six weeks ahead of the average classroom program. Teacher attendance at these voluntary after school sessions ranged from 78 to 130 and averaged about 90 teachers.[2] In addition to these planned sessions it was also indicated that,

> Principals will be responsible for several in-service sessions to be held in each school near the beginning of the year. The purpose of these will be to cover mathematics principles included in the "Textbook for Teachers" section of the Addison-Wesley series.[3]

During this year a survey was conducted to determine the division of instructional time in the Livonia elementary schools. The results of this survey, as summarized in table 14, indicated that teachers were spending more time in teaching mathematics than was called for in the district guide to Elementary Education in Livonia.[4]

Throughout the period of the pilots and the text adoption there existed high community and parent interest in the mathematics program of the schools. During this time the Elementary Mathematics

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[1]Henry C. Heusner, "Announcement of Pre-school In-service Activities for all Teachers in the Area of Language Arts and Mathematics," The Coordinate 2(Livonia, Mich.: Department of Elementary Education, Livonia Public Schools, (12 August 1965): 1.

[2]Heusner, Annual Report 1965-66, p. 31.

[3]Heusner, "Pre-school In-service Activities."

[4]Livonia Public Schools, Elementary Education in Livonia (Livonia, Mich.: Livonia Public Schools, June 1964).

TABLE 14

PERCENTAGE OF INSTRUCTIONAL TIME DEVOTED TO MATHEMATICS IN LIVONIA ELEMENTARY SCHOOLS

	District Recommended Percentage	Teachers Ideal Percentage	Teachers Actual Percentage
Primary Grades	10	15	15
Middle Grades	15	20	20

SOURCE: Henry C. Heusner, "Summary of Instructional Time in Elemenatry," Livonia, Mich., 21 February 1966.

Coordinator provided orientation sessions for seven PTA groups. Some of these orientations involved five or six two-hour sessions for a single group. In addition, the Adult Education Program taught a total of fifteen courses in Modern Mathematics for Parents over this two year period.

An article did appear in the local newspaper which was critical of the movement toward "modern mathematics."[1] This article was not specifically directed at changes in Livonia but was based on negative reactions to the modernization of mathematics across the country and to the implementation of a new program in a neighboring district. In response to this article the two Mathematics Coordinators wrote a series of three articles which were published in the paper. These articles, "Modern Math--A Puzzler?," "The Mathematics Explosion Hits Education," and "Livonia Secondary Schools Complete the Changeover" were written to explain the

[1]William K. Kumbier to Allan Rosenfeld, Livonia, Mich., 18 January 1965.

reasons for the change in the mathematics program and to explain the systematic manner in which Livonia was implementing this change.[1] The efforts taken to inform the parents and the community were seemingly successful as no major negative reaction to the implementation of "modern mathematics" occurred in the community.

During the first year of the new adoption, Kumbier described the reaction of the parents as, "Generally, their comments reflect enthusiasm for the mathematics experiences youngsters are having and are most supportive of teachers."[2] He did report, however, that some parents were concerned about the increased amount of attention given to geometry. This concern was expressed in a request for teachers to carefully consider the kinds of geometry problems children were ask to complete and not to expect children to be overly accurate when representative sketches might suffice.[3]

The change to the new texts was not without its problems. It was noted in the fall of 1965 that,

> There has been some concern about the amount of background work necessary in some grades and the consequent slowing of pace in covering the new material. You will recall that we do not expect all classes to finish the text this year. Neither do we expect that there will be 100% mastery of all concepts by all pupils. Topics introduced at one grade level will be reviewed and extended at the next.[4]

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[1] The Livonian Observer, 21, 28 April; 5 May 1965.

[2] Henry C. Heusner and William K. Kumbier to Elementary Principals, "Geometry in our Elementary Modern Mathematics Program," Notice No. DI-668, Livonia Public Schools, 18 January 1966.

[3] Ibid.

[4] Henry C. Heusner and William K. Kumbier to Elementary Principals, and Teachers, "Progress Report-New Mathematics," Notice No. DI-639, Livonia Public Schools, 8 November 1965.

At the end of the first year, it was stated that,

> The Addison-Wesley mathematics adoption has met with reasonable success in its first year. We should seek to maintain and advance the efficiency of its use. A survey of teacher needs is planned for the end of the 1965-6 year so that in-service and classroom helps may be adequate. Already we realize a need for more emphasis on effective methods for teaching number facts and relationships.[1]

Two activities during the year were related to problems of communicating the progress of students through the newly adopted mathematics program. The first of these was a meeting for an exchange of information between sixth and seventh grade teachers concerning the content of the sixth grade program and the expectations of the seventh grade teachers.[2] As a result of this meeting, the sixth grade teachers attempted to supply individual mathematics progress reports for each student leaving the elementary school. The second activity was the development of a mathematics progress card.[3] This card was designed to provide a uniform method of recording mathematics progress. Each grade level was divided into a number of mathematics units and provision was made to record the units a student had covered as well as places for comments on the students strengths and weaknesses. The use of the card was never fully implemented. It was used on an optional basis for a period

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[1]William K. Kumbier, Annual Report of the Mathematics-Science Coordinator -- 1965-1966 (Livonia, Mich.: Livonia Public Schools, July 1966), p. 9.

[2]William K. Kumbier to Charles Zoet, "Transition from 6th-7th grade (Mathematics)," Livonia, Mich., 28 April 1966.

[3]Henry C. Heusner to Elementary Principals, " Elementary Principals Meeting of May 24, 1966," Notice No. DI-730, Livonia Public Schools, 1 June 1966.

of three years and served as a forerunner of the record keeping associated with later attempts to implement individualized instruction in mathematics.

During the years from 1966-67 to 1969-70, the Addison-Wesley materials were used extensively and the only basic change in materials was the adoption of revised editions at grades one and two, in 1968-69.[1] Elementary principals and first and second grade teachers were provided the opportunity to examine the revised editions and to help in making the recommendation for this change. Only these two grade levels were considered since consumable books were used in those grades and only a minimal additional expense was involved in the change.

Concerns over Computational Skills

In 1966-67, the study of the science curriculum was stressed and no systemwide efforts in mathematics were attempted. A pilot program involving elementary curriculum representatives was established and much of the effort of the Coordinator of Mathematics and Science was directed toward working with this group. At meetings of the group much emphasis was placed on the sharing of mathematics activities that could be used to bolster computational skills.[2] Concern with computational skills was also expressed by the Director of Elementary Education in his annual report.

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[1]William K. Kumbier to George Hoekstra, "Mathematics Textbooks--Grades 1 and 2," Livonia, Mich., 3 June 1968.

[2]William K. Kumbier, MATSCI Notes 3(Livonia, Mich.: Livonia Public Schools, 9 January 1967).

> The mathematics area needs to be checked for strong and weak points. We know that computational skills and problem-solving need attention. An attempt should be made to expand our start on activities to build computational skills made in 1966-67.[1]

During 1967-68 the concern over computational skills was coupled with concern over the mathematics scores achieved by Livonia students on standardized tests.[2] In an effort to check on the results of the Iowa Test of Basic Skills, which was administered districtwide, an intensive item analysis of student responses at Monroe Elementary School was conducted.[3] This school was selected because it had choosen to receive an item analysis of its test results in both 1966 and 1967, and many of the elementary schools had not done so. The report by the Mathematics Coordinator listed a large number of items in which the children at this school scored below the national average. His observation was that the children, " . . . need more help with computational skills, currency problems and measurement."[4] He also reported that the test was highly inadequate to measure the effectiveness of a "modern mathematics" program. As a result of this review, three other standardized mathematics achievement tests were purchased and each was administered to two randomly selected sixth grade

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[1]Henry C. Heusner, Annual Report for the School Year 1966-67 (Livonia, Mich.: Livonia Public Schools, August 1967), p. 32.

[2]For a summary of standardized test scores in mathematics for grades 4-8 from 1956-57 to 1974-75 see appendix E.

[3]William K. Kumbier to Henry C. Heusner, "Iowa Test Math Scores," Livonia, Mich., 4 January 1968.

[4]William K. Kumbier, Annual Report of the Mathematics-Science Coordinator--1967-68 (Livonia, Mich.: Livonia Public Schools, June 1968), p. 3.

classes.[1] The results of these tests indicated that Livonia students were doing well in learning mathematics concepts but supported the need for additional stress in computation, work with money and measurement.[2]

For the next two years the concern over computational skills was evident in the amount of activity designed to help teachers with this aspect of teaching mathematics. In September 1968, Games and Challenges, a collection of activities to promote drill, review, and enrichment in the basic number operations, was produced by the system.[3] Each teacher received a copy of this publication. In March 1969, a kit of materials, which had been placed on a supplemental mathematics teaching aids list, was circulated among the schools and a special allocation of fifty cents per pupil was given to each building to purchase materials from this list.[4] In April 1970, a workshop for Mathematics/Science Curriculum Representatives was held on the topic of Mathematics Skills Diagnosis-Remediation. This two session workshop, which was designed to prepare the curriculum representatives to return to their buildings and work with

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[1]William K. Kumbier to Elementary Principals-Cass, Madison, Garfield, Rosedale, McKinley and Tyler, "Selected Mathematics Testing - Grade Six," Livonia, Mich., 5 March 1968.

[2]Henry C. Heusner to Elementary Principals, "Elementary Principals Meeting of May 28, 1968," Notice No. DI-1038, Livonia Public Schools, 19 June 1968.

[3]Livonia Public Schools, Games and Challenges, with a Preface by William K. Kumbier (Livonia, Mich.: Livonia Public Schools, August 1968).

[4]William K. Kumbier, MATSCI Notes 5 (Livonia, Mich.: Livonia Public Schools, 1 January 1969).

teachers, was conducted by Joseph Payne and Paul Trafton of The University of Michigan. While no follow-up evaluation of the work by the curriculum representatives was done, the evaluation of the workshop itself was very positive and the curriculum representatives left the workshop feeling that they could return to their buildings and run similar in-service activities for their staff.[1]

Individualized Mathematics

During 1967-68 individualized instruction in elementary mathematics, which prior to this time had been tried only by individual teachers in the district, became an area of central interest for several members of the administrative staff including Henry Heusner, William Kumbier and Clyde Jack, the principal of Kennedy Elementary School. Based on information received at an August 1967 meeting of the NCTM, visits to view the Bloomfield Hill's Individual Progress Curriculum and information received from the Research and Development Center at the University of Pittsburgh, the individualized approach was viewed as a " . . . promising solution for our problems."[2] Efforts were made during 1967-68 to develop a quantity of materials for use in such a program at the sixth grade level. These efforts were not successful due to a lack of time available for teachers to work on the program. The

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[1]William K. Kumbier to Elementary Math/Science Representatives, Elementary Principals, Dr. H. Heusner, "Math Workshop Summary," Livonia, Mich., 27 April 1970.

[2]Henry C. Heusner, Annual Report for the School Year 1967-68 (Livonia, Mich.: Livonia Public Schools, August 1968), p. 26.

following summer, however, two workshops were established to develop materials for individualizing mathematics instruction. One of these workshops, involving five upper-elementary teachers from different schools, focused on the development of units related to the teaching of decimals. The other workshop, under the direction of Clyde Jack, involved seven teachers from the Kennedy staff who were trying to develop an individualized program using the adopted text materials. They coded the basic text, together with supplemental materials, to the objectives set up by the Individually Prescribed Instruction program of the Research and Development Center at the University of Pittsburgh.

The following year the Mathematics Coordinator put a special emphasis on helping the Kennedy staff to secure mathematics materials and on helping with their attempts to individualize mathematics instruction. At the district level, individualized programs were publicized by the showing of films on the Individually Prescribed Instuction (IPI) program to both the principals and the mathematics/science curriculum representatives at their December meetings.[1]

In March 1969, Henry Heusner wrote a letter to the three men who were to be the principals of new elementary schools opening in September 1969. He suggested that they might wish to familiarize themselves with the individualized program being developed at Kennedy.[2] This letter implied that, although the schools would

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[1]William K. Kumbier, MATSCI Notes 5(Livonia, Mich.: Livonia Public Schools, 10 December 1968).

[2]Henry C. Heusner to Gene Ehrstin, Ed LaDuke, Jim Otto, "Individualized Mathematics Program Being Developed at Kennedy School," Livonia, Mich., 12 March 1969.

probably not be able to use this material in September 1969, it would be available in the following years.

Workshops were held, during the summer of 1969, for the Kennedy staff and some members of the staff of Madison Elementary School to continue the work on the individualized mathematics program. Based on the work done at this workshop the program was implemented at both of these elementary schools during 1969-70. Clyde Jack explained the operation of the program at Kennedy as,

> . . . the project adopted the objectives of the mathematics program from the University of Pittsburgh R&D Center and in general drew the program from Addison Wesley, Greater Cleveland, and Silver Burdett texts. Units of study were broken down into major areas and then smaller units of objectives; pre- and post-tests were developed to measure each objective. . . . A Mathematics Center is also in operation where children who have a special problem or who can work independently can pursue their own individual task. The Mathematics Center is one fo the most successful adjuncts to the program; a half-time teaching position was converted to an aide for the Center. . . . Every child is given a pre-test at the normal grade level (grade two youngsters would take the Level A test for grade one). If he passes, we would give him Level B and identify the specific objectives he did not pass. Children's exact needs are thus identified and learning froups formed, with each child having an individual 'prescription!' Children then proceed at their own rate and when the teacher feels the student has done enough work and has checked himself, a post-test is given. If he still does not pass, alternative material is given. If the student passes the post-test, he would either move to the next objective in the area or move laterally to another area. There still are a number of blanks in the prescription book because after-school and summer workshop time did not permit full development.[1]

Although both Clyde Jack and William Kumbier expressed some reservations about the extension of this program into other schools,

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[1]Henry C. Heusner to Elementary Principals, "Elementary Principals Meeting of October 28, 1969," Notice No. DI-1201, Livonia Public Schools, 13 November 1969.

because of the need for further revision and the expense involved in such an expansion, plans were made to extend the program into five other elementary schools in September 1970. These five schools were Clay, Eisenhower, and Taylor, whose principals Heusner had written to concerning the program in March 1969, plus Washington and Jefferson Elementary Schools. Washington was included in the plans because of staff interest in being involved in the program.[1] Jefferson, on the other hand, was asked to participate in order to achieve a geographical balance of schools within the system and because Donald Harris, its principal, had served as Assistant Principal at Kennedy during the previous few years and was familiar with the program.[2] Thus the expansion of what came to be called the "Kennedy-Madison Program" occurred at a time when the direct supervision and support for the program was split by the formation of two regions. This was to leave no one person directly responsible for the program across the total district.

The End of the Period

In January 1969, a new mathematics committee was formed and Arthur Domalske, Principal at Cooper Elementary School, was appointed chairman. This committee consisted of eight teachers, three prin-

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[1]Henry C. Heusner to Donald Friedrichs, "Extension of the Kennedy/Madison Individualized Mathematics Project to Several Other Livonia Schools in September of 1970," Livonia, Mich., 22 April 1970.

[2]Henry C. Heusner to Donald Harris, "Extension of Kennedy/Madison Math Project to Jefferson School," Livonia, Mich., 23 April 1970.

cipals and the Coordinator of Mathematics/Science.[1] The charge to this committee consisted of a set of long range tasks: (1) collect and evaluate scholarly opinion, research, and current practice in Livonia and elsewhere related to elementary mathematics education; (2) support and foster communication regarding studies already underway in the system; (3) identify additional studies needed in the area; and (4) prepare for and conduct a study which would result in an updating of instructional guidelines, recommendations regarding textbooks and recommendations for in-service activities.[2] This committee met periodically during the next year and a half. The committee did develop a statement of philosophy and goals for the elementary mathematics program in Livonia. By February 1970, however, it was evident that the system reorganization in the fall would change operational patterns and the committee did not attempt to complete the other tasks with which it had been charged.

The year prior to reorganization was a difficult year financially. In September 1969, as a result of a millage failure, all of grades five through eight were placed on half-day schedules. To provide for the reduced amount of time for mathematics instruction in grades five and six, sets of practice and enrichment sheets to accompany each chapter of the adopted texts were prepared by the Coordinator of Mathematics/Science.[3] These assignments were

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[1]Henry C. Heusner, "Committee on Mathematics," Livonia, Mich., 22 January 1969.

[2]Henry C. Heusner to William Kumbier, memo, 15 January 1969.

[3]William K. Kumbier to Elementary Teachers, Math/Science Representatives, and Principals, "Homework for Fith-Sixth Grade Mathematics," Livonia, Mich., 4 September 1969.

intended to be of a self-correcting nature so that parents and students or pairs of students could do this task outside of school. The use of this packet of materials was not required of all teachers but it did receive some use from September until the middle of November when full day attendance was restored for grades five and six.

Summary

From 1964 to 1970 the Livonia elementary mathematics program experienced changes which were much the same as those of many districts across the nation. A "modern mathematics" program was implemented, in-service work took place for teachers and there was a high level of parent interest in "modern mathematics." In Livonia the implementation of "modern mathematics" occurred smoothly and the controversy which happened in some districts did not occur.

Following the adoption and initial use of the new materials, concerns did arise about the level of computational skills being gained by students under the new programs. These concerns were supported by slight drops in standardized test scores. These concerns were common to many districts at this time and seem to have been realistic.

> When it has been possible to compare similar classes using traditional and modern mathematics texts, there has been a tendency for the traditional classes to perform better on computation while the modern classes perform better in comprehension.[1]

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[1]National Advisory Committee on Mathematical Education, Overview and Analysis of School Mathematics Grades K-12 (Washington, D.C.: Conference Board of the Mathematical Sciences, 1975).

The effect of this concern was two-fold. First, there was an immediate movement to direct the in-service provided for teachers toward activities which would inhance the teaching of computational skills without destroying the integrity of the adopted program. The second effect was to provide a ready setting for the introduction of individualized mathematics programs in the elementary schools. During 1967-68 and 1968-69 a major effort was made to develop an individualized mathematics program in two of the elementary schools of the district. This was done with the idea that if the program proved effective, it could then be expanded to other schools in the district. In the spring of 1970 the decision was made to expand the program to include five additional schools the following fall.

The Secondary Mathematics Program: 1964 to 1970

Role of the Secondary Mathematics Committee

Following the appointment of Charles Zoet as Coordinator of Mathematics and Science for the secondary program, the committee structure in secondary mathematics attained a stable position. The Secondary Mathematics Committee (SMC) which had been reconstituted in May 1963 began to function as a permanent body in October 1964.[1] Over the next six years this committee played a major role in proposing and directing changes in the mathematics program.

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[1]Charles J. Zoet, Secondary Math-Science Newsletter #1 (Livonia, Mich.: Livonia Public Schools, Division of Instruction, October 1964), p. 2.

The initial membership of the committee consisted of twelve teachers, one or two from each secondary school, together with Charles Zoet and William McMurtrey, the Principal at Whitman Junior High School. At its first meetings the committee identified four areas to be given high priority. The principals' groups were then ask to approve the appointment of sub-committees to study these areas. With the approval of the principals the following sub-committees were identified and given these charges:

1. Seventh and Eighth Grade Mathematics Committee. Identify the problems related to working with slower and more able students in these grades.

2. Basic Math Committee. To make recommendations on class size and grouping criteria, and to suggest materials which are suitable for use with this group of students. To consider ways in which this course might be conducted more effectively and make recommendations on them.

3. Junior High Mathematics Leadership. To identify areas in which leadership is needed and make alternate recommendations which would improve the assignment of responsibility for meeting these needs.

4. Mathematics Profile Committee. To make recommendations for a testing program which would enable us to be more knowledgeable about the growth of our students in mathematical concepts and skills.[1]

In addition to these committees, another committee, the Applied Mathematics Committee, was formed and reported during the year.

All of these committees, expect the Mathematics Profile Committee, functioned during the year and submitted a final report. Whether the appointment of these committees, which were all focused on the junior high school level, was a result of the preponderance

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[1]Charles J. Zoet to Committee members, Secondary Principals, Dr. Johnson, and Dr. Bishop, "Minutes of Secondary Mathematics Steering Committee Meeting, November 24, 1964," Livonia, Mich., 27 November 1964.

junior high school members on the committee; a dissatisfaction with the junior high school program; or the fact that a number of new texts and courses were being introduced at the high school during this year is not clear. The reports of each subcommittee were submitted to the SMC and the Mathematics Coordinator and through him to the Director of Secondary Education and the principals' groups.

The report of the Seventh and Eighth Grade Mathematics Committee stated that identification for the purpose of providing special instruction for students at both ends of the ability scale should depend upon tests given during the student's previous years together with the recommendation of the teacher from the previous grade.[1] The committee also recommended that experimental projects should be carried on in the individual junior high schools and that these projects should be evaluated through a committee working with the Secondary Mathematics and Science Coordinator. The experimental projects they suggested, many of which were tried in one or more of the junior high schools during the next ten years, included:

1. Programmed learning in conjunction with the adopted text.
2. A completely programmed text.
3. Multiple texts to be used in classes.
4. Departmentalization of the junior high school.
5. Team teaching.
6. Algebra shifted to the eighth grade for the gifted and/

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[1]Harry Talley to Mathematics Steering Committee, Dr. Bishop and members of the committee, "Report on work of the Seventh and Eighth Grade Mathematics Committee," Livonia, Mich., n.d.

or well above average student.

7. The development of different tracks for the slow, average and fast student.
8. Self selection of topics for mathematical study by the student.[1]

The Basic Math Committee in its report identified the students for whom this course was designed as those having low reading ability, low mathematics achievement, poor self-concept, short attention span, and lack of skills in arithmetic.[2] The committee anticipated that approximately 20 percent of the ninth grade students could be properly enrolled in this course. The course content suggested generally followed the same outline as the material taught in seventh and eighth grades, with an emphasis on skill development, but a greater number of practical applications were included. The objectives proposed included some dealing with content knowledge and skills and some related to developing self-concept and success experiences for students. The report included a listing of audio-visual materials and supplemental written materials which should be available for this course.[3] Additionally, separate lists of recommendations to administrators and teachers were made for improving the chances of students' success in this course. Among these recommendations were: (1) be-

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[1] Ibid., pp. 1-2.

[2] Department of Secondary Education, Report and Recommendations of the Basic Mathematics Committee (Livonia, Mich.: Livonia Public Schools, April 1965), p. 1.

[3] Ibid., pp. 4, 6-8.

gin working with slow students earlier in the mathematics program; (2) have a remedial mathematics consultant assigned, as was done in reading; (3) treat students like people not rejects; (4) make the subject matter meaningful and fun; and (5) believe in what you are teaching.[1]

During 1964-65, the two adopted textbooks for Applied Math I and II were Introduction to Mathematics by Brumfiel, Eicholz, and Shanks and Modern Elementary Algebra by Nichols and Collins.[2] The Applied Mathematics Committee focused its attention on the practice of using Introduction to Mathematics exclusively during the first semester of Applied Math I and then teaching algebra exclusively during the second semester. The committee proposed a plan for mixing and alternating arithmetic and algebraic content during the entire year.[3] They hoped that this sequence would provide for better instruction and for greater learning. This plan was implemented on a trial basis during the following year. While no formal evaluation of this plan occurred, teachers indicated by continuing to use this plan that it did more closely meet the needs of these classes.

The Junior High School Mathematics Leadership Committee surveyed the teachers in the junior high schools concerning the

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[1] Ibid., pp. 4-5.

[2] Charles F. Brumfiel, Robert E. Eicholz and Merrill E. Shanks, Introduction to Mathematics (Reading, Mass.: Addison-Wesley Publishing Co., 1961); and Eugene D. Nichols and Wagner G. Collins Modern Elementary Algebra (New York: Holt, Rinehart and Winston, 1961).

[3] For the details of this plan see p. 279 below.

areas in which they felt leadership was most needed.[1] As a result of the survey, the committee recommended that the position of Mathematics Chairman be created in each junior high school and that this person be assigned leadership only in mathematics. Also, they recommended that his responsibilities be to provide leadership in these fifteen areas:

1. Help and guide beginning teachers
2. Make instructional aids
3. Organize supplementary materials
4. Coordinate teaching activities
5. Coordinate testing programs
6. Provide necessary means of communication
7. Conduct in-service training
8. Organize and review films and filmstrips
9. Coordinate library materials
10. Conduct research and follow-up studies
11. Coordinate equipment
12. Assist counselors and administrators
13. Attend and report on conferences
14. Assist students
15. Provide public information[2]

In addition to the work of the sub-committees, other major efforts undertaken during this year included in-service training

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[1] Junior High School Mathematics Leadership Committee to Secondary Mathematics Committee, "Report and Recommendations," Livonia, Mich., 2 March 1965.

[2] Ibid., pp. 2-5.

for junior high school teachers, the study of mathematics library facilities for the junior high schools and the initiation of the computer mathematics program in the high schools.

The Coordinator of Secondary Mathematics and Science attempted to provide the in-service training through a series of after-school sessions conducted once a week at Riley Junior High School. These voluntary sessions were sparsely attended but did continue for a period of several months.[1]

Based on the recognition that the newer texts placed increased requirements on library facilities, the Coordinator conducted a study of mathematics library facilties. The result of this study was a listing of books which had been examined or recommended for placement in libraries by some member of the Livonia staff.[2] In a large measure, this list drew upon a 1963 study done by the Bryant Junior High School mathematics staff.

At the high schools, 1964-65 was a year of little experimentation as the greatest amount of work was directed toward the introduction of a new course and new textbooks. Refresher Math, which had been recommended in the 1961-62 study, was taught for the first time. Also, new textbooks, Geometry by Moise and Downs and Algebra II by Brumfiel, Eicholz and Shanks, were introduced

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[1]Leslee J. Bishop, Year-End Report: Curriculum Activities and Projects 1964-65 (Livonia, Mich.: Livonia Public Schools, July 1965), p. 31.

[2]Charles J. Zoet to Junior High Principals, Mathematics Teachers and Librarians, "Mathematics Library Facilities for Junior High Schools," Livonia, Mich., 8 February 1965.

in Plane Geometry and Advanced Algebra to replace the SMSG materials which had been used the previous year.[1]

The following year the SMC continued its emphasis on the junior high school program. In its first meeting of 1965-66, it identified the following topics which constituted much of its work for the year:

1. Continue to emphasize the need for mathematics leadership at the junior high level.
2. Identify in-service training and workshop needs with a possibility of emphasizing work with slower students.
3. Follow-up the report of the Basic Mathematics Committee from last year to see if its recommendations are being followed and how effectie they are.
4. Develop a minimum list of skills and content to be taught at each grade level and evaluate our present program in the light of those areas which we feel should be the minimum program at each grade level.
5. Seek ways to constructively explore the strengths and weaknesses of block-time teaching as it applies to science and mathematics.[2]

At the initial meeting for the year, concerns were also expressed by the SMC related to the changes taking place in the elementary school program. These concerns focused on the new text adoption in the elementary schools and the effect that changes in the elementary program would have on the junior high school program over the following years. As a result of this concern the Coordinator

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[1]Edwin E. Moise and Floyd L. Downs Jr., Geometry (Reading, Mass.: Addison-Wesley Publishing Co., 1964); and Charles F. Brumfiel, Robert E. Eicholz, and Merrill E. Shanks, Algebra II (Reading, Mass.: Addison-Wesley Publishing Co., 1962).

[2]Livonia Public Schools, Minutes of Meetings of the Secondary Mathematics Committee, Meeting of 19 October 1965.

of Elementary Mathematics and Science was offered and accepted an invitation to become a member of SMC.

A report, "Continuity of Instruction in Algebra and Advanced Algebra," which was written and circulated by the Mathematics Coordinator in September 1965, led the SMC to appoint an Algebra-Advanced Algebra Study Committee.[1] The major point of this paper was that,

> All learning must be based on previous experience and, since Algebra and Advanced Algebra are obviously parts of the same learning pattern, the teaching of Advanced Algebra must be based on understandings gained in Beginning Algebra.[2]
>
> Many aspects of instruction in beginning and advanced algebra point to the fact that the experiences of students in those programs tend to be more individualized than is recognized in our instructional processes.[3]

A list of recommendations were then stated for ways in which the continuity between these two courses and the attention given to individual student differences might be improved.

Based on this report, the committee was charged to discuss the continuity of instruction in the two algebra courses and make recommendations concerning the improvement of instruction. The committee used as basic documents for its work the report on continuity and a second report by the Coordinator on data obtained from the Cooperative Algebra Test that had been administered in May 1965 as a part of the National Longitudinal Study of Mathematical

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[1]Charles J. Zoet to Algebra, Geometry and Advanced Algebra Teachers, "Continuity of Instruction in Algebra and Advanced Algebra," Livonia, Mich., 8 September 1965.

[2]Ibid, p. 1.

[3]Ibid, p. 3.

Achievement.[1] The focus of the committee shifted from the question of continuity of instruction for the individual student to the question of the appropriateness of the existing texts for the algebra courses. As a result, their recommendations were:

1. That the Algebra One and Algebra Two texts be selected in series.

2. That during the school year 1966-67, several different pilot texts be used in Algebra One classes, with one set to be used in each junior and senior high school, and with more than one teacher using the same pilot text if possible.

3. That a new Algebra One text be adopted for use in 1967-68.

4. That the Algebra Two teachers be constantly advised of the Algebra One teachers' reactions to the pilot texts in order that they may be better able to make the best Algebra Two text selection a year later.[2]

The project which the SMC considered to be its major work for the year was related to the seventh and eighth grade programs. Another report by the Mathematics Coordinator, "An Analysis of the Scores Made by Our 8th Grade Students on the Bobbs-Merrill Arithmetic Achievement Test," formed the basis for this work.[3] This report was a study of the scores of 280 eighth grade students from one junior high school who had been tested in April 1965. The report included a statement of the following implications:

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[1]Charles J. Zoet to Junior High School Principals, "Analysis of the Cooperative Algebra Test Results," Livonia, Mich., 8 March 1966.

[2]Algebra-Advanced Algebra Study Committee to Secondary Mathematics Committee, "Final Report and Recommendations," Livonia, Mich., 26 April 1966, p. 1.

[3]Charles J. Zoet to Junior High School Principals and Mathematics Teachers, "An Analysis of the Scores Made by Our 8th Grade Students on the Bobbs-Merrill Arithmetic Achievement Test," Livonia, Mich., 15 September 1965.

> The distribution of the scores made by our students on this test seems to imply that our more able students do not, as a group, perform as well as can be expected. The balance of the students perform in a manner roughly comparable to the norming group. . . . Questions about percentage constitute nearly 1/3 of these 'misunderstood' questions. Since this topic would certainly be central to any 'general education' list for mathematics programs, we need to make provisions to assure that such 'traditional' topics are amply provided for in our mathematics program.
>
> The individualization of mathematics instruction must continue to be emphasized--particularly at the 7th and 8th grade level where the program itself does not provide for such differentiation.
>
> Teachers must be encouraged to experiment with techniques which allow them to work with the needs of individuals. . . . But since students cannot be nicely compartmentalized forever as 'slower' and 'more able' we really need to be more cognizant of the needs of all students and our teachers need to develop techniques which permit them to work with these students.[1]

The approach selected by the committee in studying the content of these grade levels was to prepare a survey of mathematics topics. At the December curriculum day, representatives from elementary schools presented an overview of the elementary mathematics program to the junior high school teachers. Following this presentation the survey consisting of a list of 190 topics was given to each junior high teacher. The teachers were instructed to categorize each of the 190 topics, for the grade level at which they taught, in one of the following ways: (1) introduced to better students, (2) introduced to most students and mastered by the better ones, (3) introduced to all students--mastered by most, (4) mastered by all, (5) introduced to slower students, or (6) the

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[1] Ibid., pp. 5-6.

topic is not treated at this level.[1] Each topic was to be marked in this manner both for the existing program and for an "ideal" program. This survey was looked on by the committee as the first step in a long range process.

> The long range objective of this plan is to allow the SMC to come up with a statement of the philosophy, objectives and content of the junior high school mathematics program as we see and want it rather than as a product of the textbooks that happen to have been adopted. In this way future textbook adoption committees could look for textbooks that fit objectives rather than obtaining textbooks which set objectives. Planning of this nature is critical at this time because of the recent adoption of a new elementary series and an impending adoption of new 7th and 8th grade texts.[2]

The teachers' responses to the survey indicated that: (1) the emphasis on arithmetic skills should be increased at both grade levels; (2) the emphasis on geometric topics should be limited at the 7th grade and increased in the 8th grade; (3) the emphasis on linear, area and volume measurement should be increased at both grade levels, but especially at the 8th grade; and (4) the teaching of algebraic topics and topics concerning applications should be left to other grades and/or teachers of subjects other than mathematics.[3]

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[1]Secondary Mathematics Committee to Junior High School Mathematics Teachers, "Survey of Topics Included in 7th and 8th Grade Mathematics," Livonia, Mich., 29 November 1965.

[2]Secondary Mathematics Committee to Junior High School Principals, "Recommendation for December Curriculum Day," Livonia, Mich., 10 November 1965.

[3]Secondary Mathematics Committee, Results of the Survey of Topics Included in 7th and 8th Grade Mathematics (Livonia, Mich.: Department of Secondary Education, Livonia Public Schools, January 1966).

The results of the survey were used to develop the 7th and 8th Grade Mathematics Curriculum Guide which was based on teacher recommendations rather than on a listing of the content of the adopted texts.[1] This guide, when distributed in June 1966, was general in nature, contained a broad set of goals, and outlined content in nine broad areas. These areas were: sets, numbers and operations, numeration systems, measurement, geometry, algebra, probability and statistics, logic, and applications.

The Junior High Math/Science Block

The concern of the SMC related to block-time teaching of mathematics and science in the junior high schools, which had been identified at its initial meeting in 1965-66, became intertwined in several of the items studied by the committee. In the presentation to the junior high school principals of the survey of seventh and eighth grade mathematics this became a point of discussion.

> It was pointed out that the junior high school principals as a group needed to spend more time discussing their philosophy in regard to block-time programs as well as other facets of the junior high school curriculum. It was also pointed out that each principal is responsible for the evaluation and the effectiveness of the program as it exists in his building and should not hesitate to recommend any steps necessary to review the effectiveness of any portion of that program at any time.[2]

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[1] Livonia Public Schools, 7th and 8th Grade Mathematics Curriculum Guide (Livonia, Mich.: Livonia Public Schools, June 1969).

[2] Donald E. Friedrichs to Secondary Principals, "Notes on Meeting of Junior High School Curriculum Steering Committee, December 10, 1965," Notice No. DI-658, Livonia Public Schools, 21 December 1965.

The implications of this meeting seemed to be that the junior high school principals did not feel the need for a systemwide mathematics organizational plan, were desirous of continuing to plan on a building basis, and felt that possibly the Mathematics and Science Coordinator and the SMC were exceeding their authority in the areas they were attempting to study.

The question of possibly breaking the block-time teaching pattern of the junior high schools in mathematics and science was not a new item at this time. It had received varying levels of discussion since 1961 or earlier. The first identifiable mention appears in April 1961.

> The problems of maintaing the block assignments in junior high school were discussed. It was the consensus of the group that the block program should be maintained in terms of philsosphy, administrative scheduling, and content.[1]

In each of the following three years the breaking of the block was a matter of concern at a spring meeting of the junior high principals and in each case the decision was postponed.

> In view of Mr. McMurtrey's concern about the possible necessity for splitting the block of time in eighth grade math and science some criteria for deciding the desirability of discontinuing its use need to be identified. This should be an agenda item for the next meeting of the junior high school principals with the discussion including Mr. Heusner since preparation of teachers is an important factor.[2]

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[1]Leslee J. Bishop to Secondary School Principals, "Meeting of Secondary School Principals on April 12, 1961," Notice No. DI-148, Livonia Public Schools, 24 April 1961.

[2]Leslee J. Bishop to Junior High School Principals, "Junior High School Principals' Meeting of April 11, 1962," Notice No. DI-226, Livonia Public Schools, 7 May 1962.

> The recommendation from certain teachers that the science-math block no longer be a basic curriculum structure in the Livonia Public Schools was considered. It was proposed that this recommendation be documented and considered as a policy issue at a later time.[1]

> Principals reported a critical shortage of teachers trained in mathematics and science. . . . The situation is most acute in seventh and eighth grade classes. It may be that some of the block situations will have to be split in order to find qualified persons.[2]

During the spring of 1965 at least two principals had written letters to the Assistant Superintendent stating their concern about filling math/science positions for 1965-66.[3] Thus the presentation of a document, "A Proposal to Discuss the Use of Block-Time in 7th and 8th Grade Mathematics and Science," to the junior high school principals by the Mathematics Coordinator was in keeping with discussions that the principals group had previously held.[4]

In February 1966, a decision was reached, based on the imbalance between supply and demand of mathematics-science teachers, to allow some deviation from block scheduling.

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[1]Leslee J. Bishop to Secondary Principals, "Meeting of Junior High School Principals, May 8, 1963," Notice No. DI-371, Livonia, Public Schools, 24 July 1963.

[2]Leslee J. Bishop to Secondary Principals, "Meeting of Junior High School Principals, March 25, 1964," Notice No. DI-459, Livonia, Public Schools, 7 April 1964.

[3]William Warren to Dr. Paul Johnson and Junior High School Principals, "Eighth Grade Mathematics and Science Teachers," Livonia, Mich., 18 March 1965; and James Casebere to Dr. Paul Johnson, "Agenda Items, Jr. High Principals Meeting," Livonia, Mich., 22 June 1965.

[4]Charles J. Zoet to Junior High Curriculum Steering Committee, "A Proposal to Discuss the Use of Block-Time in 7th and 8th Grade Mathematics and Science," Livonia, Mich., 8 December 1965.

> If, in the opinion of the principal in conference with the Director of Secondary Education, staffing and/or other conditions indicate that blocking of these two subjects, in grade eight only, result in a diminished quality in pupils' learning experiences, then authorization is granted to assign mathematics and science classes of the same group of pupils to different teachers.[1]

The following year, 1966-67, was the last year that all schools were required to maintain the math-science block at either the seventh or eighth grade. In May 1967 action was initiated which allowed each school to break the block at the seventh grade or if necessary to assign some science teachers to an extra "sixth" class with extra salary.[2] Over the next several years the math-science block was phased-out in the junior high school and those teachers who had been teaching in both content areas concentrated on either mathematics or science.

Junior High Mathematics Department Chairmen

In 1965 the SMC took a position supporting the establishment of Junior High School Mathematics Department Chairmen as had been recommended by the Junior High Mathematics Leadership Committee. In March 1966 the SMC reaffirmed its support for a separate Mathematics Department Chairman.[3] This was done even though the position

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[1]Paul E. Johnson to Junior High Principals, "Modification of Procedure for Organizing for Mathematics and Science Instruction in Grade Eight," Notice No. DI-686, Livonia Public Schools, 24 February 1966, p. 2.

[2]Paul E. Johnson to The Superintendent and Board of Education, "Proposed Action in Relation to Mathematics-Science Instruction in the Junior High Schools," Livonia, Mich., 22 May 1967.

[3]Livonia Public Schools, Minutes of Meetings of the Secondary Mathematics Committee, Meeting of 15 March 1966.

of Mathematics-Science Department Chairman had been established in each junior high school for 1965-66. The response from the Junior High School Curriculum Steering Committee, to the recommendation for a separate Mathematics Chairman, indicated that financial considerations prohibited serious consideration of the establishment of separate positions.[1] It was also indicated that the long-range effects of the appointments to the combined positions could not yet be assessed. Any decision to separate the leadership for the two areas was also closely tied to the discussions concerning the breaking of the mathematics-science block and to a philosophical position that opposed subject matter specialization in the junior high schools.

> Our feeling of support for the block of time in science and mathematics also leads to our hesitation to support your recommendation. We feel that the appointment of separate chairmen will lead to a departmentalization which seems then to lead to an emphasis in junior high school programs which we do not support. These are admittedly only feelings and we would be interested in listening to arguments that such a move would be in the best interest of junior high school students.[2]

The position of Mathematics-Science Department Chairman remained unchanged until the 1969-70 school year. In the negotiations between the LEA and the School Board for that year the position of Junior High School Mathematics-Science Department Chairman was retained in the contract. A clause was added to the

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[1] Junior High School Curriculum Steering Committee to Secondary Mathematics Committee, "Recommendations on 'Junior High School Department Chairman Position' March 17, 1966," Livonia, Mich., 3 June 1966.

[2] Ibid., p. 1.

contract, however, which stated that,

> Math and Science may be separated if the staff and the principal request and the director of secondary education approves In such instances the compensation shall be equally divided.[1]

This arrangement remained in operation through 1975 and in 1974-75 seven schools elected to have separate department chairmen while three schools operated with a single department chairman for both content areas.

Accelerated Junior High School Algebra

In keeping with the recommendations of the SMC, a pilot program in the teaching of first year algebra at the eighth grade was started at Whitman Junior High School in the fall of 1965-66. The general purposes identified for this program were to,

> . . . examine the advantages and disadvantages of using this method to improve our mathematics program for the more able students in eighth and ninth grade mathematics. . . . gain experience and to generate interest in the problems related to working with this type of student.[2]

A class group was formed by taking an able group of students who had been grouped in the seventh grade and adding a sufficient number of like students to form a class of 34 students. This course was to be taught largely from the regular algebra textbook with supplemental material taken from the regular eighth grade math text where this seemed appropriate. The content was to be covered at a rate

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[1] Professional Agreement Between The Livonia Public Schools School District and The Livonia Education Association MEA-NEA: 1969-70 (Livonia, Mich.: Livonia Public Schools, 1969), p. 19.

[2] "Proposed Experiment in 8th and 9th Grade Mathematics," Livonia, Mich., n.d., p. 2.

such that no more homework would be involved than would be expected from a regular eighth grade mathematics class. Plans were carefully developed for the evaluation of this pilot effort. These plans included the administration of pre- and post-tests to the experimental group and to control groups consisting of students completing Algebra I in June 1966 and students completing Algebra II at Franklin High School in June 1967.[1]

The preliminary report of this experiment, completed at the end of the first year, concluded that: (1) the algebra scores of the experimental class compared favorably with those of all algebra students in spite of the fact that the experimental class did not spend the entire year in the study of algebra; (2) the experimental class made significantly greater gains than other algebra students; and (3) there was no evidence that the difference in approach had a significant effect on attitudes toward mathematics or understanding of the fundamental concepts of arithmetic.[2]

During the second year of the program intensive planning was done with Franklin High School to insure that students completing the second year of this program would be properly placed in mathematics classes when they entered Franklin. While there was general satisfaction with the progress of students during the first year of the experiment and the preliminary report was positive,

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[1]William McMurtrey, Eldon Price and Charles Zoet to Dr. Paul Johnson and Dr. Donald Friedrichs, "Preliminary Report of the 8th Grade Algebra Experiment at Whitman Junior High School," Livonia, Mich., 11 October 1966.

[2]Ibid., pp. 3-4.

the Mathematics Coordinator stated,

> . . . we are not ready at this time to recommend that Algebra for eighth graders should become a regular part of our junior high school mathematics program. However, it was my understanding that, as a result of the positive nature of the report, Dr. Friedrichs indicated that proposals to duplicate this experiment at other schools would be considered.[1]

During the next two years several other junior high schools, including Bryant and Holmes, established classes to provide this type of opportunity for selected groups of students.

By March 1969 the SMC felt that the evidence with regard to offering an accelerated algebra experience was strong enough for it to take a position. At that time it recommended that, ". . . the better mathematics students at each junior high school be identified prior to the beginning of the 8th grade and that these students be enabled to take a two year sequence in mathematics which places a strong emphasis on algebra."[2] This recommendation was favorably received by the junior high school principals and plans were prepared calling for the implementation of this recommendation by the 1970-71 school year. When the final report on the Whitman Eighth Grade Algebra Experiment appeared in November 1969, it further strengthened the position of providing such accelerated experiences. The report was based on comparative data gathered over the five year period during which the students

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[1]Charles J. Zoet to Dr. Johnson, Dr. Friedrichs, Secondary Principals, "Reflections on a Report of the Whitman Algebra Experiment to Secondary Principals," Livonia, Mich., 8 November 1966, p. 3.

[2]Allan A. Edwards and Charles J. Zoet to Secondary Mathematics Advisory Committee, "Report of the Secondary Mathematics Advisory Committee Meeting-March 4, 1969," Livonia, Mich., 17 March 1969.

involved completed grades eight through twelve. It was concluded in the report that algebra could be studied by select groups of eighth graders without requiring large amounts of additional work. Also, it was stated that, " . . . it is clear that when gifted junior high school students are given an opportunity to do two years of work in algebra they do become significantly better mathematics students."[1]

During the fall of 1969, representatives of the high school mathematics departments met to discuss the effects of the accelerated algebra classes on the high school program. Out of these meetings came several suggestions for introducing both more flexibility and more courses in the high schools in order to insure proper placement for the students completing such classes in junior high school.[2] These recommendations were never finalized and by the time the first large numbers of students with this type of background reached the high schools, the district was operating on a regional basis and decisions related to providing for these students were made by each high school.

Formal approval of these accelerated eighth grade algebra classes occurred in May 1970 when the School Board approved Algebra (Continuous Progress) as a course offering.[3] This adoption did not

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[1]Charles J. Zoet to Dr. Paul Johnson, "Whitman Eighth Grade Algebra--Final Report," Livonia, Mich., 7 November 1969, p. 6.

[2]Charles J. Zoet to High School Mathematics Advisory Committee, "Minutes of the Sub-Committe on Changes Related to the Two-year Algebra Program," Livonia, Mich., 8 December 1969.

[3]Livonia Public Schools, Minutes of Meetings of the Board of Education, Meeting of 4 May 1970.

require each school to offer such a course but rather made it an option available to each school. As a result each school approached the implementation of the course in its own way. In some schools special classes were established. In others eighth grade students were integrated into ninth grade classes. Still other schools choose to provide for an accelerated experience by having small numbers of students work independently. In part, these differences in the manner in which the junior high schools implemented the accelerated algebra classes, and changes which they made from year to year, were responsible for the inability of the high schools to arrive at a generally acceptable plan for placing such students in high school classes. By the 1974-75 school year, eight of the ten junior high schools were operating some type of planned accelerated algebra program. Of this number, five schools had a special two year sequence of courses and three schools were integrating students into regular algebra classes during the eighth grade and providing a special class in the ninth grade. While the concept of accelerated junior high school algebra was formally accepted, the implementation of this concept seems to have lacked consistency.

New Systemwide Directions and New Texts

Following two years of intense activity the SMC took on a different role in 1966-67. It did not undertake any major projects for the year but rather set up and received reports from various subcommittees and served as a sounding board for the individual building activities and innovations which were taking place.

One of the sub-committees of the SMC which did function during this year was the Algebra-Advanced Algebra Instructional Materials Committee. This committee broke into two smaller committees to consider texts for Algebra I and Advanced Algebra and then reconvened as a committee of the whole to make its final recommendations. The committee recommended tha adoption of Algebra: Its Elements and Structure Book I by Banks, Sobel, and Walsh for Algebra I.[1] For Advanced Algebra they did not recommend a single book, since no adoption was scheduled for two years, but did provide a list of texts which should be considered at the time of adoption. The committee's recommendation for Algebra I was adopted as has been traditional in Livonia. During the past twenty years, while at times budgetary considerations have postponed the adoption of a text, no mathematics text recommended by a selection committee has ever been rejected in favor of another text.

A second instructional materials committee which functioned during this year was the Instructional Materials Committee for Applied Math III. This committee was formed because the publisher of the adopted text had informed the system that it was discontinuing the publication of the book. The committee reported that it had contacted twenty-five publishers but had been unable to find suitable materials to teach the course. They recommended therefore, ". . . that suitable materials can and should be written by faculty

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[1] J. Houston Banks, Max A. Sobel, and William Walsh, Algebra: Its Elements and Structure Book I (New York: Webster Division, McGraw-Hill Book Co., 1965).

members from within the system."[1] This recommendation was accepted and funds were allocated by the system for this project. During the summer of 1967, three Livonia high school teachers, Hugh Leeper, Robert Massey, and Roger Strong, wrote a text, Numerical Trigonometry: Related Topics and Applications, for use in the Applied Math III course.[2] This text was published by the school system and the authors were given permission to copyright the materials in exchange for the school system's right to produce and distribute the material internally.

During the summer of 1967, two workshops were conducted which tended to give new and different direction to the work in mathematics education in Livonia. One was a Workshop on Planning for Implementation of Curriculum Improvement Practices which was designed for all high school teachers and was funded under a Title III grant the system had received for a Project on Instructional Improvement. During this workshop much of the planning took place for extensive uses of modular scheduling and team teaching which took place in all instructional areas at Franklin and Stevenson High Schools from 1967-68 through 1970-71. At these two schools the emphasis on changes shifted from consideration of changes in content to changes in teaching methods and class management systems.

The other workshop that was held was a Workshop for Teaching

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[1]Charles J. Zoet to SENCOM, "Instructional Materials Committee for Applied Math III," Livonia, Mich., 15 May 1967.

[2]Hugh Leeper, Robert Massey, and Roger Strong, Numerical Trigonometry: Related Topics and Applications (Livonia, Mich.: Livonia Public Schools, 1968).

Mathematics to Slow Learners.[1] This workshop was attended by four high school and fifteen junior high school teachers for a one week period in August. Sessions were conducted by Allan Bernstein of the Wayne County Intermediate School District, Eugene Smith of Wayne State University, and Roger Rood, a teacher at Stevenson High School. The work started during this week was extended into the fall of 1967 through the establishment of an additional eight two-hour sessions. The number of teachers involved in these sessions was expanded to twenty-four. Terrence Coburn, a teacher from the Muskegon Public Schools, and Henry Lundy and John Bingham, Livonia High School teachers, each conducted one session. The other five sessions were devoted to the development of special materials by the participants.

The school year 1967-68 was characterized by, ". . . the increase in curricular activity at the junior hihg school level and the growing pressure of the sheer increase in numbers of schools, teachers and students in the secondary schools."[2] This year saw the appointment of mathematics instructional materials committees for: Second Year Algebra and Advanced Placement Mathematics II, Mathematics for Seventh and Eighth Grade Slow Learners, Basic Mathematics, and Basic Algebra. While the title of instructional materials committee had existed for several years, supplanting the previous designation of textbook selection committee, this was the first year that several committees approached their task from an

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[1]Charles J. Zoet, Year-End Report - 1967-68 (Livonia, Mich.: Livonia Public Schools, 26 June 1968), p. 11.

[2]Ibid., p. 1.

instructional materials point of view.[1] The recommendations from the Basic Mathematics Committee and the Seventh and Eighth Grade Slow Learner Committee consisted of sets of materials including: a basic text, a computational skills kit, achievement tests, and supplementary workbooks.

The types of program innovations which had been started during the 1966-67 school year were extended and expanded upon in 1967-68. It was stated that,

> Previously changes have tended to focus on new courses, new content for older courses or program reorganization generally. This year the emphasis tended to swing to teaching our courses in such a way that more students could be more successful than in the past.[2]

The members of the SMC found that they were serving as key members of the instructional materials committees. Consequently, the SMC did not undertake a major project for the year but rather devoted much of its time to assisting these committees, planning for in-service activities, and making itself aware of the innovations occurring in the mathematics programs of the individual schools.

This year also saw increased attention paid to evaluative aspects of the mathematics program. At Bentley High School a comparative study of student success in Geometry for students who had taken Algebra I and Basic Algebra I and II revealed that many students from Basic Algebra II succeed quite well in Plane Geometry but that they did not succeed as well as students from Algebra I.[3] At Holmes and Emerson Junior High Schools standardized tests were administered to measure achievement in Algebra I. At both schools

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[1] Ibid., p. 8. [2] Ibid., p. 5. [3] Ibid., p. 13.

the students tested had mean scores above the norms reported by the publishers.[1]

The systemwide testing of eighth grade students on the Iowa Test of Basic Skills caused concerns this year as the students scored average or slightly below average when compared to the publishers national norms.[2] These scores were not in keeping with expectations. As a result the SRA Modern Math Test was administered to a random sample of eighth grade students later in the year.[3] On this test the median Livonia eighth grade students scored at the 57th percentile of the publishers norms. No immediate program changes resulted from the various test data. This data did, however, form the foundation for concerns several years later.

By the fall of 1968 questions were being raised by junior high school teachers regarding the elementary school mathematics experiences of incoming seventh grade students. Most of these questions were based on the adoption of new materials in the elementary schools two years earlier and the recognition that students could be expected to have changed levels of knowledge of specific topics. Some answers to these questions were provided in a letter to the seventh grade mathematics teachers drafted by the Secondary Mathematics/Science Coordinator.[4] In this letter it

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[1] Ibid., pp. 13-14.

[2] For a summary of yearly scores in mathematics see appendix E.

[3] Zoet, Year-End Report - 1967-68, p. 14.

[4] Charles J. Zoet to Junior High School 7th Grade Mathematics Teachers, "Elementary School Mathematics Program," Livonia, Mich., 24 September 1968.

was indicated that based on observations by both the Elementary and Secondary Coordinators during the three years that the present text had been used: (1) elementary teachers had a tendency to bypass work on geometry, measurement exercises, decimals, percent, and negative numbers when they did not have time to finish the text materials with a class; and (2) increasing numbers of students could be expected to have more work with: equations, the number line, the concept of function, estimation, and set terminology.[1] It was indicated that these observations would be included in the considerations of the instructional materials committees on seventh and eighth grade mathematics which would be meeting during 1968-69.

The SMC formed two sub-committees for the year. One was designated to recommend a mathematics program evaluation to be undertaken on a systemwide basis. The second was charged with the task of gathering and disseminating information on innovative mathematics programs in the school system.

In-service activities during the year were of two types. A workshop for teachers of slow learners in mathematics, similar to the workshop of the previous year, was offered. A group of nine junior high school teachers and four high school teachers participated in this workshop. The second in-service activity involved the writing of behavioral objectives. Representative groups of high school teachers were selected to write behavioral objectives for each of the mathematics courses in the high school program. The request to hold this workshop activity, which origin-

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[1] Ibid.

ated from the high school mathematics department chairmen, indicated that,

> In the nine year period during which the number of high schools in Livonia has increased from one to four, the basic mathematics program of the existing schools has been adopted by each new school as it has opened. . . . At no time during this period, however, has there been a concerted effort to study and develop a standardized set of objectives for use on a system-wide basis.[1]

This workshop was funded under the system's Title III grant for Program Improvement and by June 1969 behavioral objectives had been written for ten courses in the high school mathematics program. These sets of objectives were distributed to all high school staffs but were never extensively used to implement any changes in classroom teaching. During this same period, a set of Performance Goals for Seventh and Eighth Grade Mathematics were also developed.[2] These goals were written with the idea that they would be within the reach of average students and that they would be expected to provide the major focus for the seventh and eighth grade program.[3]

The Effects of Reduced Funds

In September 1968 several cutbacks in personnel and services

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[1]Livonia High School Mathematics Chairmen to Donald E. Friedrichs and Glenn F. McAdam, "Determining Areas of Agreement on Mathematics Concepts Presently Taught in Mathematics Courses in the Livonia Public High Schools and the Statement of Behavioral Objectives for These Concepts," Livonia, Mich., 13 January 1969, p. 1.

[2]Department of Secondary Education, Performance Goals for Seventh and Eighth Grade Mathematics (Livonia, Mich.: Livonia Public Schools, 9 April 1969).

[3]Charles J. Zoet to Junior High School Principals and Mathematics-Science Chairmen, "Attached List of Seventh and Eighth Grade Objectives," Livonia, Mich., 11 April 1969.

occurred across the system. The Director of Secondary Education stated, ". . . the secondary educator in Livonia is faced with 10% more students without any increase in teaching personnel and without many services from supporting personnel which he enjoyed last year."[1] Among the reductions, some of which resulted from the negotiations between the Board of Education and the LEA, which directly effected the mathematics staff were the elimination of released time for department chairmen and the elimination of an hour of preparation time fo the instructor of the senior Advanced Placement class. One of the first acts taken by the SMC upon its activation in the fall of 1968 was to write a letter to the Assistant Superintendent in Charge of Instruction. The SMC strongly opposed the cutbacks and urged that the released time for each of the positions be restored at the earliest possible time.[2] This letter brought a positive response from the Assistant Superintendent but no immediate changes were implemented.[3]

The defeat of a millage proposal in the spring of 1969 had an even greater effect on the programs of the system. The first effect on the mathematics program was the cancellation of several workshops which the SMC had recommended for the summer of 1969.

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[1]Donald E. Friedrichs, "A Year For Assessment," Secondary Spotlight, vol. 4, no. 1 (Livonia, Mich.: Department of Secondary Education, Livonia Public Schools, n.d.).

[2]Secondary Mathematics Advisory Committee to Dr. Paul Johnson, "Concerns about the quality of the mathematics program," Livonia, Mich., n.d.

[3]Paul E. Johnson to Joint Advisory Committee on Professional Agreement Administration, "Memorandum from Secondary Math Advisory Committee re: Released Time for Mathematics Chairmen and Advanced Placement," Livonia, Mich., 24 January 1969.

Its most immediate effect on students in the secondary schools was the reduction of the student day by one-half at the seventh and eighth grades. The problem of half-day schedules, as it effected the mathematics program, was explained at one junior high in the following manner.

> Half-days do not mean half teaching. It is expected that 7th and 8th grade students will get at least 2/3 of the regular course even if on half-days all year. Give homework for study, for practice, for learning, or for fun, but give it at least 4 out of 5 days that you have students.[1]

In meeting the time parameters imposed by the half-day of student attendance, some schools chose to offer mathematics on an every-other day basis while other elected to hold classes for shortened periods each day. This meant that the amount of time that these students were in attendance in mathematics classes for this year was reduced by about one-fourth.

The loss of the millage also had an effect on the composition of the SMC. The change in schedule for the junior high schools, caused by operating two half-day sessions, made it impossible to hold regular joint meetings of junior and senior high school representatives.[2] As a result, two separate committees were formed: the Junior High School Mathematics Advisory Committee and the Senior High School Mathematics Advisory Committee. The charges to these two committees for the year were directed at problems and

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[1] Mathematics News 3 (Livonia, Mich.: Emerson Junior High School Mathematics Department, 15 September 1969).

[2] Donald E. Friedrichs to High School Principals, "Senior High School Curriculum Steering Committee Meeting - August 15, 1969," Notice No. DI-1164, Livonia Public Schools, 5 September 1969.

concerns within their own levels. This resulted in a reduction of communication between the two levels.

The major concerns of the high school committee were: the writing of pre-tests for senior high mathematics courses; the formation of instructional materials committees; and the implications of the eighth grade algebra programs for the high school program.[1] During the year pre-tests were written for Algebra II and for Trigonometry. It was intended that, following the establishment of systemwide norms, these tests would be used to help predict student success in these courses. With the division of the district into two regions the following year, the tests were not used on a consistent basis in all schools and systemwide norming of the tests did not take place. The pre-test for Algebra II, however, did continue in use at both the junior and senior high schools through 1975.

High school instructional materials committees were formed for: Refresher Math, Modern Topics in Math, Trigonometry, Solid and Analytical Geometry, and Calculus. The reports of these committees were submitted in May 1970. None of these committees recommended a change in the basic text for the course. Each of them recommended, however, that the most recent edition of the adopted text be used in the course and the Refresher Math Committee recommended that workbooks and individualized materials be added to the list of basic materials for that course.

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[1]Charles J. Zoet to SENCOM, "Suggested Charge to the Senior High School Mathematics Advisory Committee," Livonia, Mich., 9 September 1969.

A concern of the High School Committee during the year was the increased class sizes in the Refresher Math classes. As originally conceived this course was to have a limited class size in order to provide for the individual needs of those students who required remedial help. However, along with other courses which had been established with limited enrollments, class size had been gradually increased as financial problems caused the district to increase pupil/teacher ratios. In March 1970 the committee stated in a communication to the high school principals,

> It is the painful obligation of this committee to indicate that in its judgement, where reasonable class sizes and enrollment practices cannot be maintained, the Refresher Mathematics class serves no useful purpose for students and, in fact, can provide a serious disservice.[1]

While the enrollment in these classes was never reduced to the size that the High School Mathematics Committee would have liked, the Refresher Mathematics course was included in the list of courses whose size was to be restricted in comparison with other classes in the high schools.[2]

The Junior High School Committee focused on the assessment of the junior high school mathematics program, the needs for in-service training of junior high school teachers, and the problems associated with facilitating the learning of mathematics by students on a half-day schedule. In March 1970, based on the recommendation

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[1]Charles J. Zoet to High School Principals and Mathematics Department Chairmen, "Refresher Mathematics," Livonia, Mich., 11 March 1970.

[2]Paul E. Johnson to Administrative Staff, "Class for Slow Learning and Remedial Students," Notice No. DI-1245, Livonia Public Schools, 10 June 1970.

of the Junior High Committee, teams of teachers were appointed to prepare performance goals for Algebra I and Basic Algebra I and II.[1] The Algebra I team was composed entirely of junior high teachers while the Basic Algebra team was composed of equal numbers of junior and senior high school teachers. The writing of these sets of objectives completed the development of behavioral objectives for all mathematics courses for grades 7-12.

The Broken Front Approach In Practice

Beginning in 1965-66 and continuing through 1969-70, a large number of activities not directly under the leadership of the SMC occurred in individual buildings. These activities were generally planned to differentiate and individualize instructional patterns and followed the "broken front" appraoch to curriculum development advocated by the Division of Instruction. The activities and experiments which were undertaken were numerous and of varied types. The activities described in this section are included because they are representative of the general efforts or because they mark the beginnings of efforts which extended into the 1970s and in some cases are still functioning.

In 1965-66 the Mathematics Department Chairman at Bentley High School, Thomas Hartsig, introduced an experiment in the individualization of instruction in trigonometry. The course was conducted in a manner that emphasized independent study and extensive

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[1]Charles J. Zoet to Junior High School Mathematics Advisory Committee, "Teams to Prepare Performance Goals for Algebra and Basic Algebra I & II," Livonia, Mich., 5 March 1970.

individual responsibility. Assignments were given on both a long range basis, three to five weeks, and on a short range, weekly basis. The instructor gave short formal presentations only two or three times a week. Following completion of this semester course, it was concluded that, "The experience for most students was a difficult one to adjust to."[1] On a common examination given to this class and those conducted by two other teachers, the experimental class scored much lower.[2] Some of the top students in the class, however, indicated that they had enjoyed the freedom that the class offered and had found the experience stimulating. The following year this experiment was continued by Roger Strong, who was appointed Mathematics Department Chairman when Hartsig left the system. It was felt that the first years experiment had left many questions still unanswered. Thus a second attempt was made to answer the question, "Can students better improve achievement and/or attitude in mathematics by studying and learning in an individualized atmosphere than in the traditional classroom atmosphere?"[3]

During the second year two classes were compared. One class was taught in a traditional manner. The other class was taught with a minimum of class discussion. Students worked at their own

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[1]Thomas Hartsig to Jack Comstock and Charles Zoet, "An experiment in independent study in the learning of trigonometry," Livonia, Mich., n.d., p. 3.

[2]Ibid.

[3]Bentley High School Mathematics Department, "Mathematics Department Experiment in Independent Study," Livonia, Mich., 26 October 1966.

pace and received formal instruction on an average of twice a week. The results of this second year of the experiment were more positive.

> This experiment certainly indicates that trigonometry students can perform just as well without meeting every day for a formal class. Two days per week in class seems to be sufficient to present new material. This study also indicates that serious mathematics students can probably learn as much by studying independently as they can in a structured situation if we do not put them completely on their own in the beginning. It should be pointed out, however, that this study in no way indicates that students can learn as well in the absence of a teacher. The teacher was always present for help during study periods and the students relied heavily on the teacher as a resource person.[1]

Even though this experiment had shown some success, it was not continued at Bentley and the teaching of trigonometry the following year reverted to a more traditional pattern.

During 1965-66, John Bingham, a teacher at Franklin High School, began the development of "Single Concept Presentations for Individual Remedial Mathematics Students." His work involved the extensive use of audio-visual materials to present mathematics concepts. Based on his initial work he applied for and received a grant under the Elementary Secondary Education Act for the school year 1966-67.[2] This grant which paid half his salary for the year provided him released time to work on the production of materials. This work, which was conducted with initial help from the Mathematics Coordinator and from Dr. Joseph Payne of The University of Michigan, resulted in the development of slide presentations,

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[1]Bentley High School Mathematics Department, "Reports on Mathematics Department Innovations," Livonia, Mich., 7 March 1967, p. 7.

[2]Secondary Spotlight 2 (Livonia, Mich.: Department of Secondary Education, Livonia Public Schools, November 1966).

video tapes, and audio tapes. The initial reaction to the materials was positive and during the time that Bingham was with the system they were used successfully in the Refresher Mathematics classes at Franklin.[1] After he left the system, there was little use made of the materials or methods which had been developed.

A systemwide movement which was occurring at this time at the high school level was the investigation and implementation of modular scheduling. The planning for the fourth high school which was done in the fall of 1965 recognized this movement. The report of the High School Planning Committee on Mathematics Facilities, which consisted of the Mathematics Department Chairmen of the three existing high schools and the Mathematics-Science Coordinator, recommended the inclusion of five areas for the mathematics program: (1) traditional classrooms, (2) a computer laboratory, (3) a large group instruction area, (4) an individualized instruction area, and (5) teacher workspace.[2] It was recommended that these areas be located in such a manner that they would provide for great flexibility. These recommendations were, to a significant extent, included in the final plans for the building. This high school, Churchill High School, however, never adopted a modular schedule and the facilities have been used to operate a traditionally scheduled program.

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[1]John D. Bingham to Veryl Schult, "Quarterly Report, January 1, 1967, on Project No. 6-8510; Contract No. OEC-3-7-068510-0185," Livonia, Mich.

[2]Charles J. Zoet, "Report of the High School Planning Committee on Mathematics Facilities," Livonia, Mich., 18 October 1965.

While Churchill was being planned, teachers in the other high schools were beginning to implement team teaching practices, large and small group instruction, and to acquaint themselves with the methodology to implement modular scheduling. During 1965-66 two teachers at Franklin High School, Fran Smith and Dean Waldfogel, attempted team teaching in Plane Geometry to determine whether this course would lend itself to team teaching. They did feel that it was adaptable and also that it required a better job of teaching.[1] The following year the teaching team was expanded to three members and a majority of the Plane Geometry sections at Franklin were taught in a team setting. In the instructional pattern used, students met twice weekly in groups of 90 to 120 students for lectures and twice weekly in small group meetings of approximately ten students for discussion sessions. A special mathematics center was provided, in connection with the instructional materials center, for students to use during the time provided in their schedule for independent study.

> A comparison of the achievement of modular geometry students to those taught in traditional classes at the other two high schools clearly revealed that the modular students achieve at least as much as traditional students. Subjective observations of teachers indicated that modular students develop the ability to evaluate and organize their own work more suitably then traditional students. However, more of the slower tend to be cajoled into maintaining some slight progress in traditional classes than modular classes.[2]

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[1] Bentley High School Mathematics Department, Minutes of the Department Meeting of 8 April 1966.

[2] Charles J. Zoet, Year-End Report - 1966-67 (Livonia, Mich.: Livonia Public Schools, 15 June 1967), p. 9.

The following year both Franklin and Stevenson High Schools implemented modular scheduling on an extensive basis. At each school this included the development of teaching teams in mathematics. For three years Plane Geometry, Basic Algebra II and Algebra II were all taught by teams. At the end of 1969-70 when the Title III grant ended, the district did not feel that it could continue to support in-service workshops, pay resource center aides and pay the additional personnel who had worked under the grant. Thus the use of modular scheduling was ended in the high schools. By the time that this occurred many of the mathematics teachers at the two high schools were happy to see the demise of modular scheduling. Their dissatisfactions were in general related to problems with attendance, student use of independent study time and scheduling problems rather than the quality of the mathematics being learned.

During the period of modular scheduling teachers wrote Unipacs. These were self-instructional units built around a single fundamental principle or concept. These Unipacs covered a variety of topics in algebra, geometry and trigonometry.[1] Even though districtwide distribution was made of the units, each unit was most often used in the classes of the teacher who had written the unit. With a few exceptions, these units were used without formal evaluation. Teachers based the continued use of a unit on their individual feelings of student success or failure with the unit.

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[1]For a list of Unipacs developed in the Livonia high schools see appendix G.

In 1968 Gary Vance, a teacher at Stevenson High School, conducted an experiment on teaching the trigonometric functions based on the unit circle. He compared a traditional class approach to this topic to instruction by means of a Unipac which he had written. On a post-test the group of students who had studied from the Unipac performed significantly better in their understanding of the concepts.[1] The writing of Unipacs continued through the summer of 1970 when funds from the Title III grant ceased to be available. Following that time little use was made of these materials.

A Technical Mathematics course which received official approval for the 1969-70 school year was the direct result of individual building efforts rather than the direction of the SMC. Such a course was first proposed at Bentley High School in the spring of 1966.[2] At that time it was noted that,

> Our present applied mathematics program tends to emphasize theory, more than application. Therefore, there appears to be a need for a course which offers students the opportunity to study mathematics through application to technical areas.[3]

The content of the course was to be identified by working closely with the Industrial Arts Department. Following some extended discussions of this proposal, a pilot section of the course was taught during the second semester of 1966-67. This course was

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[1] Gary L. Vance, "An Experimental Approach to Teaching a Mathematics Concept in Trigonometry," Livonia, Mich., n.d.

[2] Thomas Hartsig to Dr. Paul Johnson, "A Proposal for a Pilot Course in Technical Mathematics," Livonia, Mich., n.d.

[3] Ibid., p. 1.

favorably received by students.[1] The following year the course was again taught on a pilot basis and achieved favorable results. During this year the Franklin High School staff also proposed establishing a similar course. As a result a combined planning workshop was held during the summer of 1968. Ronald Fedraw and Robert Selke, mathematics teachers at Bentley and Franklin, respectively, and Allen Herrmann, industrial arts teacher at Bentley, worked to reorganize the materials for Technical Mathematics so that they could be used on a common pilot basis during 1968-69.[2] Following the development and trial of this program by the two high schools, it was formally adopted by the Board of Education and added to the program of the district for 1969-70.

Another experiment was initiated at Bentley in 1968. This was the establishment of experimental class sections in Basic Algebra I. The instructors assumed that the major problem of the students enrolled in this course was the lack of a positive attitude toward the learning of mathematics.[3] In an attempt to overcome this problem, the classes were conducted in a very informal manner and little or no expectation was placed on students for the attainment of specific content at particular times. The instructors

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[1]Roger Strong to Jack Comstock, "Technical Math Proposal," Livonia, Mich., 20 November 1967.

[2]Ronald Fedraw, Allen Herrmann, and Robert Selke, "Technical Mathematics Workshop," Livonia, Mich., n.d.

[3]"Spotlight on Changing Attitudes Toward Learning," Secondary Spotlight 5 (Livonia, Mich.: Department of Secondary Education, Livonia Public Schools, May 1969).

attempted to develop a long range growth in attitude. In this way they anticipated that during a relatively short period of time near the end of the year, these students could learn the content that most students in Basic Algebra I learned during the total year. This approach had been approved by the principal of the school in 1967-68. It did not meet with the approval of the new principal appointed for 1968-69. He felt that the handling of the problems of these students should be taken care of through the counseling process and that more traditional classroom methods needed to be maintained.[1] Thus, even though end of the year comparisons of these students with a control class at Stevenson High School were positive on measures of both content knowledge and attitude, the experiment was discontinued following this one year.[2]

The Broken Front Approach in the Junior High Schools

During the period from 1965 to 1970, much of the work in the individual junior high schools tended to stress individualization, non-gradedness, and the use of materials such as games and learning packets. In 1966-67 the Emerson Junior High School staff started working on activities to meet the diverse needs of their students. With the assistance of William Fitzgerald of Michigan State University, they developed a list of program features which they felt

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[1]Albert Zack to Dr. Donald Friedrichs, "Experimental Class-Basic Algebra," Livonia, Mich., 5 December 1968.

[2]Peter Moloney to Kenneth Haug, Herb Van Hooser, Larry Sroka, "Attitude Survey Results," Livonia, Mich., 12 June 1969.

they could support. These included a mathematics laboratory, a skills laboratory, adjusting goals to students, and individualized study programs. During 1967-68 they experimented extensively with the use of games and manipulative devices in a mathematics laboratory.[1] The evaluation of this use was largely subjective. The staff did feel that they were successful in teaching students to use the games and that the students did learn concepts which were significant to their mathematics background. Concerns were expressed that there needed to be additional provisions to relate these experiences directly to the mathematics program. During the summer of 1968 two members of the staff, George Calder and Edward Segowski, spent five weeks developing a set of exercises built around games and manipulative materials.[2] These sets were distributed to all secondary schools in the district. No extensive use, however, was made of the set of exercises outside of Emerson.

Bryant Junior High School also implemented some mathematics laboratories during 1966-67. Their activities were designed to be motivational in nature and were used with seventh and eighth grade students who were of average ability but were one or more years behind in mathematics.[3] The following year the Bryant staff developed several team teaching programs. For Seventh Grade

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[1] Secondary Spotlight 3 (Livonia, Mich.: Department of Secondary Education, Livonia Public Schools, November 1967).

[2] Secondary Spotlight, vol. 4 no. 1 (Livonia, Mich.: Department of Secondary Education, Livonia Public Schools, n.d.).

[3] Livonia Public Schools, Minutes of Meetings of the Secondary Mathematics Committee, Meeting of 6 December 1966.

Mathematics and for Algebra I, two person teams were formed. In each course the students were placed in a variety of groupings for instruction and a large portion of the regularly scheduled class time was provided for independent study.[1]

During 1967-68 Whitman Junior High School formed a second eighth grade accelerated algebra class as a follow-up to its earlier experiment in offering eighth grade algebra. In the seventh grade they formed a special section for those students who had been identified as likely to experience a great deal of difficulty with mathematics. This section placed a strong emphasis on providing additional counseling service for the students who were enrolled.

Prior to the end of this year, the Mathematics-Science Coordinator reported that eight of the nine junior high schools were involved in some type of innovative activity in mathematics education.[2] He categorized these activities as: (1) selective grouping, (2) Unipac preparation, and (3) special efforts toward an individualized approach or independent study. Selective grouping at the four schools placed in this category involved the establishment of special groups for students of low achievement and the special eighth grade algebra section at Whitman. Holmes Junior High School, where the staff had developed a strong interest in a

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[1] Secondary Spotlight 3 (Livonia, Mich.: Department of Secondary Education, Livonia Public Schools, November 1967).

[2] Charles J. Zoet to JUNCOM, "Progress Report Junior High School Mathematics," Livonia, Mich., 5 April 1968.

non-graded, learning packet approach to teaching mathematics, was place in the category of Unipac preparation. The activities which placed schools in the third category of individualized approach or independent study were: scheduling two sections of 7th or 8th grade classes back to back to permit individualized enrichment; preparation of activities packets; mathematics labs; select grouping of algebra students; and team teaching.

Among the most significant of the individual building efforts were those instituted at Holmes and Riley Junior High Schools. In the spring of 1968, the Holmes staff proposed an experiment in the teaching of algebra.[1] They proposed to have a team of three teachers working with a group of approximately 90 students. The first several weeks of the class would be devoted to review and diagnostic testing of each student in the group. Following this period, students would be assigned to particular learning units based on their background. The progress of students through the units would be based strictly on achievement. Students would move to a new unit only after they had demonstrated proficiency on the previous unit. The staff indicated that they wished to implement this proposal because of dissatisfaction with the three track program, the frustration/boredom of students who are not able to move ahead of the majority of the class, and the frustration of students who are unable to keep up with the majority of the class. The proposal was accepted and this approach was implemented at Holmes

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[1]Barbara Mauller, James Rice and James Tomlinson to John A. McDonald, "Proposal for Experiment in Teaching Algebra," Livonia, Mich., 22 April 1968.

1968-69. The evaluation of the first year of this approach indicated that,

> This design was found to lend itself in particular to the student of average intelligence who shows a high degree of scholastic maturity. . . . On the lower end of the scale, students of low ability tended to take advantage of the "retake no fail" situation to hopefully build confidence in their own skills.
> . . . it is evident from the growth data that the experimental program compared favorably with the standard program. . . . As the program proceeds into its second phase, and refinements in technique and materials are brought into play, the unit achievement program should be challenging and beneficial to both teachers and students.[1]

During 1969-70 the second phase of the Holmes' project was completed. Over 50 percent of the ninth grade and a small number of eighth graders worked through the individualized program. The staff was realistic in recognizing that this type of program was not the most desirable for all students and that organizational problems did not allow the teachers to provide all of the individual help that students needed. In the summary of the results for the second year it was stated that,

> It was found that students could proceed through a series of units at a rate commensurate with ability, interest and skill; and that these students would grow mathematically at rates greater than, equal to, and in some cases, less than the rates of students in traditionally taught classes.
> The matching of appropriate materials to level of student interest and skill became much more evident as the program involved greater numbers of students. In order to implement the learning process for students of varied levels, units, lessons, and tests at multiple levels were and are being produced.
> The opportunities for individual contacts nearly always outnumbered the actual number of contacts. Hopefully, with

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[1]Barbara Mauller, James Rice, James Tomlinson and John A. McConald to Dr. Paul Johnson and Dr. Donald Friedrichs, "Preliminary Report of the Holmes Algebra Learning Units Project," Livonia, Mich., 17 June 1969, pp. 3-4.

> the assistance of an instructional aide and speedier methods of evaluating work, more time may be spent on instruction.
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> Teachers at seventh and eighth grade levels have familiarized themselves with the program through their functioning in the Open Lab situation. Materials have been ordered, and more will be produced to allow this program to extend down into grades seven and eight.[1]

In the spring of 1969 the staff of Riley Junior High School submitted a proposal for a two year program similar in methodology to that used at Holmes but designed for grades seven and eight. They identified the goal of the program to be, ". . . the completion of the seventh and eighth grade behavioral objectives by the student, hopefully, in two years, but if not, to provide a longer period of time for work on such goals."[2] During 1969-70 about 350 seventh and eighth graders at Riley were taught using this non-graded, phased, continuous progress concept. While the teachers were very satisfied by the progress during this year, no formal evaluation took place. The principal at Riley, Lawrence Nichols, indicated following this first year of operation,

> The staff who have been involved in this project have worked diligently and, I might add, successfully this year. However, the next school year will be critical for the future of mathematics instruction here at Riley. Next year work will continue on the development of materials for individualization and diagnosis, but we feel that much of the emphasis must shift to evaluation of the results of the project.[3]

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[1] James Rice and James Tomlinson to John A. McDonald, "Summary of Workshop on Learning Units Program of Continuous Progress at Holmes Junior High School, 1969-70," Livonia, Mich., 22 June 1970, pp. 4-5.

[2] Thomas Pobanz and Adele Sobania to Dr. Donald Friedrichs, "Summer and Fall Workshop for Year 1969-70," Livonia, Mich., p. 1.

[3] Lawrence J. Nichols to Dr. Henry Heusner, "Mathematics Project-Riley Junior High School," Livonia, Mich., 30 April 1970.

The attempts at implementing these individualized programs during 1969-70 were complicated and hampered by the half-day schedule for seventh and eighth grade students which had been imposed following the millage failure. It was only because of the great teacher interest that the programs operated successfully.

Summary

By 1964-65 the adoption of texts which were expected to provide a "modern mathematics" program in the Livonia secondary schools was nearly complete. Texts with this approach had been adopted for 7th and 8th Grade Mathematics, Algebra I, Applied Math I and II, Plane Geometry and Algebra II. Thus the period from 1964 to 1970 encompasses the problems encountered in Livonia in attempting to make "modern mathematics" work and the program changes and innovations which resulted.

During this period the Coordinator of Secondary Mathematics and Science maintained a high level of teacher involvement in all recommendations regarding the mathematics program. This involvement took place through the Secondary Mathematics Committee which consisted of representatives of all secondary buildings. The committee met at least monthly throughout the period from 1964 to 1970 and coordinated the work of all apecial mathematics committees which were appointed.

A major concern of this period was how to obtain a sufficent number of well trained mathematics and science teachers for the junior high schools. A philosophical commitment by the district to the teaching of mathematics and science as a block in grades

seven and eight required the recruiting of teachers qualified in both areas. It was difficult to hire such teachers and a conflict arose between the need to obtain qualified teachers and the philosophical commitment. This conflict was finally resolved with the abolition in 1967 of the requirement for each school to maintain the block in mathematics and science.

Major program changes during this period included the establishment of a program of accelerated junior high school algebra, the adoption of text materials for slow learners in mathematics in grades seven and eight, and the introduction of new instructional mehtods in both junior and senior high schools. Whereas many districts had established accelerated junior high school algebra programs as early as 1960, which is about the time Livonia established the Advanced Placement Program in the high schools, it was not until 1970 the Livonia formally adopted the concepts of accelerated algebra for the junior high school.

The adoption of special materials for slow learners in grades seven and eight was a response to difficulties encountered in using the "modern mathematics" materials with these students. As a result, materials were selected which placed less emphasis on the formal structure of mathematics than did the regularly adopted materials.

The introduction of methodological innovations in the secondary schools was implemented on a building basis rather than districtwide. These innovations included modular scheduling, team teaching, individualized instruction and the use of math laboratories. The introduction of these innovations on a building basis was in

keeping with the "broken front" approach to curriculum development under which Livonia operated during the 1960s. The extent to which these innovations maintained themselves was dependent upon the success of the individual schools and the extent of financial support which the system could provide. The defeat of several millage issues and the associated cutbacks in programs did have adverse effects on several of the efforts in mathematics education during this period.

The Mathematics Program: 1970 to 1975

System Organizational Patterns

Curriculum change in Livonia from August 1970 to January 1975 was characterized by two features. These were the administrative structure for curriculum development and the movement of the district toward the development and use of behavioral objectives in all curricular areas. The administrative reorganization in 1970 eliminated the division of curricular responsibility between Elementary and Secondary Departments. Under the reorganization these responsibilities were divided between two regions which were formed on a geographical basis: the Franklin/Churchill Region and the Bentley/Stevenson Region. It was planned that these two regions would share the broad based goals of the school system but would operate as autonomous units in curriculum planning and implementation. Each region was to have flexibility with regard to exact content, teaching methods and organization. It was expected that this structure would provide increased opportunities for teachers to become involved in curriculum changes and that improved articulation

of the program from kindergarten through twelfth grade would result from this change. The immediate effect of this change on the leadership for mathematics education was the reassignment of William Kumbier and Charles Zoet to the positions of Coordinator of Mathematics and Science K-12 for the Bentley/Stevenson and Franklin/Churchill Regions, respectively.

The regional structure was retained until January 1975 when the regions were dissolved. Administrative responsibilities were returned to Elementary and Secondary Departments and a Department of Curriculum Development was formed. In this reorganization, Charles Zoet was appointed Coordinator of Mathematics K-12 for the total district and William Kumbier was appointed to a similar position in science.

The second feature which characterized curriculum change during this period, the use of behavioral objectives, probably had a much greater effect on the instructional program then did the changes in administrative structure. Prior to this period much of the work related to the development of behavioral objectives had been the result of the leadership of individual coordinators and project directors. The Title III grant which had been used to implement changes in the high schools had served as a source of funds to support such efforts. This initial work together with an impetus provided by the work of the State Department of Education in writing minimal performance objectives formed the basis for organized districtwide efforts. In May 1973, the Deputy Superintendent stated, "The advent of statements of objectives for Michigan schools and the State plan for assessment have suggested the

desirability of relating local patterning to that of the State for most effective coordination and use of local and state data."[1]

To this purpose it was determined that:

1. Statements of systemwide objectives for a given "common learnings" subject area (i.e., social studies, science, etc.) shall be related to expected achievement over a three-year time period, e.g., Grades K-3; 4-6; and 7-9 thus paralleling the Michigan organization of minimal objectives.

2. Such statements of systemwide objectives as those mentioned in a., above, shall fully represent the minimal State objectives as well as those determined of importance locally, in addition.

3. Statements of objectives shall include skills of various types, understandings, concepts, and other types of learnings whose achievement may stem more from the learning process than the particular nature of the subject matter; also included shall be significant information, understandings, concepts and affective learnings which may relate directly to the specific nature of the subject matter.

4. Once stated and offically approved such statements of objectives are the basic representation of the instructional program. They provide the basis for selecting learning experiences offered our students. They provide the basis for selecting instructional materials to serve in developing these experiences. They provide the basis for selecting the strategies and techniques through which students, teachers, other persons and aspects of the environment interact.[2]

A systemwide steering committee consisting of teachers and administrators was established in October 1973 to oversee the development of behavioral objectives.[3] At the direction of this

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[1]Paul E. Johnson to All Staff Members Involved in Instructional Program Studies, "Clarification of Guidelines Related to Instructional Program Studies and Instructional Materials Selection," Notice No. SO-620, Livonia Public Schools, 15 May 1973.

[2]Ibid., pp. 2-3.

[3]Lawrence J. Nichols and Donald E. Friedrichs to Members Systemwide Steering Committee and Building Principals, "Proposed

committee eight priority areas were identified and Ad Hoc groups were charged with formulating statements of minimal objectives for their respective areas. Three of the eight areas identified were: K-3 Mathematics, 4-6 Mathematics, and Junior High School Mathematics.[1] By the end of June 1974, all of these groups had developed sets of objectives which had been reviewed by teachers groups. These sets of objectives were officially accepted by the appropriate principals' groups in the fall of 1974. Thus, in the fall of 1974 there existed a description of the mathematics program of the Livonia Public Schools in terms of a set of minimal objectives for grades K-9 and a set of course objectives, which had been written in 1969 and 1970, for all courses for grades 7-12.

Regional Committee Structure and Operation

When the two regions were formed in 1970 they each established their own organizational pattern for curriculum work. The Franklin/Churchill Region adopted a highly structured committee organization for each of the subject areas which was headed by a coordinator. The Bentley/Stevenson Region chose to implement a more informal structure involving large meetings of curriculum representatives and department chairmen with special committees being appointed as a need was identified.

Process for Defining Minimal Instructional Objectives," Notice No. RBS?_FC-699, Livonia Public Schools, 18 October 1973.

[1]Paul E. Johnson to Instructional Staff, "Statement Describing the Work of the Systemwide Steering Committee on Minimal Instructional Objectives Bulletin #2," Notice No. SO-815, Livonia Public Schools, 7 March 1974.

As a part of the emphasis on K-12 articulation which it was hoped regionalization would help to promote, four two-day meetings were held outside the district during late September and early October 1970. Each of the meetings was attended by the department chairmen and curriculum representatives in mathematics, science, English, and social studies from one of the high schools and those elementary and junior high schools which served as feeder schools to that high school. The purpose of these meetings was to allow the leadership people to become acquainted and to develop some basic understandings of programs that existed in those schools that served the same area of the district. These meetings were apparently successful since the following statement regarding their effect on the mathematics program appeared in an end of the year report.

> The leadership training sessions at Waldonwoods and the Wilcox Instructional Materials Center were significant activities during the past year. Through them a background was set for K-12 communications which was drawn on throughout the year. These sessions also helped to pinpoint the common problems existing at all three levels and in some cases led to specific efforts to resolve those problems.[1]

Following these meetings each region began to function within the structure which had been established by its Director. In the Bentley/Stevenson Region two mathematics/science groups were organized and met on a K-12 basis within subregions. Each subregion was centered about one of the high schools in the region. Throughout the fall, these groups met to exchange information

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[1]Charles J. Zoet to Donald E. Friedrichs, "End of the Year Report - Mathematics/Science June - 1971," Livonia, Mich., June 1971, p. 5.

concerning the mathematics and science programs at each level: elementary, junior high, and senior high. By February 1971 the mathematics and science teachers in the Bentley subregion had formed into two groups and a Committee on the Unification of the Mathematics Curriculum was appointed for this subregion.[1] This committee was charged to secure and review the objectives currently in use in Livonia schools; compare such objectives with other such lists and if necessary revise existing objectives and/or integrate additional objectives for the mathematics curriculum with the ultimate purpose of presenting a K-12 set of sequential mathematics objectives.[2] As a result of the work done by this group and similar activities which were taking place in the Stevenson subregion, a group of eight teachers worked during the summer of 1971 on developing and reorganizing the mathematics objectives for the region in grades K-8. The results of this work were distributed in August 1971 under the title, Performance Goals for Mathematics K-8.[3]

In the following year, 1971-72, no major committees on mathematics operated within the region. Meetings of curriculum representatives and department chairmen continued to be held on a monthly basis, as they had during the previous year. The goals

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[1]William K. Kumbier to Dr. Heusner, Principals of the Bentley Area, "Establishing Committees for Promoting K-12 Articulation in Science and Mathematics," Livonia, Mich., 14 December 1970.

[2]William K. Kumbier to Bentley Area Math/Science Curriculum Representatives, Department Chairmen, Principals, "Charge to Bentley CUMC Group," Livonia, Mich., 9 February 1971.

[3]Bentley/Stevenson Region, Performance Goals for Mathematics K-8 (Livonia, Mich.: Livonia Public Schools, August 1971).

for the mathematics curriculum which were identified for this year were: (1) to improve the arithmetic computational skills of upper elementary and junior high students, and (2) to increase efforts to individualize mathematics teaching in grades 4-8 across the region.[1]

In October 1972 a regional K-12 Mathematics Curriculum Study Group was approved.[2] This committee was a total region group as compared to the subregional group formed in the winter of 1970-71. The special emphasis of this group was to be placed on programs involving grades K-8. The group consisted of seven elementary teachers, five junior high teachers, two high school teachers, one media specialist, one learning specialist, one administrator from each level, and the Mathematics-Science Coordinator. The charge to the committee included a claendar which indicated that by May 1973 a statement of philosophy and objectives was to be completed and that recommendations for field testing of materials and/or needed program construction should be made. By May 1974 the committee was to have prepared complete recommendations for change and a calender that would suggest gradual implementation over a period of two or three years.

Between December and the following June this committee and the subcommittees that it formed met on a regular basis and made use of released time from classroom instruction which was provided

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[1]William K. Kumbier, "Proposed Regional Goals for Mathematics Curriculum Improvement," Livonia, Mich., 12 October 1971.

[2]Henry C. Heusner, "Regional Program Goal for Mathematics Curriculum Improvement," Livonia, Mich., 19 October 1972.

for by the Regional Office. In this process the Committee examined the mathematics programs at each level, reviewed recent test data and survey data which had been collected in the district relative to individualized programs, prepared a written statement of philosophy and goals, and established screening committees to examine new text series for elementary and junior high school programs and for selected courses at the high school.

During this year the two regions were charged by the Deputy Superintendent to be sure that they had developed and adopted a common statement of mathematics goals for the district. As a result of this direction, in March 1973 the two regions accepted the following set of ten goals.

> At the completion of their mathematics program in Livonia schools, every student should have made significant progress toward:
>
> 1. Being able to solve problems involving the basic operations with numbers.
>
> 2. Being able to apply the basic operations with numbers to real-life situations.
>
> 3. Being able to use the basic relations which apply to numbers and their common operations.
>
> 4. Understanding the basic concepts of measurement and being able to use a variety of measurement devices to determine measures such as time, weight, length, angles, area and volume with common units.
>
> 5. Understanding many of the non-metric properties of common geometric figures.
>
> 6. Become familiar with common metric relationships applying to geometric shapes such as scale drawings, similarity, pythagorean triples, etc.
>
> 7. Being able to substitute appropriate values for variables into formulas using +,-,x, to determine the values of a dependent variable.

8. Being able to solve the problems involving money which must be met by most consumers.

9. Recognizing and being able to use the symbolism and terms of mathematics which are in common use.

10. Being able to interpret and use the representation of numerical data and relationships in the form of charts, graphs and tables.[1]

Following the acceptance of these system goals, the Bentley/Stevenson committee completed its work and presented the following proposals.[2]

1. The Individualized Mathematics Program in use in selected elementary schools continue to be supported financially by the regional office.
2. Pilot studies of new text materials should be conducted during 1973-74 in elementary school mathematics, seventh and eighth grade mathematics and Algebra I.
3. A set of evaluation procedures which the committee had developed should be used in each of the pilot studies.
4. The text Advanced Mathematics: A Preparation for Calculus by Coxford and Payne be adopted for use in Trigonometry and Mathematical Analysis.[3]

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[1]Charles J. Zoet, "Mathematics Goals for Livonia Public Schools," Livonia, Mich., 14 March 1973.

[2]William K. Kumbier to Regional Math Study Committee, Principals, Math Department Chairmen, Elementary Math/Science Curriculum Representatives, "Summary of the Regional Mathematics Study Committee Meeting, May 23, 1973," Livonia, Mich., 1 June 1973.

[3]Arthur F. Coxford, Jr. and Joseph N. Payne, Advanced Mathematics: A Preparation for Calculus (New York: Harcourt, Brace & World, 1972).

These recommendations, except for the new text adoption, were implemented. The text adoption did not occur because funds were not available.

The structure for mathematics established in the Franklin/Churchill Region in 1970 involved the establishment of five standing committees: the Churchill K-12 Mathematics Committee, the Franklin K-12 Mathematics Committee, the Junior High School Mathematics Committee, the High School Mathematics Committee, and the Elementary Mathematics/Science Committee.[1] Each of these committees was composed of a representative from each building within the area of the committee's concern. In addition each committee had either one or two building administrators as members.

During 1970-71 the two K-12 committees studied the total mathematics program of the region. This study involved presentations by teachers from each level and discussions and exchanges of information with the commmittees. As a result the other three committees were able to focus their attention on the solution of problems that they identified within their own levels. The meetings of all of these committees were generally well attended except that the administrative members frequently found it difficult to free themselves to attend the meetings. This committee structure, however, was found acceptable and was continued during the existance of the region.

The only additional committees that were appointed were

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[1]Charles J. Zoet, "Mathematics and Science Committees 1970-71 Assignments and Meeting Dates," Livonia, Mich., 29 September 1970.

instructional materials committees or groups selected to complete very specific tasks which had been identified by the standing committees and approved by the principals' groups. Following the establishment of the original committees, one of the first projects undertaken was the development of content priorities in mathematics for grades K-8. A special committee consisting of twenty-seven teachers representing grades K-8 was formed.[1] This group, using the adopted text materials, took each topic contained in the texts and assigned it a priority for coverage according to the following system:

Priority (R) Review - Used to designate topics which have received emphasis at a previous grade level but should probably be reviewed at least briefly before being used at this grade level.

Priority (1) Major emphasis - These topics must be studied at this grade level and various diagnostic and practice schemes undertaken to attempt to assure mastery.

Priority (2) Minor emphasis - These topics must be introduced at this grade level with sufficient support to assure a reasonable opportunity to understand the concept but the practice necessary to mastery will not occur at this grade level.

Priority (3) Supplemental - These topics are optional for this grade level.[2]

The set of priorities was distributed to all teachers in the region and during the existence of the region served as the basic outline for the mathematics program in grades K-8.

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[1]Charles J. Zoet to K-8 Mathematics Teachers, "Priorities for K-8 Mathematics; Final Report of the Study Group (K-8)," Notice No. RFC-235, Livonia Public Schools, 29 June 1971.

[2]Ibid., pp. 1-2.

During 1970-71 this region adopted a very comprehensive plan for the selection of instructional materials.[1] This plan, which was developed by a joint teacher and administrator committee, established a five year calendar for the selection of materials in each subject area. Based on this calendar the first regional instructional materials committee formed was a committee for Algebra I which had a reporting date of January 1972. Other committees appointed in 1971-72 which had reporting dates in the spring of 1973 were committees for elementary mathematics, 7th and 8th grade slow learner mathematics, Algebra II and Senior Math.

Text Adoptions

Throughout the period from 1970 to 1975, two problems affected the work of instructional materials committees in both regions and the adoption of new texts in all curricular areas. These were the coordination between the two regions regarding the recommendations for new texts and the lack of funds to purchase text materials as they were recommended.

The autonomy of the two regions to recommend new adoptions had seemed to be well understood until the first recommendation for a new text was made in January 1972. At that time Modern Algebra-Structure and Method by Dolciani, Berman and Wooton was recommended by the Franklin/Churchill Region for use in Algebra I starting with

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[1] Instructional Materials Committee, Report of Guidelines for Instructional Materials Committee (Livonia, Mich.: Livonia Public Schools, 11 March 1971).

the 1972-73 school year.[1] Upon receipt of this recommendation, the Deputy Superintendent raised a series of questions regarding the recommendation. These questions related to the extent of communication between the two regions regarding this recommendation, how well this text fit the overall district objectives for Algebra I, and how the adoption of this text, recommended by one region, would effect the future study and recommendation of another text for this course by the second region. A series of meetings and discussions were held during the spring of 1972 at which time it was agreed that the behavioral objectives written in 1970 did represent the common objectives for the district for Algebra I. It was also agreed that recommendations for new texts by a single region would be presented as requests for co-basic adoptions or for the replacement of one of the existing texts if a co-basic adoption already existed. The recommendation for the new text in Algebra I was finally presented to and approved by the Board of Education in June 1972.

During 1971-72 the Franklin/Churchill Region also began the study of new text materials for elementary school mathematics. The adoption of these materials was planned for June 1973. The study of six sets of materials during the second semester resulted in the establishment of a pilot study in grades 1-6 during 1972-73 using Modern School Mathematics: Structure and Use by Duncan and others.[2]

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[1]Mary P. Dolciani and William Wooton, Modern Algebra: Structure and Method, Book 1 (Boston: Houghton Mifflin Co., 1970).

[2]Ernest R. Duncan, et al., Modern School Mathematics: Struc- and Use, rev. ed. (Boston: Houghton Mifflin Co., 1972).

Based on the results of this pilot study which compared this series with the adopted series, Elementary School Mathematics by Eicholz and others, the two series were accepted as co-basic for the elementary schools in June 1973.[1]

During 1972-73 the Bentley/Stevenson Region also conducted a study of text materials. The committee from this region placed at the top of its recommendations, for both elementary mathematics and Algebra I, the same texts which had been recommended by the Franklin/Churchill Region. In each case the committee recommended that a pilot be conducted during 1973-74 using these materials. A second elementary mathematics series, Heath Elementary Mathematics by Dilley, Rucker and Jackson, was also piloted.[2] Following the completion of these pilots the Bentley/Stevenson Region accepted the adopted texts and in addition the Heath Elementary Mathematics series was approved as a co-basic text for elementary schools in June 1974.

Both regions also conducted studies and made recommendations for the adoption of texts in specific junior and senior high school courses during 1972-73 and 1973-74. Many of these recommendations were never submitted to the Board of Education for adoption because funds were not available to implement such adoptions.

In the fall of 1974, with the recognition that the regional administrative structure was coming to an end, systemwide meetings

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[1]Robert E. Eicholz et al., Elementary School Mathematics.

[2]Clyde A. Dilley, Walter E. Rucker, and Ann E. Jackson, Heath Elementary Mathematics (Lexington, Mass.: D.C. Heath and Co., 1972).

of High School Department Chairmen and of Junior High School Department Chairmen were reinstated for mathematics. Instructional materials committees were also established on a districtwide basis. The committees listed in table 15 were appointed and given anticipated implementation dates for any recommendations that they might make.

TABLE 15

MATHEMATICS INSTRUCTIONAL MATERIALS COMMITTEES
APPOINTED OCTOBER 1974

Committee	Proposed Implementation Date
7th & 8th Grade Mathematics	Sept. 1975
Computer Math	Sept. 1975
Trigonometry and Math Analysis	Sept. 1975
Geometries (Plane, Basic, AD I)	Sept. 1976
Basic Algebra I & II	Sept. 1976 & 77
Advanced Placement III (Calculus)	Sept. 1976

The Seventh and Eighth Grade Mathematics Committee was charged with, " . . . correlating regional efforts in materials selection that had taken place in 1972-73-74."[1] Based on these regional efforts, which had included the completion of sets of evaluation scales, five series of texts were piloted in 1974-75. In this pilot effort each

[1]Junior High School Instructional Materials Committee, Grades 7-8 to Paul E. Johnson, "Final Report of Instructional Materials Recommendations for Mathematics in Grades Seven and Eight," Livonia, Mich., 15 May 1975, p. 1.

pilot teacher was interviewed by the committee, a questionnaire related to the teachability of the text was completed by each teacher, and a student attitude survey was administered. Based on the pilot, the committee recommended that Mathematics: Books Seven and Eight by LeBlanc and others, and Holt School Mathematics: 7 and 8 by Nichols and others be adopted as co-basic texts.[1] The committee also recommended that:

> . . . while these texts are good for most of our students they are somewhat weak for stronger students. Schools whose programs make special provisions for better students should have the opportunity to purchase a small number of texts for that purpose.[2]

The committee slao recommended that a workshop for one teacher from each junior high school be held to develop a priority list of content topics as they related to the Livonia Minimal Objectives for Mathematics 7-9. The texts were adopted for 1975-76 and a workshop was held in June 1975 at which time priority lists were prepared which related the content of the texts to the system objectives.

The Computer Math Committee recommended the adoption of Communicating with the Computer - BASIC by Jacobs and others.[3] This was the first time that the formal adoption of a text had been made for Computer Math. This recommendation was accepted and this text was purchased for 1975-76.

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[1]John F. LeBlanc et al., Mathematics: Books Seven and Eight (Morristown, N.J.: Silver Burdett, 1974); and Eugene D. Nichols et al., Holt School Mathematics: 7 and 8 (New York: Holt, Rinehart and Winston, 1974).

[2]Junior High School Instructional Materials Committee, "Final Report," p. 3.

[3]Zeney P. Jacobs et al., Communicating with the Computer - BASIC (Boston: Allyn and Bacon, 1975).

The Trigonometry and Math Analysis Committee recommended the adoption of Advanced Mathematics by Coxford and Payne and indicated that the pilot use of this text at Bentley and Stevenson in 1974-75 had been very positive.[1] Also, this committee recommended that the title of the second semester course be formally changed to Math Analysis. The recommendations of this committee were approved by the high school principals. The text adoption was not implemented, however, because of limited funds.

The Geometry Committee identified as part of its task the revision of the behavioral objectives for geometry which had been written in 1969. To replace what was a rather extensive listing of objectives, they wrote a set of Minimal Objectives for High School Geometry.[2] This set of objectives was to be submitted to the high school mathematics staff in each building for discussion during the fall of 1975. Both the Geometry and Basic Algebra Committees submitted recommendations for the pilot use of materials in September 1975.[3] These recommendations were not implemented because of limited funds.

Major Concerns

Many of the major concerns of this period resulted from tests and the attempts to analyze and use the resulting data. Several

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[1]Coxford and Payne, Advanced Mathematics.

[2]James Reeves, Dale Rothenberg, and Merrilee Zawadzki, "Minimal Objectives for High School Geometry," Livonia, Mich., 25 June 1975.

[3]Charles J. Zoet to Esther Heusner, "Projected Needs for Pilots-Use of Materials in Basic Algebra and Geometry - September 1975," Livonia, Mich., 14 May 1975.

factors combined to make testing a focal point of concerns in mathematics education in Livonia.

By September 1970 performance objectives were complete for a majority of the mathematics courses in the junior and senior high schools and were in the process of being completed for the other courses. The writing of tests to measure the achievement of these objectives was the next logical step. Tests directed to specific performance goals had been developed at several grade levels. For the sixth and seventh grades these were the Livonia Mathematics Diagnostic Test 1A and 1B.[1] For the seventh and eighth grades they were the Livonia Mathematics Diagnostic Tests 2A and 2B.[2] A pretest for Algebra II had also been developed and used in both Algebra I and Algebra II.

Two aspects of standardized testing were also a force at this time. First, the State of Michigan held its first year of statewide assessment in mathematics and reading in grades four and seven during January 1970. Secondly, in the district testing program the Comprehensive Test of Basic Skills (CTBS) replaced the Iowa Test of Basic Skills (ITBS) starting in 1970-71.

The changes in the testing program, the resulting amounts of new or changed data and the assignment of two evaluation specialists to each regional office, with the responsibility to help teachers

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[1]Department of Secondary Education, Livonia Mathematics Diagnostic Tests: 1A and 1B (Livonia, Mich.: Livonia Public Schools, November 1969).

[2]Department of Secondary Education, Livonia Mathematics Diagnostic Tests: 2A and 2B (Livonia, Mich.: Livonia Public Schools, November 1969).

and administrators examine such test data all served to intensify the focus on test results. Also, changes in assignments caused administrative leaders to examine such data more fully in order to understand the status of the educational programs for which they had become responsible in the reorganization.

During 1970-71 Charles Zoet prepared several memos discussing the results of the locally prepared tests.[1] These memos were written to point out the weaknesses identified by the tests and to stress the instructional implications of the results. The first point stressed was that a major portion of the instructional time in seventh grade should be devoted to an orderly development of fractions, decimals and percents and that topics involving applications of geometric concepts should receive a high priority in seventh grade. A second point was that for many students there was an extensive loss in scores from Algebra I to Algebra II and that the students entering Algebra II tended to represent a distinct dichotomy in terms of their knowledge of Algebra I.[2]

By the fall of 1971 both regions had recognized that the scores on the previous years administration of the CTBS were low in the area of mathematics. The immediate effect of this was an

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[1]Charles J. Zoet to Seventh Grade Mathematics Teachers, "Seventh Grade Mathematics Program," Livonia, Mich., 8 September 1970; Charles J. Zoet to Franklin K-12 Mathematics Committee, "Summaries of Diagnostic Testing Related to the Learning of Fractions in Grades 6, 7 and 8," Livonia, Mich., 1 December 1970; and Charles J. Zoet to High School Mathematics Chairmen: Algebra Teachers, "Preliminary Report of 'Pretest for Algebra II' Test Results," Livonia, Mich., 30 March 1971.

[2]Zoet, "Preliminary Report of 'Pretest for Algebra II' Test Results."

increased emphasis by both regions on the improvement of computational skills.[1] At an individual building level several schools made intensive studies of their test results. At Perrinville Elementary School this led to a change in their program for skill development in both mathematics and language arts. The staff identified a sequence of skills covering the entire elementary school program. Based on students' scores on pre-tests administered schoolwide, mini-classes of students were organized to work on the lowest skill level which the pre-tests indicated students did not know. From its initial form the program developed to include the use of a computer to assist in the management and record keeping for the instructional groups. During 1974-75 this program at Perrinville was identified as a pilot program for the system.

In December 1971 the improvement of test scores became a high priority item for the total district upon the distribution by the Deputy Superintendent of a notice entitled, "Needed Study of Standardized Testing Program Results and the Implications for Action."[2] In this document he examined and analyzed the results of systemwide testing over a period of years and identified strengths and weaknesses in each area. In mathematics the major weakness identified was in computation. The document also listed actions which individual schools could take to examine their own results

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[1]For a summary of yearly test scores in mathematics see appendix E.

[2]Paul E. Johnson to All Administrative Staff Members, "Needed Study of Standardized Testing Program Results and the Implications for Action," Notice No. SO-319, Livonia Public Schools, 6 December 1971.

and to correct weaknesses at the building level. Much of the work of individual buildings and the regional committees from January 1972 to May 1972 was directed toward meeting the expectations put forth by the Deputy Superintendent. These efforts were,

> . . . most successful in raising achievement in the two target areas--language mechanics and computational skills. The gap between anticipated achievement level and obtained achievement level was eliminated at every grade level on regional and districtwide scores.[1]

The results of these efforts were reflected in test scores for several years.

Another effort related to testing was the work of the Franklin K-12 Mathematics Committee to develop a mathematics proficiency test for use in the high school. During 1972-73 this committee wrote a test consisting of items which it felt should constitute common learnings in mathematics for all Livonia students. This test was administered to all eleventh grade students at Franklin High School and the results were examined according to the level of mathematics which students had studied. Over the next two years the test was revised and was administered on a more extensive basis to students at Franklin and Churchill High Schools and at Whittier Junior High School. At Franklin the results were used to counsel a number of lower performing students into a special skills section established for seniors during the second semester of 1974-75. In January 1975, the concept of a mathematics proficiency test was accepted on a districtwide basis.

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[1]Henry C. Heusner, "CTBS/CTMM Results for 1972--Generalizations," Livonia, Mich., 5 June 1972.

Agreement was reached by the high school principals that such a test would be administered to all ninth grade students in January of each year and that all students who reached the proficiency level would be excused from having to meet anewly introduced requirement for students to take one-half unit of mathematics in grades 10-12.[1] Based on this agreement, a group consisting of one mathematics teacher from each high school worked in June 1975 to revise the existing proficiency test and to select the items on the test which would be administered for the first time in January 1976.

During the first three years of the Michigan Educational Assessment Program relatively little attention was paid to the results of the mathematics testing except to recognize that the scores for Livonia were generally higher than the statewide scores. Beginning in 1973-74, however, when the the state change to objective referenced testing, more extensive use was made of the data. While the percentage of Livonia students attaining each objective was higher than the statewide percentage at both the fourth and seventh grades on each years tests, the data was used to identify building and district priorities. Each year both elementary and junior high schools were ask to identify several objectives upon which their students had done most poorly and to place a special emphasis upon teaching to these objectives during the year.

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[1]Lawrence J. Nichols to High School Principals, "Notes from High School Principals' Meeting February 26, 1975," Notice No. SED-74, Livonia Public Schools, 19 March 1975.

The completion of the Livonia Minimal Objectives in Mathematics for grades 4-9 in 1974 firmly tied the state objectives and corresponding test data to the mathematics program of the Livonia Public Schools.[1] The objectives adopted in Livonia used the state objectives as a base, added additional minimal objectives and also included a set of objectives at a higher level of difficulty which were designated as "basic" objectives. A program to develop a set of objective referenced tests for the set of 4-6 mathematics objectives was instituted by the Department of Curriculum during the winter of 1974-75. This program involved a large group of elementary teachers in the development of test items and the proposed format of the tests. By June 1975 a series of fifteen test booklets, each of which covered items from one or two strands of mathematics, as identified in the state objectives, was prepared. These booklets were field tested in September 1975 in the fifth and sixth grade classrooms in the district and classroom sets were then made available for teacher use in each building during 1975-76. Plans call for an extensive examination of the test results by teachers following the field testing and the eventual revision of the test booklets.

In addition to the testing program and the development of tests, other concerns of this period were related to the junior high school program and to the articulation of the mathematics

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[1]Livonia Public Schools, Livonia Public Schools Minimal Objectives for Mathematics: Grades 4-6 (Livonia, Mich.: Livonia Public Schools, June 1974); and Livonia Public Schools, Livonia Public Schools Minimal Objectives for Mathematics: Grades 7-9 (Livonia, Mich.: Livonia Public Schools, June 1974).

program between the junior and senior high schools. There was a continuing concern about the junior high school programs and the possible changes in requirements needed to meet half-day sessions, reduced numbers of hours in the school day and other changes which might be required because of the limited funds available to the district. In addition to the half-day sessions during 1969-70, the mathematics program was effected in 1972-73. For the 1972-73 school year, plans for the junior high schools were developed on the basis of a five period day rather than the six period day which had traditionally existed. As a part of this plan the requirement for students to take mathematics in ninth grade was dropped. When the six period day was retained the requirement was held in abeyance but was reinstated the following year.[1] In this situation, however, only a few students choose not to elect mathematics.

During 1973-74 a systemwide study of the junior high school program took place. The study was designed to examine the total curriculum of the junior high schools and to make recommendations for changes. While the study did bring about changes in some areas, its effect on the mathematics program was minimal. The junior high school mathematics course offerings, as shown in table 16, were basically the same in 1974-75 as they were in 1970-71.

The concerns of this period related to articulation between the junior and senior high schools had their focus in the programs

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[1]Livonia Public Schools, Minutes of Meetings of the Board of Education, Meeting of 5 February 1973.

TABLE 16

LIVONIA JUNIOR HIGH SCHOOL MATHEMATICS
OFFERING 1974-75

Course	Grade	Required
7th Grade Mathematics	7	Yes
8th Grade Mathematics	8	Yes
Algebra (Continuous Progress)	8-9	No
Algebra I	9	No
Basic Math	9	No
Basic Algebra I	9	No

designed to provide for individualization and acceleration at the junior high schools. The major problem was how the appropriate placement for students from these programs should be determined when they entered the high school program. The problem was the same in each region for students who had taken an accelerated algebra course. The amount of algebra credit each student should receive had to be determined and then the proper high school course for each student had to be determined to insure a smooth flow of advancement without repeating or skipping content. In 1970-71 and 1971-72 this problem was handled on a regionwide basis through the existing committees in the Franklin/Churchill Region and through subregional meetings of department chairmen in the Bentley/Stevenson Region. In all cases the solution reached was to identify specific points in the content of algebra which students would be required to reach in order to obtain one, one and one-half or two units of

algebra credit.[1] These points were to be required regardless of the length of the course or the course title used in each junior high school. In general, the high schools agreed to accept any student into the Advanced Placement Program who had completed an accelerated algebra experience in the junior high school and who also had a teacher's recommendation. If a student did not satisfy these two conditions, he would be screened for the program in the same manner as were students who had taken Algebra I in ninth grade. In addition to these general guidelines, individual agreements were worked out between the high schools and their feeder schools each year as special problems arose. As of 1974-75 these individual agreements continued to be necessary because of the latitude given to the junior high schools to fit accelerated algebra classes, as well as the rest of their mathematics program, to their own methods of operation.

Similar problems also existed during this period in articulation between Basic Algebra I in the ninth grade and Basic Algebra II in the high school. These problems centered on the content to be covered in each part of the two course sequence and the awarding of credit for algebra upon the completion of the sequence. In many

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[1]William K. Kumbier to Mathematics and Counseling Staffs of Riley Junior High, Bentley High School, Mr. Ray, Mr. Laundroche, "Placement of Riley 9th Graders in Bentley Mathematics Classes," Livonia, Mich., 19 November 1971; Allan A. Edwards to Junior High Mathematics Department Chairmen, "Agreements reached at Meeting of 10/29/71," Livonia, Mich., 9 November 1971; and Charles J. Zoet to High School Mathematics Committee, "Minutes of the Advisory Committee on High School Mathematics Meeting Held at Churchill High School on November 9, 1970," Livonia, Mich., 3 December 1970.

cases students working in an individualized program in the junior high school finished the year at a point in their study of algebra which did not correspond to the end of a course in the high schools. Attempts were made to introduce special sections or courses to accommodate groups of these students. An example of this was a course, designated Algebra 1B, which was introduced at Stevenson in 1972-73 to allow students to complete the study of algebra in one semester. As a result of these problems, by the end of 1974-75 consideration was being given to eliminating the awarding of algebra credit for Basic Algebra I and II, providing a more individualized experience in these classes, and requiring that tenth grade students desiring to obtain algebra credit enroll in Algebra I. In this way, it was thought that many of the problems involved in providing proper placement for students could be solved.

Major Program Development

Major program development at both the elementary and junior high schools throughout this period was related to the revision and expansion of the individualized mathematics programs which had started in individual schools in the late 1960s. Following the formation of the two regions, one of the first communications from Henry Heusner, the Director of the Bentley/Stevenson Region to the two Mathematics-Science Coordinators in August 1970 stated,

> . . . it would seem to me that much of our instructional program efforts in the next several years have been cut out for us. . . . We should certainly seek help from other school districts, federal grants, R&D Centers, as well as interested foundations, so that at the earliest possible time we can offer a meaningful, articulated, personalized mathematics curriculum

> in our 35 elementary schools, nine junior high schools, and four senior high schools.[1]

From this time until he left the district in 1973, Heusner was a strong supporter of the attempts of individual schools and groups of schools to become involved in individualized instruction.

In the elementary schools the major effort was the extension and support of the individualized program which had begun at Kennedy Elementary School. In September 1970 the expanded program included seven elementary schools: Kennedy, Madison, Taylor, Clay, Washington, Eisenhower, and Jefferson. In each of the buildings some provision was made for a mathematics center, either as a separate room or as a part of the instructional materials center. This facility was staffed either by teacher aides or by parent volunteers. The importance of these additional persons was emphasized by several of the principals at the start of the second year of the program in their buildings. "The importance of the teacher aide to the program and the math center can not be underestimated in our perception."[2]

The most immediate problem following the expansion to seven schools, and one which continued to the end of the program, was the reproduction and distribution of the large number of pre- and post-tests and worksheets required by this program.[3] The respon-

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[1]Henry C. Heusner to Charles Zoet and William Kumbier, "Need to develop a K-12 articulated mathematics program that stresses diagnostic personalized instruction," Livonia, Mich., 5 August 1970.

[2]Donald Harris, William Brauer and James Otto to Donald Friedrichs, "Kennedy Math Program in Franklin-Churchill Region," Livonia, Mich., 30 September 1971.

[3]For samples of these materials see appendix H.

sibility for this process was assigned to the Bentley/Stevenson Regional Office which did not have the facilities to maintain this extensive a reproduction and distribution process. By the fourth month of the expanded program it was indicated that, "The printed portion of materials are now the prime bottle-neck in the program."[1]

By the end of the 1971-72 school, the staff in several schools began to question the retention of the program. Their questions were focused on management problems and the possibility that funds might not be available to supply a teacher aide for 1972-73. These concerns and the results of evaluation during the year, which indicated that while all schools were making use of the printed materials not all schools were using them to conduct an individualized program, brought about several changes. During the late spring of 1972, William Kumbier spent time working with the Taylor staff on a "re-orientation" to the program in order to support their continued use of the program.[2] Clay Elementary dropped the program and Cass Elementary School was added as a replacement. In order to accomplish this change, time was provided for the Cass staff, prior to the beginning of school in the fall, to plan and to make the necessary physical arrangements to work with the program.

Throughout the existence of this program extensive evaluation was conducted. Data concerning mathematical development, attitudes, and the processes being used in the schools were collected and

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[1]William K. Kumbier to Dean Waldfogel, "Review of Problems Associated with I. M. Project," Livonia, Mich., 1 December 1970.

[2]William K. Kumbier to Henry Heusner, "Individualized Mathematics--Taylor School," Livonia, Mich., 19 May 1972.

reported to the principals of the schools involved as well as to the regional administrators. In general this data did not indicate any significant positive results in favor of the individualized program. The students in the Kennedy-Madison Program scored significantly lower than students from other schools on mathematics computation and there were no significant differences on mathematics concepts and applications.[1] Measures of student attitudes and independence of working patterns showed no significant differences favoring the program.[2] While principals and teachers using the program desired to keep the program as long as materials and aides were available, the demise of the program on a districtwide basis occurred in June 1974. At that time the support for the program was discontinued because of the ever increasing expense of reproducing the materials for the program and the failure of the program to provide significantly positive results.

Another major effort to introduce individualized instruction in elementary mathematics was the use of the Individually Prescribed Instruction (IPI) materials at Taft Elementary School.[3] The introduction of these materials which took place in September

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[1]Peter J. Moloney to Kennedy-Madison Mathematics Principals, "Individualized Math Project (Kennedy-Madison) Test results," Livonia, Mich., 29 April 1974.

[2]Peter J. Moloney, "Individualized Math Project Student Attitude Survey #4," Livonia, Mich., 29 February 1972.

[3]Henry C. Heusner to Administrative Staff of Bentley/Stevenson Region, "Minutes of Elementary Principals Meeting Bentley/Stevenson Region Monday June 26, 1972," Notice No. RBS-443, Livonia Public Schools, 19 July 1972.

1972 was the direct result of the interest of Henry Heusner in having these materials tried in Livonia. At the time the materials were examined, it was felt that in its prepackaged form the program consisted too extensively of paper and pencil work. As a result a mathematics laboratory was established in the building and students were regularly scheduled into this area for hands-on activities to supplement the paper and pencil activities of the IPI program. In the initial evaluation of this program, a comparison of the Taft students with a random sample of students from the district showed significantly greater growth for the Taft sixth grade students on the arithmetic section of the CTBS.[1] At the fifth grade there was no significant difference in the two groups. There was also no significant difference in the attitudes toward mathematics of the Taft students and the control group. Based on these results the program was continued at Taft. Because this program was more expensive than the traditional program and because of the efforts being made with the Kennedy-Madison Program, no efforts were made to extend the program to other elementary schools in the district. The program was continued at Taft through the 1975-76 school year but because Taft was to be closed in June 1976, due to the declining enrollment in Livonia, that will probably be the last year that the program is used in Livonia.

In the junior high schools the efforts begun at Holmes and Riley to develop sets of materials for individualized instruction

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[1]Allan A. Edwards, "Summary Report Taft IPI Evaluation 1972-73," Livonia, Mich., 27 September 1973.

provided the basis for an exchange of materials which was also to involve Ford Junior High School following its opening in September 1971. Prior to June 1971 each of the junior high school staffs had worked independently on developing materials. At that time the Holmes staff had a well developed set of materials for algebra and the Riley staff had materials for grade seven. During the summer of 1971 members of the staffs from these two schools worked together so that these materials could be used at both schools.[1] The two members of the Riley staff, who had been responsible for the original work on the seventh grade materials, both transferred to Ford Junior High in the fall of 1971. Since they planned to continue the work they had started and wished to transfer this approach to Ford, they were also included in the summer work sessions. As with the elementary program, the reproduction of materials was a major problem in maintaining these programs. At both Holmes and Ford the individualized programs continued through 1975-76 with modifications being made yearly by each staff as problems were identified. At Riley the program continued for several years but the members of the staff who had initiated the program were no longer at the school and the teachers who replaced them did not have the same commitment to this approach. As a result, the program returned to a more traditional classroom structure.

While these schools were cooperatively developing these materials, other schools were also constructing programs designed

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[1]William K. Kumbier to Henry C. Heusner, "Additional Work on Riley (7th) and Holmes (9th) Math Programs," Livonia, Mich., 23 June 1971.

to provide more individualization of instruction. Dickinson Junior High School started its own program in the fall of 1970 using an approach which involved both team teaching and individualized instruction and continued this program through 1974-75.[1] The other junior high schools expanded the opportunities for students to progress at various rates by the provision of courses for slow learners and for students who were ready for accelerated classes by the creation of special mathematics sections at all grade levels.

This period was relatively inactive as far as major systemwide program changes at the senior high school level. Two new courses were added to the high school offerings during the period. A Practical Geometry course was adopted in 1973. This course developed from a proposal submitted by the Bentley High School staff in 1970. The proposed course was to be similar to the course which had been proposed in the systemwide study conducted in 1961-62. With the support of the regional office the Bentley staff worked on the development of materials for the course and wrote a text, Practical Geometry: A Course in Practical, Numerical Geometry.[2] The outline for this course was similar to that of Plane Geometry. The emphasis of the course, however, was on numerical properties rather than on the development of proof. Starting in 1972-73, the course was offered at Bentley as a one-semester course and the following year a similar course was implemented at Churchill. By

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[1]Peter A. Pascaris and Marjorie J. Ingram to Henry Heusner, "Progress Report on summer workshop for teaming in Basic Math and Basic Algebra," Livonia, Mich., 9 November 1970.

[2]John Andrews, Jack Lidster, and Gary Vance, Practical Geometry: A Course in Practical, Numerical Geometry (Livonia, Mich.: Livonia Bentley High School, n.d.)

1974-75 only Stevenson High School was not offering such a numerical geometry course.

The other course added during this period was a second semester computer mathematics course which was introduced in 1974-75 for students desiring to do advanced work with computers. The additon of these two course brought the list of high school mathematics courses offered in Livonia in 1974-75 to those shown in table 17.

In-service and Workshops

Much of the in-service activity during the period from 1970-71 through 1973-74 was directed at the elementary teachers. The first extensive in-service program following the formation of the regions was initiated by the Bentley/Stevenson Region in January 1971. Based on low test scores and general teacher concerns, it was decided that in-service related to the teaching of computation with fractions was needed. Training was provided for Mathematics-Science Curriculum Representatives and Department Chairmen with the intent that they would return to their buildings and provide training for the teachers within their building. The training consisted of a half-day session held during the second week of February. No record exists of the extent to which building level sessions were held to follow-up the initial training session.

During 1970-71 contacts were made jointly by the two regions with Donald Buckeye of Eastern Michigan University regarding the establishment of some jointly sponsored workshops and the possibility of obtaining NSF funds for such work. As a result of this contact,

TABLE 17

LIVONIA HIGH SCHOOL MATHEMATICS
COURSE OFFERINGS 1974-75

Course Title*	Grade Level	Schools**
Algebra I	10	All
Basic Algebra I	10	All
Basic Algebra II	10	All
Refresher Math	10	All
Applied Math	10	All
Technical Math	10	B-F-S
Practical Geometry	10	B-F-C
Plane Geometry	10	All
Computer Uses in Math	10	All
Computer Math II	10	All
Advanced Placement Math I	10	All
Algebra II	11	All
Modern Topics in Math	11	B-C
Advanced Placement Math II	11	All
Trigonometry	12	All
Analytical & Solid Geometry	12	All
Senior Math	12	F-C
Advanced Placement Math III	12	All

*The officially adopted course titles are used. Some schools offer these courses under other titles.

**B-Bentley, C-Churchill, F-Franklin, and S-Stevenson.

a mathematics workshop for K-8 teachers was established for the summer of 1971. This two-week workshop, led by Buckeye and John Ginther, also of Eastern Michigan University, focused on the following topics:

1. Development of continuity and sequence of topics in mathematics.
2. Discussion, development, and practice with teaching methods in mathematics.
3. Construction of and experience with using mathematics teaching aids.
4. A specific emphasis on the topic of fractions and algorithms with whole numbers.[1]

As a follow-up to this workshop, two courses were offered by Eastern Michigan University in Livonia during 1971-72. First semester "New Topics in Modern Mathematics" was offered and second semester "Modern Mathematics Methods" was offered. The district provided financial support for these courses and teachers taking them for credit paid $20 toward the cost of the course. Each course enrolled its maximum of thirty teachers.

During this year extensive use was made of Buckeye and Ginther to provide in-service activities. On the November curriculum day they conducted a workshop on activities in a mathematics laboratory. This workshop was for junior and senior high school teachers and each junior high school was able to send three teachers and each high school, one teacher. In January Buckeye conducted a

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[1]Charles J. Zoet and William K. Kumbier to Participants of Mathematics Workshop, "Details of Mathematics Workshop-Summer 1971," Livonia, Mich., 1 July 1971.

workshop for early elementary teachers on addition and subtraction in grades 1-3.

In January 1972 the system received a NSF grant of $33,000 to be used by the system in cooperation with Eastern Michigan University for teacher in-service education in mathematics during the summer of 1972 and the 1972-73 school year.[1] A total of thirty elementary and junior high school teachers were accepted into the program. The objectives for this program were the same as those listed for the earlier workshop except that an additional objective was to be stressed. This objective was to develop leadership persons capable of assisting local in-service efforts in the school system at both the elementary and junior high school level.[2] The teachers participated in a six-weeks summer course followed by twenty meetings during the ensuing school year. The participants received a stipend for attending the summer course and a total of six hours of credit upon completion of the program.

Upon the completion of the summer program, the participants were formed into teams of three members to serve as resource groups to conduct in-service activities during 1972-73.[3] Follow-up surveys in February and June 1973, indicated that nearly all of the participants had used materials or methods related to individualization

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[1]Livonia Public Schools, Minutes of Meetings of the Board of Education, Meeting of 21 February 1972.

[2]Eastern Michigan University and Livonia Public Schools, A Summer Institute and Academic Year for Teachers of Mathematics-Grades 1-8 (Livonia, Mich.: Livonia Public Schools, n.d.)

[3]William K. Kumbier to Elementary and Secondary Principals, Math Curriculum Rep's, Department Chairmen, "Mathematics 'Cluster-Teams' for school year 1972-73," Livonia, Mich., 12 September 1973.

or mathematics laboratories which they had studied in the program.[1] Only slightly over half, however, reported that their school had done extensive work on mathematics in either of these areas during the year. In the following years only a very limited use was made of this group of trained teachers. This occurred because funds were not available to release groups of teachers to meet for the type of training sessions which had been envisioned when this program was initiated.

The only other major in-service activity in mathematics conducted during this period was related to the adoption of the new elementary text series. Training was provided by a consultant from the Houghton Mifflin Publishing Co. who conducted grade level sessions for teachers and who spent half-day periods in the elementary schools in the Franklin/Churchill Region during the weeks of 3 December 1973 and 4 February 1974.

Summary

While Livonia operated under a regional organization from 1970 to 1975, the major changes, problems and directions of the mathematics program were similar across the district. Major efforts during the period were devoted to developing a more clearly delineated mathematics program in terms of content priorities and behavioral objectives. Within each region work progressed in different sequences and at different paces. The work of each region did,

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[1]William K. Kumbier to Henry Heusner, "Summary of NSF-EMU-LPS Mathematics Activity--June, 1972-February, 1973," Livonia, Mich., 26 February 1973; and Allan A. Edwards, "E.M.U. Institute and Workshop Evaluation," Livonia, Mich., 12 September 1973.

however, fit under broad objectives which were agreed upon district-wide.

Throughout this period data resulting from testing programs and program evaluation exerted a significant force on the mathematics program. The development of behavioral objectives was directly related to the Michigan Educational Assessment Program. The district expanded upon the objectives published by the State Department of Education. Additional minimal objectives were added and a second more advanced level of basic objectives were added. The development of a related set of objective referenced test was then begun. The district also continued its norm referenced testing program and drops in the scores on computation dictated increased emphasis on this area in the elementary and junior high schools.

Major changes in the mathematics program during this period included the discontinuance of several of the methodological innovations which had been started in the late 1960s. The individualized instruction programs at both the elementary and junior high schools ended or were reduced in scope. These programs as they developed in Livonia suffered from several of the criticisms identified by the National Advisory Committee on Mathematical Education in Overview and Analysis of School Mathematics: Grades K-12.[1] These problems were: (1) limited time for student interaction with other students and with teachers, (2) a lack of alternative

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[1]National Advisory Committee on Mathematical Education, Overview and Analysis of School Mathematics: Grades K-12 (Washington, D.C.: Conference Board of the Mathematical Sciences, 1975), pp. 58-60.

modes of instruction, and (3) an excessive amount of time required by record keeping. Finally, because there was no hard data that children were learning better under this type of program than with more traditional methods and because these programs did require additional funds, the decision was made to eliminate districtwide support for the programs. Other innovations that were discontinued during this period for similar reasons were modular scheduling and team teaching programs at the junior and senior high schools.

In-service training during this period focused on the elementary and junior high school teachers. A major emphasis of this training was the use of concrete materials in mathematics laboratory settings. A part of the training program conducted was supported by a NSF grant which was obtained jointly with Eastern Michigan University.

THE DEVELOPMENT OF THE MATHEMATICS PROGRAM OF THE LIVONIA PUBLIC SCHOOLS FROM 1944 TO 1975

Volume II

by
Allan Arthur Edwards

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Doctoral Committee:

Professor Phillip S. Jones, Chairman
Professor Charles F. Brumfiel
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CHAPTER V

COURSE OFFERINGS AND ENROLLMENTS IN THE SECONDARY MATHEMATICS PROGRAM

Introduction

Changes in the secondary mathematics program of the Livonia Public Schools occurred in two general ways. First, changes occurred through the adoption of new courses and sequences of courses. These additions either introduced new mathematical content or altered the arrangement of content within existing courses. Secondly, changes occurred as content within an existing course was altered to meet a new need or change in emphasis. Often such a change was accompanied by the adoption of a new text which closely reflected the new emphasis. As new options were available to students, the enrollment patterns in courses often quickly reflected these changes.

In this chapter the major changes in content and emphasis are identified for each of the adopted secondary mathematics courses. Such changes are described in terms of text changes, the purposes identified by the authors of the texts, course outlines and objectives, and the reasons which were given for recommending changes in existing courses or for the adoption of new courses. The enrollment patterns for special courses or groups of courses are also examined for changes which may have occurred because of the changes in content or emphasis.

Required Mathematics Courses

Secondary students in Livonia have always been required to take mathematics in both the seventh and eighth grades. In general all ninth grade students have also been required to take a mathematics course. From 1961-62 through 1974-75 this requirement was coupled with a requirement that a student had to complete one unit of mathematics in grades nine through twelve. Exceptions to the requirement for ninth grade mathematics could be made only by the principal of the junior high school. Thus, because nearly all students completed their required mathematics course in grade nine only a few students were required to elect mathematics in the high school. Only during 1972-73 was the requirement for mathematics in the ninth grade eliminated. This was done in anticipation of a reduction in the junior high school program because of financial problems. When such a reduction did not occur, the requirement was reinstituted the following year. The dropping of the requirement had minimal effect on the ninth grade mathematics program that year as nearly all students elected to take mathematics.

In February 1975 new graduation requirements for all Livonia high schools were adopted and a requirement for the completion of one semester of mathematics in grades ten through twelve was added.[1] Thus starting with the graduating class of 1978 some slight increase in enrollment in mathematics courses at the high schools may be anticipated as students satisfy this requirement.

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[1] Livonia Public Schools, Minutes of Meetings of the Board of Education, Meeting of 17 February 1975.

As is shown in table 18, the districtwide percentage of high school students enrolled in mathematics was close to 60 percent from 1961-62 through 1974-75. Prior to that time the enrollment in mathematics had been 51 percent or lower each year. The increase which first occurred in 1961-62 can be attributed to the increased emphasis on mathematics and science occurring nationally at this time and to the addition of two new courses, Applied Math III and Senior Math, to the high school program during 1960-61. This increase occurred about equally in the "college prep" and "non-college prep" courses as is shown in table 19. Following that time the addition of new courses to the program did not cause any increase in the percentage of students enrolled in mathematics. The only major shift in enrollment patterns, which did occur, happened in 1964-65 when the "college prep" enrollment decreased by 5 percent from the previous year and the "non-college prep" enrollment increased by 9 percent. This shift was the direct result of the change in objectives and content of the Applied Math I and II sequence.[1]

Seventh and Eighth Grade Mathematics

The seventh and eighth grade mathematics program of the district from the 1940s through the late 1950s was highly oriented to the teach- of arithmetic and computational skills. The major emphasis of the courses was on the applications of arithmetic to "real life" problems and situations. In Everyday Arithmetic by Douglass, Kinney, and Lentz which was used in Livonia starting in 1952, it was stated,

[1] For a discussion of this change see pp. 276-280 below.

TABLE 18

PERCENTAGE OF SENIOR HIGH SCHOOL 1ST SEMESTER
POPULATION ENROLLED IN MATHEMATICS
1956-57 THROUGH 1974-75

Year	Bentley	Franklin	Stevenson	Churchill	All Schools
1956-57	32				32
1957-58	44				44
1958-59	50				50
1959-60	51				51
1960-61	47				47
1961-62	58				58
1962-63	59	65*			62
1963-64	62	57			59
1964-65	61	66			63
1965-66	56	64	88*		63
1966-67	57	59	75		62
1967-68	61	64	61		62
1968-69	58	64	57	83*	62
1969-70	56	63	55	65*	59
1970-71	59	62	58	60	60
1971-72	59	60	54	56	57
1972-73	63	56	58	59	59
1973-74	63	53	60	61	59
1974-75	64	52	61	58	59

*This percentage is based on less than a full 10 to 12 grade program. Each new high school opened without a 12th grade class.

TABLE 19

PERCENTAGE OF SENIOR HIGH SCHOOL 1ST SEMESTER POPULATION IN COLLEGE PREP* AND NON-COLLEGE PREP COURSES IN MATHEMATICS 1956-57 THROUGH 1974-75

	Bentley		Franklin		Stevenson		Churchill		All Schools	
Year	Coll Prep	Non-coll Prep	Coll Prep	Non-coll Prep	Coll Prep	Non-coll Prep	Coll Prep	Non-coll Prep	Coll Prep	Non-coll Prep
56-57	32	0							32	0
57-58	34	10							34	10
58-59	40	10							40	10
59-60	40	11							40	11
60-61	38	9							38	9
61-62	44	14							44	14
62-63	41	18	52	13					46	16
63-64	46	16	45	12					45	14
64-65	39	22	42	24					40	23
65-66	37	19	40	24	40	48			39	24
66-67	38	19	37	22	41	34			39	23
67-68	40	21	38	26	39	22			39	23
68-69	39	19	37	27	39	18	36	47	38	24
69-70	37	19	34	29	37	18	37	28	35	24
70-71	39	20	34	28	37	21	33	27	36	24
71-72	39	20	32	28	37	17	34	22	35	22
72-73	40	23	32	24	35	23	34	25	35	24
73-74	42	21	31	22	38	22	34	27	36	23
74-75	43	21	31	21	43	18	35	23	38	21

*College prep as used here includes: Algebra I, Plane Geometry, Algebra II, Trigonometry, and Advanced Placement Math I, II and III. All other courses are inculuded under Non-college prep.

> This year, you will put your arithmetic to work solving real-life problems about home, school, and various activities of your community--the kind of problems you yourself meet every day. That is the reason this book is called Everyday Arithmetic.[1]

That this emphasis was followed is evident from the chapter headings from this text.

Chapter 1 Mathematics at Work

Chapter 2 Mathematics and Earning Money

Chapter 3 Mathematics and the Consumer

Chapter 4 Mathematics in Design and Construction

Chapter 5 Mathematics in Buying and Selling

Chapter 6 Using Formulas in Life

Chapter 7 Using Triangles in Life

Chapter 8 Banking and Investment

Chapter 9 Using Congruent Triangles and Ratios in Measurement

Chapter 10 Algebra in Everyday Life[2]

This stress on applications began to give way to a stress on mathematical structure with the construction of a topic outline for seventh and eighth grade mathematics in 1960.[3] This outline was developed as a part of a complete statement of the curricular structure for the junior high schools done during 1959-60.

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[1]Harl R. Douglass, Lucien B. Kinney and Donald W. Lentz, Everyday Arithmetic: Junior Book 2 (New York: Henry Holt and Co., 1954), p. v.

[2]Ibid.

[3]Division of Instruction, General Curricular Structure and Course Outlines for the Junior High Schools (Livonia, Mich.: Livonia Public Schools, 12 July 1960).

Seventh Grade

I. Number systems
   A. History
   B. Place value
II. Whole numbers
III. Fractions
IV. Decimals
V. Percent
VI. Ratio and proportion
   A. Scale drawings
   B. Maps
VII. Graphs
VIII. Measurement
   A. Linear
   B. Angular

Eighth Grade

I. Review of seventh grade topics
II. Geometric Figures
   A. Angles
   B. Perimeter
   C. Area
   D. Volume
   E. Definitions
   F. Classification
   G. Construction
III. Ratio and Proportion
   A. Scale drawings
   B. Maps
   C. Indirect measurement
IV. Development of formulas and equations
V. Exponents and roots
VI. Metric system
VII. Economics[1]

The change in emphasis was continued through the use of UMMaP and SMSG materials in pilot classes during 1960-61 and 1961-62. The change was completed with the adoption of the texts Exploring Modern Mathematics 1 and 2 by Keedy, Jameson and Johnson for 1962-63.[2]

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[1] Ibid.

[2] Mervin L. Keedy, Richard E. Jameson and Patricia L. Johnson, Exploring Modern Mathematics: Book 1 and 2 (New York: Holt, Rinehart and Winston, 1963).

The authors indicated that this series was, " . . . inspired by and is based upon the work of the University of Maryland Mathematics Project and the School Mathematics Study Group."[1] The development of number systems and the structure of mathematics was stressed.

> Arithmetic and algebra have been integrated, so as to eliminate the artificial distinction between them, and in order to provide more than one year's time to digest the important ideas of the latter. Geometry is also integrated with the other material where practical, and is to be found throughout the series.[2]

The chapter titles from these texts emphasize the changes in content that had occurred.

Exploring Modern Mathematics: Book 1

Chapter 1 Numeration Systems

Chapter 2 Properties of Whole Numbers

Chapter 3 Points, Lines, Curves and Planes

Chapter 4 Factoring and Prime Numbers

Chapter 5 Mathematical Systems

Chapter 6 The Number System of Arithmetic

Chapter 7 Figures on a Plane

Chapter 8 Measures

Chapter 9 Applying the Number System to Arithmetic[3]

Exploring Modern Mathematics: Book 2

Chapter 1 The System of Integers

Chapter 2 Geometry: Congruence, Constructions and Circles

Chapter 3 Exponents and Scientific Notation

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[1] Ibid., p. v. [2] Ibid.

[3] Keedy, Jameson and Johnson, Exploring Modern Mathematics: Book 1, pp. vii-viii.

Chapter 4 The System of Rational Numbers

Chapter 5 Geometry: Areas, Regular Polygons and Circle Graphs

Chapter 6 More about Integers and Rational Numbers

Chapter 7 Solving Equations

Chapter 8 Polynomials

Chapter 9 Applied Problems, Conjunctions of Equations[1]

In 1968-69 the content of the seventh and eighth grade mathematics programs was redefined in terms of a set goals. It was stated that, "Every student should be able to perform the following activities by the end of the regular eighth grade mathematics program."[2] The goals were listed in seven areas and it was indicated that the topics probably should not be taught in the order given. The topics and subtopics contained in this list were:

I. Sets
   A. Set concepts
   B. Set relations
   C. Set operations

II. Numbers and Operations
   A. Whole numbers
   B. Common fractions
   C. Decimal fractions
   D. Percents
   E. Integers
   F. Rational numbers (positive and negative)
   G. Properties of numbers

III. Numeration systems
   A. Modern (Base) systems
   B. Square root notation

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[1]Keedy, Jameson and Johnson, Exploring Modern Mathematics: Book 2, pp. vii-viii.

[2]Department of Secondary Education, Performance Goals for Seventh and Eighth Grade Mathematics (Livonia, Mich.: Livonia Public Schools, 9 April 1969), p. 1.

C. Exponential notation
D. Scientific notation

IV. Metric and non-metric geometry
A. Linear measurement
B. Area measurement
C. Volume measurement
D. Angular measurement
E. Other measurements
F. Non-metric concepts
G. Non-metric constructions
H. Non-metric properties of figures

V. Algebra
A. Variables
B. Algebraic expressions
C. Equations
D. Inequalities
E. Graphing

VI. Special topics for all students
A. Statistics
B. Consumer applications
C. Ratio and proportion

VII. Enrichment topics for selected students and classes[1]

The goals related to this set of topics served as the basic statement of the seventh and eighth grade program and were used in making text adoptions in 1969 and 1975. In 1969 Modern School Mathematics: Structure and Method 7 and 8 by Dolciani and others, and Structuring Mathematics and Extending Mathematics by Deans and others were adopted as co-basic texts.[2] Again in 1975 co-basic texts were adopted. At that time Mathematics: Grades 7 and 8 by LeBlanc and others and Holt School Mathematics: Books Seven and Eight by

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[1] Ibid.

[2] Mary P. Dolciani et al., Modern School Mathematics: Structure and Method 7 and 8 (Boston: Houghton Mifflin Co., 1967); Edwina Deans et al., Extending Mathematics (New York: American Book Co., 1968); and Edwina Deans et al., Structuring Mathematics (New York: American Book Co., 1968).

Nichols and others were adopted.[1] At the time of these adoptions each junior high school was free to select that series which it felt best fit the needs of its students.

In 1968 a special text adoption occurred to provide a text specifically selected for use in classes of slow learners in mathematics at grades seven and eight. While text materials were adopted for this group of students, there was never an offically adopted course for slow learners. Each junior high school had the option to form special sections for these students. Based on criteria which included: a low reading level, interest appeal, coverage of basic arithmetic skills, and the inclusion of diagnostic materials, the series Basic Modern Mathematics by Eicholz and others was adopted.[2] In 1973 a list of materials to be used to supplement or replace these texts was adopted. The recommendation made at that time stated, " . . . that each mathematics department will give careful consideration to its needs and resources for this program and then determine how it will use the monies allocated for these materials."[3]

Ninth Grade Mathematics

After completing the required seventh and eighth grade math-

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[1] LeBlanc et al., Mathematics and Nichols et al., Holt School Mathematics.

[2] Robert E. Eicholz et al., Basic Modern Mathematics: First Course and Second Course (Menlo Park, Cal.: Addison-Wesley Publishing Co., 1969).

[3] Instructional Materials Committee for Students in Grades 7-9 Who Have Difficulty with Mathematics to Donald Friedrichs, "Final Recommendations," Livonia, Mich., 9 April 1973, p. 4.

ematics courses Livonia students have had at least two options for the mathematics course they would take in the ninth grade. One of these options was always Algebra I. The other option or options have been named General Mathematics, Basic Mathematics, Applied Mathematics or Basic Algebra. The content and the students for whom these courses were intended differed but the intent was always to provide additional mathematics for the student who did not feel competent or interested in taking Algebra I.

Until 1956-57 the alternative to Algebra I was General Mathematics. This course was a continuation of the work which had been done in seventh and eighth grades and had an emphasis on the use of mathematics in life situations. The text which was last used in this course was Mathematics to Use by Potter and others.[1]

Beginning in 1956-57, General Mathematics was discontinued and students were provided with two options in addition to Algebra I. The first option was called Basic Math I and was intended to be a remedial mathematics course in which the emphasis was on the remediation of individual student's difficulties in mathematics. The text Mathematics to Use, which had been used in General Mathematics, remained as the offically adopted text for this course until 1963. In practice, however, the course was taught with an extensive number of supplementary materials. In 1963 Arithmetic: Concepts and Skills by Brumfiel and others was adopted.[2] In 1968

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[1]Mary A. Potter et al., Mathematics to Use (Boston: Ginn & Co., 1950).

[2]Charles F. Brumfiel et al., Arithmetic: Concepts and Skills (Reading, Mass.: Addison-Wesley Publishing Co., 1963).

Refresher Mathematics by Stein was adopted along with a list of supplementary materials.[1] Regardless of the text used the basic intent of this course remained the remediation of individual student's deficiencies and no definitive course outline was ever established for this course. While no systemwide test data was collected on students in this course, many of the students who enrolled in this course elected to take either Algebra I or Basic Algebra upon entering high school. As a result it must be assumed that the course was meeting its objectives with many students.

Applied Mathematics I and II

The second option for ninth grade students which was established in 1956-57 was called Applied Math I. This course was the first course in a two course sequence. The second course, Applied Math II, was offered in the tenth grade starting in 1957-58. Applied Math I was also offered in the high school, under the title Basic Math II, as an elective for those students who had taken Basic Math I in the ninth grade. The intent of this two course sequence was to provide a way for students to obtain the equivalent of Algebra I, but at a slower pace and on a less theoretical basis. The two volume series Everyday General Mathematics: Books One and Two by Betz and others was chosen for use in these courses.[2] The major emphasis of this series was on "functional competency." The

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[1] Edwin I. Stein, Refresher Mathematics (Boston: Allyn and Bacon, 1968).

[2] William Betz et al., Everyday General Mathematics: Books One and Two (Boston: Ginn and Co., 1956).

authors felt that this could be emphasized by giving priority to applications in the domains of finance, technology and science.[1] The first of the two volumes devoted a major portion of time to the review of fundamental operations from arithmetic. Other units were then devoted to the role of money in social living, using basic concepts of geometry, and an introduction to algebra. The major focus of the second volume was on the study of algebra. It included topics through the study of quadratic equations. In addition, it also contained units on the application of mathematics to community life, technical work, and science; a major section on geometric ideas and relations; and numerical trigonometry. During the time these texts were used, they served as the controlling factor in defining the content and structure of these two courses.

In 1964-65 as a part of the system movement toward "modern mathematics," a new set of texts was adopted for Applied Math I and II. The texts were Introduction to Mathematics by Brumfiel, Eicholz and Shanks and Modern Elementary Algebra by Nichols and Collins which was the same text being used in Algebra I.[2] It was planned that Introduction to Mathematics would be used for the first semester of Applied Math I and that the first five chapters of the algebra text would be taught during the second semester. The remainder of the text would then be covered in Applied Math II and any additional time at the end of the course would be used in

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[1] Ibid., p. iii.

[2] Charles F. Brumfiel, Robert E. Eicholz, and Merrill E. Shanks, Introduction to Mathematics (Reading, Mass.: Addison-Wesley Publishing Co., 1964); and Eugene D. Nichols and Wagner G. Collins, Modern Elementary Algebra (New York: Holt, Rinehart and Winston, 1961).

the study of geometric topics. This arrangement proved to be unsatisfactory for Applied Math I because teachers encountered difficulty in integrating computational skills and algebraic concepts when the text were used separately. For the next several years Applied Math I was taught using the plan for integrating these two texts which is shown in table 20. The use of these two texts continued until 1968 when a series, Introductory Algebra 1 and 2 by Jacobs, which was designed for use in such a sequence was adopted.[1] Both the 1964 adoption and this adoption were based on an assumption that the appropriate mathematical content for most students at the ninth and tenth grades was algebra.

Whether the completion of Applied Math I and II should be treated as equivalent to the completion of Algebra I was a topic of nearly continuous discussion following the development of these courses. At the time the course were established, it was stated that the completion of the two courses would be equivalent to Algebra I. This seems to have held true for several years. By 1960, however, a grade requirement was added. In the recommended prerequisites for Plane Geometry that year it stated, "Every student who is enrolled in Plane Geometry must have completed one full year of Algebra I. (Applied Math II with a grade of 'B' or higher.)"[2] Even this consideration of granting credit to those students with

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[1]Russell F. Jacobs, Introductory Algebra 1 (New York: Harcourt Brace & World, 1969); and Russell F. Jacobs, Introductory Algebra 2 (New York: Harcourt Brace & World, 1969).

[2]Bentley High School, Catalog of Courses, Revised (Livonia, Mich.: Livonia Public Schools, February 1960), p. 16.

TABLE 20

APPLIED MATHEMATICS I ORGANIZATIONAL OUTLINE: 1965-66

Approx Time (weeks)	Topic	Reference
1½	Symbols	Brumfiel - Chapter 1
1	History	Brumfiel - Chapter 2
2	Whole numbers	Supplementary materials for drill in computation, and introduction of different methods of computing such as the Tractenberg method of speed multiplication
2½	Sets	Algebra - Chapter 1
1½	Factors & Primes	Brumfiel - Chapter 7
2	Fractions	Supplementary materials for drill
2	Basic Principles	Algebra - Chapter 2
2	Decimals	Supplementary materials for drill
3	Real numbers	Algebra - Chapter 3
2	Percents	Supplementary materials for introduction and drill
6	Algebraic Expressions	Algebra - Chapter 4, except for more difficult proofs
7	Equations	Algebra - Chapter 5 (to page 189)
1½	Story Problems	Brumfiel - Chapter 20 for algebraic story problems

SOURCE: Leslee J. Bishop, Year-End Reports Curriculum Activities and Projects: 1964-65 (Livonia, Mich.: Livonia Public Schools, July 1965), p. 13.

grades of B or better seems to have been dropped for several years since no mention is made of such credit until the course descriptions for the year 1964-65 at which time new text materials were adopted. At that time the course description for Applied Math I stated, "This course with the addition of Applied Math II will constitute one year's work in Algebra and consequently any student completing both Applied Math I and II will receive Algebra credit."[1] This continued to be the pattern for awarding credit for a period of about seven years during which time all students who completed Applied Math I (or Basic Algebra I as it was renamed in 1968) were encouraged to enroll in Applied Math II (Basic Algebra II). Starting in 1971-72, larger numbers of students were encouraged to enroll in Algebra I in the tenth grade. This was done because, with the individualized programs in the junior high schools, students were entering Basic Algebra II with widely varying backgrounds. It was felt that those students who desired to continue their study of mathematics with Plane Geometry and Algebra II could be better served in Algebra I and that as a result greater flexibility for working with the remaining students would be possible in Basic Algebra II.

The number of students at each high school enrolled in Algebra I and Basic Algebra II each year are shown in table 21. It can be seen that prior to 1964-65 a much larger number of students took Algebra I in the tenth grade than took Basic Algebra II. From 1964-65 through 1974-75 a larger number took Basic Algebra II and in a number of years Algebra I was not even taught at individual schools because of

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[1]Bentley High School, Programs of Study (Livonia, Mich.: Livonia Public Schools, 1964), p. 20.

TABLE 21

ENROLLMENT IN ALGEBRA I AND BASIC ALGEBRA II*
AT SENIOR HIGH SCHOOL 1ST SEMESTER
1957-58 THROUGH 1974-75

	Bentley		Franklin		Stevenson		Churchill	
Year	Alg	B.Alg	Alg	B.Alg	Alg	B.Alg	Alg	B.Alg
1957-58	36	86						
1958-59	111	110						
1959-60	133	171						
1960-61	178	75						
1961-62	237	127						
1962-63	192	89	180	38				
1963-64	171	116	209	142				
1964-65	60	337	86	236				
1965-66	25	204	27	278	0**	181		
1966-67	21	254	31	212	11	256		
1967-68	24	237	88	269	29	304		
1968-69	21	231	24	266	0	213	0**	204
1969-70	0	239	20	321	0	237	17	206
1970-71	18	238	0	311	0	259	17	310
1971-72	62	196	0	299	0	212	18	296
1972-73	71	249	0	278	29	234	27	333
1973-74	66	188	34	217	116***	290	73	268
1974-75	75	217	80	163	101***	210	140	142

*Prior to 1968-69 Basic Algebra II was called Applied Math II.

**During the first year of operation of Stevenson and Churchill a ninth grade program was offered at the same location and any Algebra I students took this course with the ninth grade classes.

***At Stevenson during 1973-74 and 1974-75 courses were offered under several different titles and the distinctions between Algebra I and Basic Algebra II were not maintained.

a lack of demand. There was, however, an increase in the number of students enrolled in Algebra I from 1971-72 through 1974-75.

Algebra I and Advanced Algebra

During the late 1940s and the 1950s there was little change in the content of Algebra I and Advanced Algebra in the Livonia Public Schools. The texts originally adopted for other courses were A First Course in Algebra by Lennes and Maucker and Second-Year Algebra by Schorling, Smith, and Clark.[1]

A First Course in Algebra introduced the study of algebra through the use of formulas.

> We are now to take our first steps in passing from ordinary arithmetic into elementary algebra. We shall begin by learning to state some familiar rules of arithmetic in a new way. . . . Besides using ordinary numerals (1, 2, 3, and so on) we shall also use letters to represent numbers. When we restate a rule in this way, we call it a formula.[2]

Rules, which were referred to as operational principles, were presented as mechanical procedures. The authors did, however, ask students in various problems throughout the book to provide a statement of rules which corresponded to a problem. In this manner they hoped to keep students from learning, ". . . simply to imitate appearance of form on paper and to memorize a verbal form without knowing its meaning."[3]

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[1] N. J. Lennes and J. W. Maucker, A First Course in Algebra, sec. rev. (New York: Macmillan Co., 1949); and Raleigh Schorling, Rolland R. Smith and John R. Clark, Second-Year Algebra (Yonkers-on-Hudson, New York: World Book Co., 1942).

[2] Lennes and Maucker, First Course in Algebra, p. 11.

[3] Ibid., p. vi.

The next text, Algebra Course 1 by Fehr, Carnahan and Beberman, which was adopted in 1955, was very similar in its approach and organization.[1] The text began with the study of formulas and concluded with the study of quadratic equations. It did, however, introduce a discovery approach. Discovery exercises were based on the idea that, "The principles of algebra are reasonable and can be based upon the concepts and operations of arithmetic which the pupil has learned."[2] Students were led through a sequence of related steps from familiar facts to new principles. This was then followed by developmental discussion, worked examples, a check of the examples, and an extensive set of practice materials the first part of which was to be done under the supervision of the teacher. Motivation was provided through the inclusion of discussions of the practical or cultural value of the topics to be studied. Thses discovery ideas were in keeping with the work that Beberman was beginning at the University of Illinois with the UICSM program.

In 1960 when the first districtwide course outline for Algebra I was prepared, the topics included in the course consisted of:

I. General Numbers

II. Simple Equations

III. Positive and Negative Numbers

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[1]Howard F. Fehr, Walter H. Carnahan and Max Beberman, Algebra: Course 1 (Boston: D.C. Heath and Co., 1955).

[2]Ibid., p. v.

IV. Monomials, binomials

V. Polynomials

VI. Graphs of linear equations

VII. Systems of linear equations

VIII. Special products and factors

IX. Fractions, fractional equations

X. Ratio, proportion, variation

XI. Square roots and radicals

XII. Quadratic equations[1]

This outline followed closely the chapters of Algebra Course 1 which remained the adopted text trhough 1961-62.

As had the original text for Algebra I, Second-Year Algebra, which was first used for Advanced Algebra in 1948-49, focused on the study of formulas in the early parts of the text.[2] The emphasis of the text was on solving problems and obtaining answers rather than the development of concepts. The authors indicated that the book was, ". . . written from the point of view of mathematics for mathematics sake."[3] This was based on a feeling that, ". . . those who elect a second course in algebra do so primarily because they wish rigorous training for the mathematical sciences."[4] The text, together with the two which followed it, contained essentially the same content and gave no indications of the changes which would occur with the introduction of "modern mathematics."

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[1]Division of Instruction, General Curricular Structure, pp. 25-6.

[2]Schorling, Smith and Clark, Second-Year Algebra.

[3]Ibid., p. iii.

[4]Ibid.

Algebra for Problem Solving: Book 2 by Freilich, Berman and Johnson was adopted in 1954 and was used until 1960 when it was replaced by Algebra: Book 2 by Welchons, Krickenberger and Pearson.[1] The course description which was written in 1960 for Advanced Algebra and would have been equally applicable to any of these tests called for the minimal coverage of:

1. Fundamental operations
2. First-degree equations in one unknown
3. Type products, factoring, equations
4. Fractions and fractional equations
5. Functional relations, graphs and linear functions
6. Systems of linear equations
7. Ratio, proportion, and variation
8. Exponents, radicals and imaginaries
9. Quadratic functions and equations
10. Logarithms
11. Systems of equations involving quadratics
12. Progressions
13. The binomial theorem
14. Determinants
15. Permutations, Combinations and Probability[2]

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[1]Julius Freilich, Simon L. Berman and Elsie P. Johnson, Algebra for Problem Solving: Book 2 (Boston: Houghton Mifflin Co., 1953); and A. M. Welchons, W. R. Krickenberger and Helen R. Pearson, Algebra Book Two, rev. ed. (New York: Ginn and Co., 1957).

[2]Bentley High School, Bentley High School Course Descriptions and Curriculum Outlines (Livonia, Mich.: Livonia Public Schools, 5 May 1960), p. 59.

The first text adopted in Livonia which reflected a change to "modern mathematics" was Modern Elementary Algebra by Nichols and Collins which was adopted for Algebra I in 1962.[1] This text emphasized the unifying theme of sets and set language, the structure of the number system and of algebra, and the creative approach to problems and problem solving. The outline for this texts differed from earlier texts in that the first sections stressed the development of the number system, set terminology, and an axiomatic development. A major difference was the reduction of the number and complexity of the manipulative problems contained in the text. Concepts were developed and practice took place through the use of a large number of questions and problems which required minimal computation and were often of the true or false type. The study of the quadratic equation remained the goal for completion by the end of the course. The replacement of this text in 1967 by Algebra: Its Elements and Structure, Book 1 by Banks, Sobel and Walsh reflected a dissatisfaction with the level of difficulty of the exercises and the limited amount of computational practice which had been provided in Modern Elementary Algebra.[2]

In 1970 the first system outline for Algebra I which did not in effect reproduce the chapter headings of the text in use was produced in the form of a set of performance goals.[3] This set of

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[1]Nichols and Collins, Modern Elementary Algebra.

[2]Banks, Sobel and Walsh, Algebra: Its Elements and Structure.

[3]Department of Secondary Education, Performance Goals for Algebra I (Livonia, Mich.: Livonia Public Schools, July 1970).

goals placed the content which students would be expected to study into nine categories and indicated that the order of presentation of the content within each category would be left to the discretion of the teacher. These categories were:

1. Sets
2. Real numbers
3. Polynomials
4. Open sentences in one variable
5. Graphing open sentences in two variables
6. Systems of open sentences in two variables
7. Rational expressions and applications
8. Exponents and radicals
9. Quadratic sentences[1]

The adoption of the text Modern Algebra: Structure and Method by Dolciani and Wooton for Algebra I in 1972 was based on this set of performance goals.[2]

The increased emphasis on the development of the number system and on mathematical structure which was occurring during the early 1960s was also reflected in a 1964 adoption for Advanced Algebra. The pilot use of SMSG Intermediate Mathematics in this course for the previous two years had served a transitional role until the first students who had studied algebra from a modern viewpoint in Algebra I reached the eleventh grade.[3] Algebra II by Brumfiel, Eicholz and

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[1] Ibid.

[2] Dolciani and Wooton, Modern Algebra.

[3] School Mathematics Study Group, Intermediate Mathematics.

Shanks which was adopted stressed that,

> . . . ideas are of the utmost importance, and that the teacher must find time for their proper development. Real mathematics is an admixture of computational skill and understanding of abstract concepts.[1]

The first three chapters of this text: Numbers and Number Systems, Rational Numbers, and Real Numbers are indicative of the change in emphasis from the texts of the 1950s. This text also placed greater emphasis on the complex number system and on the function concept than had previous texts. This text, as did those which were to follow it, contained an extensive section on trigonometry. This was part of a movement to include the study of trigonometry at an expanded level as a part of the study of second-year algebra. Livonia never adopted this approach and retained the study of trigonometry for the twelfth grade mathematics courses.

In 1969 performance goals were written for Advanced Algebra.[2] These goals were based on the following outline of the minimal content for the course:

I. Number system

  A. Real numbers

  B. Complex numbers

II. Exponents and radicals

III. Equations

  A. Linear equations in one variable

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[1]Charles F. Brumfiel, Robert E. Eicholz and Merrill E. Shanks, Algebra II (Reading, Mass.: Addison-Wesley Publishing Co., 1962), p. v.

[2]Department of Secondary Education, Performance Goals for Algebra II (Livonia, Mich.: Livonia Public Schools, June 1969).

B. Linear equations in two variables

C. Quadratic equations in one variable

D. Quadratic equations in two variables

E. Radical equations

IV. Inequalities

V. Functions

A. Concept of function

B. Types of functions

1. linear functions

2. quadratic

3. polynomial

4. exponential

5. inverse

6. logarithmic[1]

Also in 1969 a new text was adopted for Algebra II. The adoption took place not because of a desire to change the content of the course, but rather, as in Algebra I, to obtain a text which contained a greater number of exercises and one which was more in keeping with the background of most of the students entering the course. The text chosen was Modern Algebra and Trigonometry: Structure and Method Book 2 by Dolciani, Berman and Wooton.[2] This text was felt to maintain the same emphasis on structure as the prior text. It did include a larger number of exercises and problems

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[1] Ibid.

[2] Mary P. Dolciani, Simon L. Berman and William Wooton, Modern Algebra and Trigonometry: Structure and Method Book 2 (Boston: Houghton Mifflin Co., 1965).

which were graded in order of increasing difficulty. Also, it relieved the teacher from much of the responsibility for the proper development of ideas that had been necessary with the use of Algebra II. The revised versions of this text remained the offical adoption of the system through 1974-75.

Plane Geometry

During the late 1940s when the first text was selected for Plane Geometry in Livonia, authors were attempting to be responsive to the need for increased applications in mathematics and to react to demands to better suit the content of courses to the students taking them. The text Modern-School Geometry by Schorling, Clark and Smith which was adopted indicated that this was done through eight features of the book.[1]

1. Reasoning is emphasized
2. Arithmetic and algebra are used in geometric situations.
3. The presentation is less difficult than that of the conventional course
4. Understandings are developed
5. A systematic techniques of proving propositions is developed
6. Interest features are provided
7. Different ability levels are provided for
8. Requirements of college examining boards, etc., are met.[2]

This first text was used until 1954 when Plane Geometry by Mallory

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[1] John R. Clark, Rolland R. Smith and Raleigh Schorling, Modern-School Geometry (Yonkers-on Hudson, N.Y.: World Book Co., 1943).

[2] Ibid., pp. vii-x.

and Oakley was adopted.[1] The authors of this text stated that they stressed two objectives which they considered to be of prime importance, ". . ., the training of future scientists and teaching students to think intelligently,. . ."[2] As a part of their approach they stated that,

> There is the long, gradual introduction to reasoning and to proof needed to introduce students to an entirely new subject. . . . The emphasis is on original thinking, not on memorization of the proofs of propositions.[3]

In order to ease the transition to proof, several of the more difficult theorems were postulated and indirect proof was postponed to the later chapters of the text. The content of the text was arranged into fourteen chapters.

Plane Geometry

Chapter 1 Introduction

Chapter 2 Geometric Proof

Chapter 3 Using Congruent Triangles

Chapter 4 Parallels and Parallelograms

Chapter 5 Circles

Chapter 6 Measurement of Angles in Circles

Chapter 7 Introduction to Locus

Chapter 8 Inequalities and Indirect Proof

Chapter 9 Ratio and Proportion

Chapter 10 Similar Polygons

Chapter 11 Numerical Trigonometry

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[1] Virgil S. Mallory and Chauncey W. Oakley, Plane Geometry (Chicago: Benjamin H. Sanborn Co., 1953).

[2] Ibid., p. v.

[3] Ibid., p. vi.

Chapter 12 Areas

Chapter 13 Locus (Part II)

Chapter 14 Regular Polygons and Circles[1]

This organization differed from that of the prior text in that it reduced the number of distinct units in the course from eighteen to fourteen and eliminated separate sections devoted to constructions and included this material within appropriate related units. It also included optional sections in several chapters which related the plane geometry studied to that of three-space.

In 1959 the text Plane Geometry by Schacht and McLennan was adopted.[2] The authors indicated that the text was based on four reasons for teaching plane geometry.

> . . . (1) to develop an understanding of the meaning and nature of mathematical proof; (2) to improve the quality of thinking in non-mathematical situations; (3) to further develop mathematical concepts of an arithmetic and algebraic nature; and (4) to provide an understanding of plane and space realtionships for a better appreciation of nature and the arts as they apply to daily life.[3]

The organization of this text differed from the previous text in several ways. It placed a special emphasis on the locus concept and contained a separate chapter early in the text on basic constructions and loci. It also introduced parallel lines and the associated proofs prior to the time at which it introduced triangles. There was also a greater inclusion of optional topics,

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[1] Ibid., p. ix.

[2] John F. Schacht and Roderick C. McLennan, Plane Geometry (New York: Henry Holt and Co., 1957).

[3] Ibid., p. v.

such as three-dimensional geometry and analytic geometry, throughout the chapters of the text.

The pilot use of SMSG Geometry in 1962-63 and 1963-64 served the purpose of providing a transition to a "modern approach" to teaching Plane Geometry.[1] In 1964 Geometry by Moise and Downs was adopted.[2] This text followed very closely the SMSG text for which Moise had been one of the co-writers. In addition to the use of set terminology and an increased precision in language the text differed from the earlier texts used in Livonia in several other features.

1. The concepts of space geometry were introduced early and used throughout the remainder of the text.
2. Coordinate systems on a line were introduced in Chapter 2 in order to develop a metric and were used extensively.
3. A chapter on plane coordiante geometry was included.
4. The section on areas was moved to the middle of the course rather than appearing at the end.
5. A basic purpose of the text was identified to be to teach students to read mathematics as well as to write it.

While most mathematics texts in the district were changes at five year intervals, this text was readopted in 1969, when a change in text was considered, and continued in use through 1974-75.

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[1] School Mathematics Study Group, Geometry.

[2] Moise and Downs, Geometry.

Trigonometry and Solid Geometry

From 1949-50 through 1959-60 the most advanced mathematics courses taught in the Livonia Schools were separate one-semester courses in Trigonometry and Solid Geometry. These two courses formed the final year of the "college preparatory" sequence in mathematics. When the courses were first introduced Solid Geometry was offered during first semester and Trigonometry was taught during second semester.

The original text adopted for Solid Geometry was Modern-School Solid Geometry by Smith and Clark.[1] This text was part of the same series of books which were being used in Plane Geometry and Advanced Algebra. It emphasized the discovery of geometrical truths of three-dimensional space and their establishment by logical methods; the development of computational skills in the mensuration of common geometrical solids; the practice of perceptual analysis leading to the ability to see relationships in space; and an extension of an understanding of the nature of logic.[2] The content of the text was divided into the following topics: (1) perpendicular lines and planes, (2) parallel lines and planes, (3) dihedral and polyhedral angles, (4) locus and projections, (5) polyhedrons, (6) cylinders and cones, (7) spheres, and (8) spherical polygons.[3]

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[1] Rolland R. Smith and John R. Clark, Modern-School Solid Geometry (Yonkers-on-Hudson, N.Y.: World Book Co., 1939).

[2] Ibid., p. v.

[3] Ibid. p. vii.

In 1955 a new text was adopted for the course, Dynamic Solid Geometry by Skolnik and Hartley.[1] The authors indicated that this text could be used in any one of three forms:

> . . .(1) The logical structure and the applications receive about equal treatment; (2) proofs of propostions are not required, but much time is spent on originals and numerical problems; and (3) a course of less than one semester which places the whole stress on numerical exercises, the necessary theory being developed intuitively.[2]

Which of these three forms the course took in Livonia during this period is not recorded. This text, however, did not bring about any major change in content, although it did introduce the concept of motion to relate theorems and concepts. The content was grouped under five major headings: (1) Emerging from the plane; (2) Assembling planes; (3) Translating a line; (4) Rotating a line; and (5) Rotating a semicircle.[3]

The first text adopted for Trigonometry was Plane Trigonometry by Mills, Atkin and Flagg.[4] This text presented the definitions of the trigonometric functions in terms of the general angle but much of the emphasis of this text was on the solution of triangles and a geometrical approach was used in the development of the fundamental relationships. In 1956 this text was replaced by Trigonometry with Tables by Welchons and Krickenberger.[5] This text still placed an

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[1]David Skolnik and Miles C. Hartley, Dynamic Solid Geometry (Princeton, N.J.: D. Van Nostrand Co., 1952).

[2]Ibid., p. v.

[3]Ibid., p. vii.

[3]Clifford N. Mills, Edith I. Atkin and Elinor B. Flagg, Plane Trigonometry (New York: Scott Foresman and Co., 1947).

[4]A. M. Welchons and W. R. Krickenberger, Trigonometry with Tables (Boston: Ginn and Co., 1957).

emphasis on the solution of triangles but contained more extensive sections on the graphs of the trigonometric functions, the inverse functions, and on the fundamental relations. Also, the use of radian measure was stressed in the latter half of the text.

In 1960 a single text was adopted to serve both the Trigonometry and Solid Geometry courses and although the course names were retained the content of the courses was revised. The adopted text was, Foundations of Advanced Mathematics by Kline, Oesterle and Willson.[1] This text consisted of six sections: solid geometry, plane trigonometry, analystic geometry, calculus, statistics, and algebra. The section on solid geometry contained a very limited number of theorems and was principally concerned with, ". . . acquiring a knowledge of the facts of importance concerning solid figures."[2] The course was taught so that trigonometry was covered first semester, solid geometry and analytic geometry second semester and the topics from the other sections were included where the instructor felt them to be appropriate. A course description for the second semester stated,

> This course is a study of spatial relationships as applied to many solid figures, i. e., prisms, cylinders, cones, etc. Many selected topics in the analytic geometry are also discussed with emphasis upon the application of analytic geometry to the solution of problems in plane and solid geometry. Most of the semesters work will be in the analytic geometry.[3]

The adoption of a new text in 1965, Principles of Advanced Mathematics by Meserve, Pettofrezzo and Meserve and the writing of

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[1]William Kline, Robert Oestele and Leroy Willson, Foundations of Advanced Mathematics (New York: American Book Co., 1959).

[2]Ibid., p. 4.

[3]Bentley High School, Programs of Study: 1962-63 (Livonia, Mich.: Livonia Public Schools, 1962), np.

performance goals for these courses in 1969 continued the movement toward integrating the subject matter of the courses.[1] In each case the amount of solid geometry was reduced to include work with only a few basic formulas. The emphasis on trigonometry was changed so that the study of circular functions was central and work with triangles and their solution was secondary in importance.

During the late 1960s and early 1970s individual schools used several different names for these two courses in the programs of study. In 1968 the name of the second semester course was officially changed to Solid and Analytical Geometry which was more descriptive of the content of the course. In 1975 the high school principals formally accepted a change in name for the two semesters of mathematics to Mathematical Analysis.[2] This change in title recognized the change in emphasis which had taken place. More practically the change was recognized by the inclusion of statements in the high school programs of study such as,

> This course provides for some review and further analysis of algebraic functions, such as polynomials, and incorporates the matrix solution for solving equations. An introduction to the theory of limits is also included.[3]

Until the introduction of the Advanced Placement III class in 1960-61, the number of students completing a "college prep" sequence in mathematics was the number of students enrolled in Solid

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[1]Bruce E. Meserve, Anthony J. Pettofrezzo and Dorothy T. Meserve, Principles of Advanced Mathematics (New York: L. W. Singer Co., 1964).

[2]Lawrence J. Nichols to High School Principals, "Notes from High School Principals' Meeting, April 23, 1975," Notice No. SED-104, Livonia Public Schools, 29 April 1975.

[3]Bentley High School, Programs of Study: 1973-74 (Livonia, Mich.: Livonia Public Schools, 1973), p. 25.

Geometry and Trigonometry. Following 1960-61. it was the total number of students enrolled in these three courses. Table 22 shows the percentage of the twelfth grade class in each of the Livonia high schools who were enrolled in these courses during first semester of each year following 1951-52.

Two distinct changes in enrollments at this level of the mathematics program occurred. The increased nationwide emphasis on mathematics and science of the late 1950s is very evident in the jump in enrollment that occurred from 1957-58 to 1958-59. This increase maintained itself for three years but was followed by an equally sharp decline in enrollment in 1961-62. There then followed a gradual increase and leveling of the enrollment until the districtwide enrollment in these courses varied from 16 to 19 percent from 1964-65 through 1964-75. The lower enrollments from 1961-62 through 1963-64 coincided with the period during which pilot programs involving the introduction of "modern mathematics" were occurring in Plane Geometry and Advanced Algebra. This change in content and emphasis may have had a negative effect on these students whose background was primarily "traditional mathematics." If this negative reaction did occur, it could account for the decrease in the percentage of students electing to take "college prep" mathematics during their senior year.

Modern Topics in Mathematics

In attempts to provide mathematics courses suited to the needs of students, a number of courses were added to the high school program in Livonia. Only one of these courses, excluding Advanced Placement and Computer Uses in Mathematics which are considered in chapter 6,

TABLE 22

PERCENTAGE OF 12TH GRADE STUDENTS ENROLLED IN 4TH YEAR OF COLLEGE PREPARATORY MATHEMATICS* DURING 1ST SEMESTER OF SENIOR YEAR

Year	Bentley	Franklin	Stevenson	Churchill	All Schools
1951-52	13				13
1952-53	17				17
1953-54	11				11
1954-55	14				14
1955-56	13				13
1956-57	11				11
1957-58	13				13
1958-59	18				18
1959-60	20				20
1960-61	17				17
1961-62	13				13
1962-63	14				14
1963-64	13	16			15
1964-65	11	20			16
1965-66	14	18			16
1966-67	16	23			19
1967-68	16	19	16		17
1968-69	20	21	16		19
1969-70	17	17	15		16
1970-71	19	19	18	13	17
1971-72	20	17	16	15	17
1972-73	20	17	16	17	18
1973-74	20	17	16	17	18
1974-75	19	14	19	17	17

*The courses included in this category are Trigonometry, Solid Geometry and Advanced Placement Math III.

was related to the changes associated with the "modern mathematics" movement. This one-semester course, Modern Topics in Mathematics, was adopted in 1961 but was not taught until 1963.

The original description of this course in the programs of study indicated that it would contain the study of some elementary number theory, symbolic logic, and probability.[1] In practice, however, the course content was probability and statistics as it had been recommended by CEEB in its 1959 report.[2] During the first several years the course was taught, there was no adopted text and both Probability: An Introduction by Goldberg and Probabiltiy: A First Course by Mosteller, Rourke and Thomas were used as basic texts.[3] In 1964 the latter text was adopted and either it or a later edition of the text served as the basic text and in effect defined the content of the course through 1974-75.

Generally, the course was offered only one semester each year at each high school if it was taught at all. The enrollment was dependent upon the ability of the mathematics department to interest a large enough number of students to be able to offer the course. The only consistent offering of the course was at Bentley High School where it was offered each year from 1963-64 through 1974-75.

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[1]Bentley High School, Programs of Study: 1962-63, np.

[2]Commission on Mathematics, Program for College Preparatory Mathematics, Report of the Commission on Mathematics (New York: College Entrance Examination Board, 1959).

[3]Samuel Goldberg, Probability: An Introduction (Englewood Cliffs, N.J.: Prentice-Hall, 1960); and Frderick Mosteller, Robert E. K. Rourke and George B. Thomas, Jr., Probability: A First Course (Reading, Mass.: Addison-Wesley Publishing Co., 1961).

Applied Mathematics III

To meet the needs of students outside the tradtional "college prep" sequence, as it existed in Livonia during the 1950s, courses of two types were added to the high school program during the 1960s and 1970s. These courses were either remedial in nature or were of a practical or applied nature and assumed at least basic arithmetic competency on the part of students. The earliest classes of this type were Applied Math III and Senior Math both of which were adopted in 1960.

Applied Math III, which had a prerequsite of Algebra I, was designed as a one semester course for students who had failed Plane Geometry or Advanced Algebra during the first semester. The first several years the course was taught, no text book was adopted and teacher prepared materials were used. The course description at that time listed these topics:

1. Properties of triangles
2. Definition of triangles which are similar or congruent
3. Review of ratio and proportion
4. Indirect measurement using similar triangles
5. Definition of basic trigonometric functions
6. Application of basic trigonometric functions to solving right triangles
7. Use of trigonometric tables
8. Solution of obliques triangles by right triangle methods
9. Application of trigonometric functions
10. Solution of the general triangle
11. Expansion of the definition of trigonometric functions to angles greater than 90°.[1]

In 1963 the text Essential Mathematics for Skilled Workers by Keal and Leonard was adopted and some shift in the emphasis of the

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[1]Bentley High School, Course Descriptions and Curriculum Outlines for 1962-63 (Livonia, Mich.: Livonia Public Schools, July 1962), pp. 61-61a.

course occurred.[1] This text contained several chapters on arithmetic, algebra, and geometry and the study of the content of these sections became a more formalized part of the course. The emphasis of this text was, ". . . on computation, with a maximum of practice and a minimum of abstract theory."[2] It continued in use through the end of the 1967-68 school year at which time its publication was discontinued. At that time the school district published its own text, Numerical Trigonometry: Related Topics and Applications.[3] This text was written to, ". . . give the student materials he can read and understand and which will subsequently help him to learn the techniques for solving triangulation problems."[4] The content of the course was organized into seven chapters: (1) algebra, (2) logarithms, (3) slide rule, (4) geometry, (5) trigonometric ratios, (6) Use of Trigonometric Ratios, and (7) Oblique Triangles. This text continued in use through the 1974-75 school year and since no set of performance goals were ever written for this course, it served to define the content of this course. Following its introduction, this couse was taught on a regular basis in all of the Livonia high schools although its enrollment expanded beyond the group of students for whom it was originally designed. Many students elected this course in place

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[1]Harry M. Keal and Clarence J. Leonard, Essential Mathematics for Skilled Workers (New York: John Wiley & Sons, 1942).

[2]Ibid., p. v.

[3]Hugh Leeper, Robert Massey and Roger Strong, Numerical Trigonometry: Related Topics and Applications (Livonia, Mich.: Livonia Public Schools, 1968).

[4]Ibid., Intro.

of or as a follow-up to Plane Geometry if their need for mathematics was not oriented to a preparation for college.

Senior Math

Senior Math which was introduced as a course in consumer mathematics for twelfth grade students during 1960-61 had a varied existence in the Livonia high schools. It was taught at Bentley for a period of four years from 1960-61 through 1963-64. It was taught at both Franklin and Churchill every year, starting with their first senior classes in 1961-63 and 1968-69, respectively. It was never taught at Stevenson High School. The decisions to offer this course at some schools and not at others were made by the mathematics departments of the individual schools.

The original text adopted for this course was Mathematics for the Consumer by Lankford, Shorling and Clark.[1] The content of this text fit well the description of the course as,

> . . . a terminal course in mathematics for seniors in high school. The course will include a review of our number system and the laws governing our number system. Informal discussions involving consumer problems in insurance, budgeting, statistics and other problems of home and community.[2]

The purposes stated for the course were:

> To develop competence in the fundamental operations of mathematics and their application to home and community problems.
>
> To develop an interest in mathematics which arises from the ability to solve everyday consumer problems readily.

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[1] Francis G. Lankford, Raleigh Schorling and John R. Clark, Mathematics for the Consumer, rev. ed. (Yonkers-on-Hudson, N.Y.: World Book Co., 1953).

[2] Bentley High School, Course Descriptions: 1962-63, p. 64.

To develop a clear concept of common topics, such as compound interest, installment buying, and taxation.[1]

The inclusion of this course in the mathematics program of the high school was in keeping with the elimination or de-emphasis of the topics it contained from the seventh, eighth and ninth grade programs as "modern mathematics" texts were adopted for these grades during the early 1960s.

In 1965 two texts were adopted for the course. These were Applied Business Mathematics by Piper and Gruber and Preliminary Mathematics: Review Text by Dressler.[2] Later adoptions which continued the emphasis on the consumer aspects of this course were: Mathematics for Daily Living by Lewis which was adopted in 1970 and Consumer Mathematics by Lankford and Goe which was adopted in 1975.[3]

In the schools where this course has been offered, it has been popular and, as is shown in table 23, has enrolled as high as 27 percent of the senior class. The percentages do seem to reflect some long term trends in enrollment at both Franklin and Churchill. Whether these trends are due to external forces effecting course selections or to changes in the methods or content at the individual schools is not clear.

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[1] Ibid., pp. 64-64a.

[2] Edwin B. Piper and Joseph Gruber, Applied Business Mathematics, 8th ed. (Cincinnati, Ohio: South-Western Publishing Co., 1963); and Isidore Dressler, Preliminary Mathematics: Review Text (New York: Amsco School Publications, 1962).

[3] Harry Lewis, Mathematics for Daily Living (Cincinnati, Ohio: McCormick-Mathers Publishing Co., 1970); and Francis G. Lankford and William E. Goe, Consumer Mathematics, sec. ed. (New York: Harcourt Brace Jovanovich, 1974).

TABLE 23

PERCENTAGE OF SENIOR CLASS ENROLLED IN SENIOR MATH: 1960-61 THROUGH 1974-75

Year	Bentley	Franklin	Churchill
1960-61	8		
1961-62	21		
1962-63	27		
1963-64	16	13	
1964-65		15	
1965-66		15	
1966-67		18	
1967-68		19	
1968-69		20	
1969-70		23	
1970-71		17	7
1971-72		15	8
1972-73		13	12
1973-74		14	14
1974-75		8	15

Refresher Mathematics

Refresher Mathematics was introduced as a remedial course in the mathematics program of the high schools in 1964-65. The course was designed to enroll primarily tenth grade students and a prerequisite for the course was a recommendation of the counseling and mathematics departments that a students was in need of remedial

help in mathematics. The course was describe as,

> . . . remedial in nature. It attempts to develop the student's ability to function with basic operations of addition, subtraction, multiplication, and division of whole numbers, fractions, and decimals.[1]

In the Bentley High School Counselor Guidelines it was stated that,

> If a student scores above the 10th percentile on the numerical portion of a standardized test such as the D.A.T., S.C.A.T., or the I.T.E.D., then he probably should not be scheduled into this class.[2]

The text which was originally adopted for this course and continued to be used either in the original or revised edition was Trouble-shooting Mathematics Skills by Bernstein and Wells.[3] The approach of this text was in keeping with the individual diagnosis of problems and remediation which was planned for this course. This course has consistently enrolled about 5 to 10 percent of the tenth grade students since it was added to the program. The first semester enrollments for the course, as a percentage of the tenth grade class, are shown in table 24.

Technical Mathematics

In 1969 Technical Mathematics was adopted as an official course offering in the district. The description of the course stated that it was,

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[1]Bentley High School, Programs of Study: 1964-65 (Livonia, Mich.: Livonia Public Schools, 1964), p. 21.

[2]Bentley High School Guidance Department, Program of Study Guidelines (Livonia, Mich.: Bentley High School, 1964), p. 15.

[3]Allen L. Bernstein and David W. Wells, Trouble-Shooting Mathematics Skills (New York: Holt, Rinehart and Winston, 1963).

TABLE 24

ENROLLMENT IN FIRST SEMESTER REFRESHER MATHEMATICS AS A PERCENTAGE OF 10TH GRADE CLASS: 1964-65 THROUGH 1974-75

Year	Bentley	Franklin	Stevenson	Churchill
1964-65	5	14		
1965-66	12	11	7	
1966-67	8	6	6	
1967-68	6	9	6	
1968-69	8	9	10	8
1969-70	7	11	8	8
1970-71	7	14	5	6
1971-72	9	11	6	5
1972-73	9	8	11	6
1973-74	6	9	9	9
1974-75	6	10	7	11

> . . . designed for the student who is preparing for a technical or skilled trades vocation. The student will learn to use some of the basic measuring tools such as the micrometer caliper, the vernier caliper and the machinist's ruler. The student will also learn the mathematical skills and techniques necessary for solving practical problems encountered by skilled workers. This course emphasizes practical problems rather than theory.[1]

This course, to some extent, duplicated the content of the Applied Mathematics course. However, where that course had a prerequisite of Algebra I, the prerequisite for this course was Basic Algebra I.

[1]Bentley High School, Programs of Study: 1971-72 (Livonia, Mich.: Livonia Public Schools, 1971), p. 26.

The text adopted for use in the course was General Mathematics for the Shop by Nelson and others.[1] The enrollment in this course has generally been such that each of the high schools has offered one section of the course each semester.

Practical Geometry

The last of the applied courses added to the mathematics program was Practical Geometry. The initial development of this course began at Bentley High School as a one-semester course during 1972-73. At that time a text Practical Geometry: A Course in Practical, Numerical Geometry was written by Andrews, Lidster and Vance.[2] The course was officially adopted by the district in 1973-74. By 1974-75 the course, or a revised form of the course, was being offered at three of the four high schools either under the title Practical Geometry or Basic Geometry.

The units outlined in the text paralleled the chapters of standard texts in plane geometry. The content, however, was presented on a less theoretical basis and the problem sets included in the text consisted of exercises which were on an average simpler than those found in most geometry texts. These exercises were primarily computational and placed only minimal emphasis on proof. The course was described in the Bentley Programs of Study as being of

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[1] Gilbert D. Nelson et al., General Mathematics for the Shop (Boston, Mass.: Houghton Mifflin Co., 1956).

[2] John Andrews, Jack Lidster and Gary Vance, Practical Geometry: A Course in Practical, Numerical Geometry (Livonia, Mich.: Livonia Public Schools, n.d.)

> . . . most value to the student desiring to develop his ability to analyze and understand basic geometric figures. Formal proof is not emphasized as the geometric concepts are developed from a numerical approach, with practical applications integrated whenever possible. Topics covered include the classification of geometric figures, models and constructions, angle measurement, congruent and similar geometric figures, and geometric patterns in architecture and everyday situations.[1]

Summary

The course offerings in secondary mathematics in the Livonia Public Schools reflect two distinct movements during the period of twenty years from 1955 to 1975. One movement was a change in the content of existing courses which reflected the nationwide movement of the 1960s toward "modern mathematics." This change occurred in the content and the materials in all of the courses generally considered to be the mainstream of the mathematics program: 7th and 8th Grade Mathematics, Basic Algebra I and II, Plane Geometry, Trigonometry, and Solid and Analytic Geometry. In many ways Livonia implemented the recommendations of the CEEB and SMSG;i.e., changes in content and methodology were instituted in grades 7-12 a course in probability and statistics was added to the program.

The points at which Livonia's program differed most from the recommendations of these groups were in the eleventh and twelfth grade courses. In Livonia, the study of trigonometry was not moved into the eleventh grade algebra course but was left as part of the twelfth grade program. Also, the texts adopted for the twelfth grade courses, Trigonometry and Solid and Analytic Geometry, did not reflect

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[1]Bentley High School, Programs of Study: 1974-75 (Livonia, Mich.: Livonia Public Schools, 1974), p. 28.

the recommendations as quickly or to as great an extent as did the texts selected for other courses. This may have occurred, at least in part, as a result of the existance of the Advanced Placement Program in Livonia. Since this program included the best mathematics students, their was a feeling that the most appropriate content for students in these courses was the traditional pre-calculus content.

During the late 1960s and the 1970s as new adoptions took place in all course and as course descriptions were revised, the content changes introduced in the 1960s were integrated into the courses. The texts placed less emphasis on structure than the texts which were used during the middle 1960s and were often selected to provide more extensive sets of practice problems as teachers increased emphasis on computational and manipulative skills.

The second movement reflected in Livonia's course offerings was the inclusion of courses designed to meet the needs of relatively small groups of students. The Advanced Placement Program, Computer Uses in Mathematics, and Modern Topics in Mathemaics were all added to the program to meet the needs of students who had high ability or interest in mathematics and who had attained a satisfactory level of achievement in mathematics. Other courses were added to the program to provide additional practical or applied content which was missing from the highly algebra oriented program which was being taught in Livonia's Applied Math I and II sequence during the 1960s. These courses included: Applied Math III, Senior Math, Refresher Math, Technical Math, and Practical Geometry.

During the past twenty years, the enrollment in the mathematics program in the Livonia secondary schools has been consistently high. In the junior high schools the enrollment was always nearly 100 percent since mathematics was required at all grades and only occasionally were individual students excused from taking mathematics. At the high schools the percentage of students taking mathematics was relatively constant after 1961-62. Prior to that time, the percentage of students enrolled in mathematics had varied from a low of 32 percent in 1956-57 to a high of 51 percent in 1959-60. From 1961-62 through 1974-75 the districtwide percentage varied between 57 and 63 percent of the high school population. During this period the percentage of students enrolled in both "college prep" and "non-college prep" courses remained fairly constant at each school. Differences which occurred between schools could generally be accounted for by the population served by each school, the combination of courses offered at each school, and the differences in the percentage of tenth grade students in each school. The one exception to this seems to be a decrease in mathematics enrollment at Franklin High School which occurred from 1968-69 through 1974-75. This decrease does seem to be related to a decrease in the enrollment in Senior Math at this school during this period.

CHAPTER VI

TWO CONTINUING SPECIAL PROGRAMS

Of the programs and courses which have been tried in Livonia, two of the programs at the secondary level stand out for their continued acceptance and growth. These are the Advanced Placement Program and the computer mathematics program. In each case, Livonia was among the earliest systems to recognize a need for such programs and to implement them.

Advanced Placement Mathematics

The Advanced Placement Program in mathematics has been a stable and accepted part of the mathematics program in the Livonia high schools since its complete implementation in 1960-61. Members of that year's graduating class were the first students to complete the three year sequence of courses designed to provide students with what was considered to be the equivalent of one year of college calculus.

The impetus to establish this program in Livonia was a need identified by the high school staff to offer a more challenging experience in mathematics for able students at the high school level. These concerns developed at the same time that such concerns were also developing at the national level. The first high school students in Livonia to be provided with special experiences in mathematics were a group of about fifteen students who were selected

for an enriched Advanced Algebra class during the second semester of the 1956-57 school year.[1] Based on the success of this class, the following year, enriched classes were offered during the second semester for both Advanced Algebra and Trigonometry students.

During 1957-58 the staff examined various possibilities for providing a structured program for these able students. They selected tha Advanced Placement Program as the most promising for Livonia. The decision was made that students would be selected for the program upon entering high school in the tenth grade and that these students would cover the normal three year sequence of high school mathematics in two years. In this way, the final year of mathematics could be devoted to the study of calculus. The program was described in the Bentley High School Programs of Study of that period as:

> The advanced placement program in mathematics includes the content recommended by the Commission on Mathematics of the College Entrance Examination Board (CEEB). This sequence of courses is offered to outstanding students who wish to receive college credit for the 12th grade advanced placement course. All students completing the three year sequence are required to take the final examination prepared by CEEB.[2]

The three courses and their contents were described in letters sent to the parents of prospective participants prior to the tenth grade.

> 'Logical Systems and Spatial Relations' - which consists of topics in Plane, Analytical, Solid Geometry and topics in pure logic.

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[1]Bentley High School Mathematics Staff, "Advanced College Placement Class Added to Mathematics Curriculum at Bentley High School, Livonia," Action 12 (January 1959): 6-7.

[2]Bentley High School, Programs of Study: 1961-62 (Livonia, Mich.: Livonia Public Schools, 1961), p. 35.

'Mathematical Analysis' - which consists of Advanced Algebra, Trigonometry, and additional selected topics from Analytical Geometry.

'Analytical Methods and Calculus' - which consists of an introduction to, and the development of calculus, study of analytical geometry, statistics, number topics, etc.[1]

Because of concerns regarding the ability of students to deal with this content and to help insure the success of students chosen for this program, a careful screening process was instituted for the selection of students. This process, which has remained basicly unchanged, included five points.[2]

1. The junior high school Algebra I teachers and counselors submitted lists of students they recommended for the program based on their personnel knowledge of the students.
2. All students on this list, plus any students whose scores in the areas of verbal, numerical, abstract reasoning and spatial relations on the Differential Apptitude Test (DAT), which is a standardized apptitude test given to all 9th grade students in the district, were at the 90th percentile or above, were then screened by a committee of mathematics teachers at the high school.
3. This screening committee examined the following criteria: the teacher recommendation, the student's junior high grades, the scores on the four areas of the DAT, the student's IQ, and the student's score on reading tests.

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[1]David D. Amerman, letter to parents, Livonia, Mich., 13 May 1963.

[2]Bentley High School Mathematics Staff, "Advanced Placement Mathematics-Selection of Students-Policy Statement," Livonia, Mich., 3 May 1962.

In general, the students selected had to receive a favorable score or rating on a majority of the areas for which data was available.

4. Lists of students screened into the program were then returned to the junior high schools. This allowed the junior high school counselors to make a tentative determination of the interest of each student and allowed an additional exchange of information between the junior high school and senior high school.
5. A letter was sent to the parents of each student selected. This letter described the contents of the program and invited the student to participate in the program. Such participation required the student to return a permission slip signed by his/her parents. In addition the students and the parents were invited to attend a meeting held at the high school to discuss the program prior to the time that the final decision regarding the student's tenth grade program had to be made.

Another early concern was how to make the election of this course attractive enough to overcome what was felt might appear to both students and parents to be an overly difficult sequence of courses. This was handled in two ways. First, it was agreed that students enrolled in the program would receive an additional honor point in the calculation of their grade point average.[1] Thus, a

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[1]Donald E. Friedrichs to Assistant Principals, Counselors and Teachers of Accelerated and Advanced Placement Classes, "Honor Points," Livonia, Mich., 8 February 1962.

student receiving a B as a grade for the semester would have his grade point average calculated as if it were an A. As a result of the awarding of extra honor points in mathematics and also in English, the highest ranking students in the Livonia schools often have better than an A (4.0) average. The second thing that was done to insure the acceptance of the program was to give students the right to move out of the program and into the regular college preparatory sequence at any time without prejudicing their grade or standing in the course. The movement between the Advanced Placement Program and the college preparatory sequence took place in both directions. During the first few years of the program, when large numbers of new students were moving into the district, it was not uncommon for several students to move from Plane Geometry into the Advanced Placement I class during or at the end of the first semester each year.

The first group of students selected for the program entered the tenth grade in September 1958. This group consisted of twenty-seven students which was 3.3 percent of the entering tenth grade class at Bentley High School. By the time these students were seniors the size of the class had decreased to eighteen of the original group plus one eleventh grade student who had been allowed to bypass the Advanced Placement II course.

A concern related to this first class and the next several classes was the willingness of colleges to accept the results of the Advanced Placement Examinations. In order to clarify each college's position, letters were sent to the colleges that members of the class planned to attend. These letters explained the program at Bentley, asked for a determination as to whether the college would recognize

the Advanced Placement Examination results, and if they would not, under what circumstances they would be willing to grant credit. Most colleges were willing to accept the results although during the first several years one or two colleges did require the students to take an examination after their arrival on campus. Other minor problems occurred for individual students when the requirements for admission into a particular college program listed Solid Geometry and this did not appear as a course title on the high school transcript. These problems, however, were not widespread since nearly 90 percent of the students from the first several classes attended either The University of Michigan or Michigan State University and both of these institutions were very willing at accept the results of the Advanced Placement Examinations.[1]

The Advanced Placement Examination given in May each year requires the payment of a fee which has increased from $17 in the early 1960s to $29 for the 1975 examination. Following the adoption of the program, the Livonia Board of Education established a policy of paying for this examination for all students who had completed the courses in mathematics or English. This policy was restated in March 1964 and clarifying statements were added to indicate how students who had not completed one of these courses might qualify under the policy.[2] This policy continued in effect until August 1971

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[1]"Statistics on Bentley High School Advanced Placement Students," Livonia, Mich., n.d.

[2]Leslee J. Bishop to Secondary Principals, "Meeting of Senior High School Principals, February 14, 1964," Notice No. DI-440, Livonia Public Schools, 2 March 1964.

at which time, as part of a movement to reduce costs, the Board of Education adopted a policy requiring, ". . . that the costs of advanced placement tests be defrayed by the students who desire to take such tests; and, further, that a statement be included in said policy which specifies procedures through which any external tests will be provided, free of charge to students who are financially unable to pay for them."[1] The immediate effect of this change in policy was to reduce the percentage of students enrolled in the calculus course who took the Advanced Placement Examination in mathematics. In 1971, 81 percent of the students enrolled in the course took the test. In 1972 only 54 percent of the students took the test. As is shown in table 25, these percentages are representative of the years prior to and following 1971 and 1972. While the percentage of students enrolled in the calculus course who took the examinations dropped in the years from 1971 to 1975, the percentage of all seniors in Livonia who were enrolled in this course was higher during this period than at any other time. The highest percentage of seniors enrolled in the course was reached in 1973-74 when 5.2 percent of the twelfth grade students were enrolled in the course. This compares with the low of 1.6 percent of the seniors who took the course in the second year of the program. The increases in the percentage of twelfth grade students enrolled in calculus which occurred between 1966-67 and 1967-68 and between 1969-70 and 1970-71 can be accounted for by the easing of screening procedures and by

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[1] Livonia Public Schools, Minutes of Meetings of the Board of Education, Meeting of 13 September 1971.

TABLE 25

ADVANCED PLACEMENT III ENROLLMENT AND AP EXAMINATIONS TAKEN BY LIVONIA STUDENTS: 1960-61 THROUGH 1974-75

Year	District Grade 12 Enrollment	District AP III Enrollment	Percentage Grade 12 Enrolled in AP III	Students Taking AP Exam	Percentage AP III Students Taking AP Exam
1960-61	640	19	3.0	18	95
1961-62	671	11	1.6	9	82
1962-63	687	19	2.8	17	89
1963-64	1,033	26	2.5	24	92
1964-65	1,418	37	2.6	31	84
1965-66	1,478	31	2.1	27	87
1966-67	1,580	40	2.5	30	75
1967-68	1,811	65	3.6	52	80
1968-69	2,174	83	3.8	77	93
1969-70	2,293	79	3.4	70	89
1970-71	2,441	107	4.4	87	81
1971-72	2,625	107	4.1	58	54
1972-73	2,684	114	4.2	47	41
1973-74	2,788	146	5.2	61	42
1974-75	3,108	144	4.6	72	50

the provision for accelerated algebra programs at the junior high schools which allowed larger numbers of students to enter the tenth grade Advanced Placement I course.

Beginning in the late 1960s arrangements had to be made to accomodate the students who had taken an accelerated algebra course in junior high school. Since not all schools provided such a course, several questions had to be considered.[1] These included such things as:

1. Are different criteria to be used for placing students who have had an accelerated algebra class into Advanced Placement than are used for other students?
2. How are students to be placed who have not succeeded in an accelerated course in junior high school?
3. How is the focus of the eleventh grade course to be changed to reflect the fact that part of the content will have been studied by some of the students but not by others?
4. With the possibility of increased numbers of students should two different courses be offered during the senior year?
5. If two courses are to be offered in the senior year, should these reflect the two levels into which the Advanced Placement Examination was divided in 1968-69

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[1]Donald E. Friedrichs to Secondary Principals, "Notes on Meeting of Senior High School Curriculum Steering Committee, October 15, 1968," Notice No. DI-1095, Livonia Public Schools, 13 November 1968.

or should only one course have calculus as its basic content and the other be more of an enrichment course?

In general, the answers to these questions resulted in all students who had successfully completed an accelerated algebra program in junior high school being placed in Advanced Placement I without having to meet the established screening criteria. Those students who had not successfully completed the program were allowed to elect Algebra II in either their junior or sophomore year as if they had not taken the accelerated class in junior high school.

The questions related to changes in content in the eleventh grade class and the split of students into different classes in the twelfth grade were the topic of much discussion at secondary mathematics meetings. Several plans were proposed. The problems related to the scheduling of such classes and the financial commitment required to offer single section courses kept such plans from being adopted on a districtwide basis. At times individual schools split groups into two distinct classes. The students completing eleventh grade Advanced Placement at Stevenson High School in 1968-69, for example, were divided into two groups for the following year. One group took the Advanced Placement III course and the other group spent most of the year continuing to do pre-calculus work. No school ever identified a large enough group of students that a section of calculus directed at the more difficult BC level examination was formed. At the time that the Advanced Placement Examination was divided into two levels, it was felt that it would be unlikely that such a section could ever be formed. Discussions at that time

brought about a statement from the Secondary Mathematics Coordinator that,

> . . . we have surmised that at each school our program is likely to produce two or three students who could be ready for the more difficult (BC) exam. On talking to a number of you it was agreed that, in our present situation we should attempt to identify those students early and encourage them to work individually to get ready for the more difficult (BC) exam.[1]

The largest group of Livonia students to attempt the BC exam did so in 1974-75. At that time a total of four students took the BC exam and all of them scored a 5, the highest grade possible, on the exam.

One of the difficulties in providing for the small number of students who should have been prepared for the BC exam each year was the lack of teacher time. When the Advanced Placement Program was adopted the teacher of the twelfth grade class and, whenever possible, the teacher of the eleventh grade class, were provided with a period of preparation time for the class. This was done in keeping with the recommendations of the CEEB that such additional preparation time would be needed.[2] This time was provided through the 1967-68 school year. Following the contract negotiations for 1968-69 in which the released time for Department Chairmen was eliminated, the hour of preparation time for Advanced Placement teachers was also eliminated. The loss of this time together with the fact that several teachers were teaching Advanced Placement III

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[1]Charles J. Zoet to Teachers of Advanced Placement Mathematics and Algebra I, "Advanced Placement Mathematics 1968-69," Livonia, Mich., 20 September 1968.

[2]College Entrance Examination Board, A Guide to the Advanced Placement Program 1961-62 (New York: College Entrance Examination Board, 1961).

for the first time in 1968-69 minimized any initial efforts to prepare students for the BC exam. The Secondary Mathematics Committee addressed itself to this problem and communicated to the administration its concerns about the removal of this preparation time and the deteriorating effect it would have on the program. Discussion also took place concerning the possibility of dropping the Advance Placement Program. In a letter to the Principal of Bentley High School, the Bentley Mathematics Department Chairman suggested this as a possibility.

> This revision could take two general directions: (1) abandon the concept of advanced placement and schedule those students into regular college preparatory math classes, or (2) revise the program towards enrichment type classes rather than accelerating towards college level mathematics in the senior year.[1]

Such changes were not made. The preparation time was not restored and the Advanced Placement classes remained essentially unchanged in form and content.

The success of the Advanced Placement Program in Livonia can be measured in terms of the acceptance of the program by parents and students, the numbers of students receiving passing scores of three or better on the Advanced Placement Examinations, and the reactions of students to the program once they entered college. As measured by each of these points, this program seems to have functioned well. Throughout the existence of the program only one or two students each year have turned down the opportunity to participate. This would indicate that no serious negative feelings

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[1]Roger Strong to Albert Zack, "The Advanced Placement Mathematics Program," Livonia, Mich., 20 February 1970.

toward the program have developed. During the early 1960s the counselors in the high schools made regular, yearly trips to the state colleges and universities to interview graduates. These interviews provided only positive feedback with respect to the Advanced Placement Program. While such interviews no longer take place as extensively, teachers and counselors still indicate that they have received no unfavorable comments from returning students regarding this program.

The numbers of students from the district who received scores of 3, 4 or 5 on the Advanced Placement Examination in mathematics are shown in table 26. In most years the percentage of Livonia students receiving such grades is comparable to the percentage of students receiving them nationwide. Major exceptions appeared in 1964-65, 1967-68, 1968-69, and 1970-71 when the percentage of Livonia students was much lower than the nationwide percentage. In each of these years the teacher at one or more of the high schools who was teaching Advanced Placement III was doing so for the first time.

While the main content of the Advanced Placement sequence has remained much the same for the fifteen years the program has existed in Livonia, it has varied in minor ways from year-to-year depending at least in part on the adopted text materials. During the first several years of the program, there were no special texts adopted for either Advanced Placement I or II. In Advanced Placement I the texts for Plane Geometry, Plane Geometry by Mallory and Oakley and Plane Geometry by Schacht and McLennan, were used as basic texts.[1] These

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[1]Mallory and Oakley, Plane Geometry; and Schacht and McLennan, Plane Geometry.

TABLE 26

STUDENT SCORES ON ADVANCED PLACEMENT EXAMINATION IN MATHEMATICS: 1960-61 THROUGH 1974-75

Year	Livonia Students Taking Test	Livonia Students Scoring 3,4,5	Livonia Percentage of Students Scoring 3,4,5	National Percentage of Students Scoring 3,4,5
1960-61	18	15	83	57
1961-62	9	8	89	59
1962-63	17	9	53	53
1963-64	24	11	46	50
1964-65	31	6	19	48
1965-66	27	14	52	49
1966-67	30	14	46	41
1967-68	52	17	33	51
1968-69	77	28	36	53
1969-70	70	37	52	52
1970-71	87	30	34	53
1971-72	58	44	76	59
1972-73	47	29	61	59
1973-74	61	40	66	60
1974-75	72	56	78	66

texts were supplemented by materials such as Essentials of Solid Geometry by Welchons, Krickenberger and Pearson and by teacher lectures which were derived from a variety of sources.[1] Starting in 1961 Geometry by Brumfiel, Eicholz and Shanks was also used for two years.[2] The first official adoption of a text for this course was for the 1963-64 school year when Geometry by Moise and Downs was adopted.[3] This remained the basic text for Advanced Placement I through the 1974-75 school year. During 1974-75 the text Geometry: A Transformational Approach by Coxford and Usiskin was used on a pilot basis at Franklin High School.[4] This pilot was continued for the 1975-76 school year with the possibility that the text might be adopted following its second year of use as a pilot text.

During the first several years the students in Advanced Placement II used the adopted texts from Algebra II and Trigonometry. These texts were Algebra: Book Two by Welchons, Krickenberger and Pearson and Foundations of Advanced Mathematics by Kline, Oesterle and Willson. Supplementary books which were available in classroom sets were: Integrated Algebra and Trigonometry by Fischer and Ziebur, Principles of Mathematics by Allendoerfer and Oakley and Senior

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[1]A. M. Welchons, W. R. Krickenberger and Helen R. Pearson, Essentials of Solid Geometry (New York: Ginn and Co., 1959).

[2]Brumfiel, Eicholz and Shanks, Geometry.

[3]Moise and Downs, Geometry.

[4]Arthur F. Coxford and Zalman P. Usiskin, Geometry: A Transformation Approach (River Forest, Ill.: Laidlaw Brothers, 1971).

[5]Welchons, Krickenberger and Pearson, Algebra: Book Two, rev. ed.; and Kline, Oesterle and Willson, Foundations of Advanced Mathematics.

Mathematics by Mallory and Fehr.[1] The first official adoption of a text for this course, Contemporary Algebra and Trigonometry by Griswold, Keedy and Schacht, was made in 1963-64.[2] This text was retained until the 1968-69 school year when Algebra Two and Trigonometry: Theory and Application by Fitzgerald and others was adopted.[3] The final change was the adoption, based on a recommendation from the Franklin/Churchill Region, in 1973-74 of Algebra 2 with Trigonometry by Drooyan and others.[4] The number of different texts used in this course reflects the feelings of the staff that no one book was sufficiently comprehensive to cover the content which the course outline indicated should be covered in Advanced Placement II.

The text Elements of Calculus and Analytic Geometry by Thomas was adopted for Advanced Placement III in 1960-61, the first year of the course.[5] Although instructional materials committees reviewed texts for this course in 1965, 1970 and 1975, no changes were ever recommended beyond a change to the 1967 revision of the

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[1]Robert C. Fisher and Allen D. Ziebur, Integrated Algebra and Trigonometry (Englewood Cliffs, N.J.: Prentice-Hall, 1958); Carl B. Allendoerfer and Cletus O. Oakley, Principles of Mathematics (New York: McGraw-Hill Book Co., 1955); and Virgil S. Mallory and Howard F. Fehr, Senior Mathematics (Chicago: Benjamin H. Sanborn & Co., 1955).

[2]Mervin L. Keedy, Alice L. Griswold and John F. Schacht, Contemporary Algebra and Trigonometry (New York: Holt, Rinehart and Winston, 1961).

[3]William M. Fitzgerald et al., Algebra 2 and Trigonometry: Theory and Application (River Forest, Ill.: Laidlaw Brothers, 1968).

[4]Irving Drooyan et al., Algebra 2 with Trigonometry (New York: Macmilliam Co., 1970.

[5]George B. Thomas, Elements of Calculus and Analytic Geometry (Reading, Mass.: Addison-Wesley Publishing Co., 1959)

text.[1] In each committee's discussions it was indicated that this text had been satisfactory and followed very closely the content prescribed for the Advanced Placement Examinations and therefore each committee saw no reason to recommend a change.

The Computer Mathematics Program

The computer mathematics program in Livonia has experienced long term growth since its introduction into the mathematics curriculum in 1964-65. It was introduced as an innovative approach to expanding the curricular offerings in mathematics and quickly became an established part of the high school mathematics program. During its existence, however, it experienced as many problems as any other program. This occurred because of the expense involved in offering such a program and the need to keep updating equipment as existing equipment became obsolete.

The initial work leading to the program in computer mathematics began in 1962-63 with discussions concerning the involvement of the district in electronic data processing. The initial discussions came to a focus in May 1963 when the Secondary Principals Group appointed the Committee on Implications of Electronic Data Processing for Instruction. This committee consisted of teacher representatives from mathematics and business education as well as administrative personnel. In December 1963 this committee presented a set of recommendations which identified a need for additional study in the area of mathematics but presented fairly specific

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[1] George B. Thomas, Elements of Calculus and Analytic Geometry, rev. ed. (Reading, Mass.: Addison-Wesley Publishing Co., 1967).

recommendations for the establishment of programs in business education.[1]

In December 1963 the Secondary Mathematics Committee prepared a statement on the role of the computer in the mathematics curriculum.[2] In this statement it was recognized that computer technology could be expected to play an increasingly important role in the mathematics program. The position was taken that,

> While we believe that existing topics should be carefully examined for implications for computer work, we do not believe, nor do we find anything in the literature which implies, that these topics are not sufficient to prepare students for their exposure to computers. Hence we do not believe that it would be beneficial to our students to delete materials from existing courses in order to permit specific instruction in the functioning of computers, etc.
>
> We do believe that we should also make available adequate extra curricular provision to provide for the students demonstrating an interest in this field. If a small computer could be made available to some of our more able students to use during after school or study hours, this would be very helpful. Science projects in this area might also be beneficial. The mathematics clubs might also become involved in a study of topics related to computers.[3]

Based on the work of these committees, a decision was made to purchase a computer for classroom instruction. From several computers which were considered the Burroughs E-103 was selected.[4] This computer was selected because it would allow students to have

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[1] Albert L. Goldberg, "Report Summary--Electronic Data Processing for Instruction," Livonia, Mich., 5 December 1963.

[2] Livonia System Wide Secondary Mathematics Committee, "Comments on the Role of Data-Processing in the Mathematics Curriculum," Livonia, Mich., n.d.

[3] Ibid.

[4] In system documents this computer is referred to both as an E-101 and as an E-103.

a significant amount of hands-on experience and because, since Burroughs was phasing out this model, they were willing to sell it to the system at a relatively low price.

The computer arrived in the system during the summer of 1964 and Burroughs provided training for four Livonia mathematics teachers during August 1964. The initial planning for the use of the computer called for the development of two eight-to-ten week sessions to be offered on a non-credit basis either during study periods or after school.[1] The instructors were to be released from one regular class assignment to develop materials and to teach these non-credit sections. In reviewing this initial planning it was indicated that,

> In the first session we planned to teach the student how to operate the computer; this included programming of the computer and some techniques for solving fairly standard problems, for example, determining the roots of linear equations. During the second ten-week period we expected to use the computer to solve some more complex problems and to explore some of the mathematics peculiar to the solution of problems on a computer; i.e. numerical methods, approximations, series, etc.[2]

During the first semester the computer was located at Franklin High School where James Carey served as instructor. For the second semester it was moved to Bentley High School where Peter Moloney was the instructor. Following the initial use at each of the schools, these observations were made related to future use.

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[1]Charles J. Zoet to Dr. Johnson, Dr. Bishop, High School Principals and Personnel Concerned with the Use of the E 101 Computer, "Utilization of the E 101 Computer and Related Problems," Livonia, Mich., 22 September 1964.

[2]Charles J. Zoet to Mr. Yates, Drs. Johnson and Bishop, "E101 Computer," Livonia, Mich., 19 May 1965, p. 2.

1. Students, under supervision, can learn to operate the E-103 to solve standard problems in thirty hours (six weeks) of class time.
2. By studying operations manuals, etc., highly motivated students can teach tehmselves to operate the computer.
3. About 50 percent of the students enrolled on an after-school non-credit basis allow other activiites to assume priority over these sessions and drop out.
4. Interest in using the computer to support other class work (electronics, physics, etc.) develops spontaneously.
5. The computer has definite motivational value for a mathematics program.
6. Moving a computer from school to school, as we have done, is detrimental to the growth of interest and expanding use of the computer. Each high school could generate sufficient interest in a computer to justify having an E103 located there permanently.
7. In order to permit sufficient access to the computer an instructor should not attempt to work with more than 15 students at a time when introducing them to the computer.[1]

During the summer of 1964 Carey and Moloney collaborated to produce text materials for use with students in ten week non-credit experiences during 1965-66. A second computer was purchased and installed at Franklin High School in September and during that year each school was able to teach the course. By January 1966 a proposal for a one-semester credit course, Computer Uses in Mathematics, was prepared and presented to the Board of Education. This course received approval and was implemented during 1966-67 at Bentley and Franklin as well as at the new Stevenson High School. The description for this course included in addition to work on programming and the operation of the E-103, a listing of a representative group of mathematical and scientific problems to be covered.[2] This list included: linear equations, systems of equations, evaluation of

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[1] Ibid., p. 3.

[2] Charles J. Zoet to Dr. Johnson, "Description of a Course Entitled: 'Computer Uses in Mathematics'," Livonia, Mich., 20 January 1966.

polynomials, construction of tables of values, falling body problems, methods of approximation, iterative methods and random walk techniques as well as an introduction to more general material related to computers.

During the spring of 1966 a manual Computer Uses in Mathematics was assembled and published by the district.[1] This manual served as the basic text for the computer mathematics course as long as the E-103 was used. In addition to programming and operational materials, the manual contained sets of problems designated as Level I, II and III. Level I problems were programming problems. Level II problems were problems all students were expected to be able to program and Level III problems were designed for students desiring more challenging problems. The distinction between Level II and Level III problems was based on the programming difficulty rather than the mathematical difficulty of the problem. The following two problems are illustrative of the problems placed at these two levels.

Level II - Factor a given whole number N into prime factors. Restrict yourself to numbers less than 1000, so that you will not have to divide by any prime greater than 31.[2]

Level III- Make change from a $10 bill. Write a program that will tell a clerk how many fives, singles, quarters, etc. should be returned to a customer who is paying for some amount between 1¢ and $10 with a ten dollar bill.[3]

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[1]Department of Secondary Education, A Student Manual: Computer Uses in Mathematics (Livonia, Mich.: Livonia Public Schools, 1966).

[2]Ibid., p. 2.3.

[3]Ibid., p. 2.5.

In the spring of 1967 a special class was formed for a limited number of students who had studied the E-103 and for interested teachers to learn FORTRAN.[1] This class was taught at the Board of Education Offices using the IBM computer which was located there.

Over the next two years each of the high schools taught the adopted one-semester course using the E-103. During this time efforts were made to expand the use of the computer and the number of students who enrolled in computer mathematics. One effort was the establishment of workshops for junior and senior high school teachers to learn to program and use the E-103. Two workshops, which involved a total of thirty teachers, were conducted by Kenneth Knipschild of the Bentley staff during the spring of 1967.[2] A second factor in expanding the program was the appointment of Knipschild to the position of Specialist in Computer Education in February 1968. This appointment released him half-time from his classroom duties to coordinate the efforts of the district and to work directly with advanced students. A third factor in expanding the program was the increased availability of the IBM 1440 computer at the Board of Education Offices which resulted from the purchase of a second computer by the school system. Knipschild was able to make use of this computer and in March 1968 he began work with two classes of students to teach them programming in FORTRAN.

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[1]Secondary Spotlight, I (Livonia, Mich.: Department of Secondary Education, Livonia Public Schools, June 1966).

[2]Charles J. Zoet to SENCOM, "E-103 Computers and Computer Uses in Mathematics," Livonia, Mich., 18 March 1968.

By the late spring of 1968 it was evident that the maintenance of the E-103 computers was becoming a problem because of frequent breakdowns and the difficulty in obtaining service and replacement parts. During the first semester of 1968-69 a study of replacement possibilities was made and in March 1969 a trial placement of a dial-access terminal was made at Franklin High School. Computer time was rented from Applied Computer Time Share, Inc. (ACTS). Based on this trial use, plans were developed to place terminals at both Franklin and Churchill High Schools in the fall of 1969 and to operate totally on the basis of dial-access terminals during 1969-70. The loss of a millage vote disrupted these plans and curtailed the program at both schools during the first semester. Churchill cancelled its class and Franklin returned to the use of the E-103. By second semester rental agreements had been established with ACTS and terminals were placed at Franklin and Churchill. Instruction at this time shifted to the BASIC language.

During the summer of 1969 Kenneth Knipschild had resigned from the school system and in the financial situation which the district found itself, no replacement was immediately named. In February 1970 Lary Smith was appointed to the position of Specialist for Computer Education on a half-time basis.

Prior to the time that he left, Knipschild and Smith had written, as a part of the total set of performance goals for secondary mathematics, a set of goals for Computer Uses in Mathematics.[1]

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[1]Kenneth Knipschild and Lary R. Smith, "Performance Goals for Computer Uses in Mathematics," Livonia, Mich., 5 May 1969.

In recognition of the changes in equipment taking place, this set of goals was in no way tied to the use of a particular computer or set of equipment. As such, it provided the basic structure for the first courses which were taught using the terminals. At the time that these courses began no text was adopted. Each school instead bought classroom sets of some text, such as Programming in Basic by Farina, for students to use in conjunction with the programming materials provided by the computer companies.[2]

The arrangement with ACTS to supply computer time continued for a period of two years. This arrangement proved to be satisfactory except for the increasing expense which resulted from the increasing number of students and the time demands that they were generating. In 1971-72 each high school was restricted to offering computer mathematics only one of the two semesters and a tight restriction was placed on the amount of computer time which each class could use. This resulted in a drop from 240 to 120 in the number of students who took computer math in comparison with the previous year.

In order to reduce costs and to re-establish the earlier enrollment levels in computer mathematics, Livonia leased a Hewlett Packard 2000E computer to serve the programs of the four high schools for 1972-73. The allowed the expansion of the number of terminals at each high school to four as well as allowing for unlimited access time for students. This installation provided rapid access and its use was very satisfactory during the first year of operation. Some

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[1]Mario V. Farina, Programming in BASIC: The Time-Sharing Language (Englewood Cliffs, N.J.: Prentice-Hall, 1968).

operational problems did occur the second year when the number of terminals at each high school was reduced to three and in an effort to reduce the cost of the installation computer time was rented to Schoolcraft Community College. Following the 1974-75 school year the lease agreement with Hewlett Packard was terminated and plans were made for the Livonia computer classes to use the computer facilities of the Wayne County Intermediate School District during the 1975-76 school year.

The performance goals written in 1969 stated as prerequisites for Computer Uses in Mathematics the ability to correctly evaluate algebraic expressions and to accurately solve algebraic equations.[1] This was interpreted to mean the successful completion of one year of algebra. While a large portion of the course objectives were devoted to the programming and operational aspects of the computer, the following three objectives illustrate the depth of mathematical understanding which was considered minimal to complete the course.

1. Given a purely algebraic statement, the student will be able to properly code it.

2. Given an algebraic problem of the following type, within one (1) week the student will be able to prepare a flow diagram and a coded program that will produce the proper results: i.e. those expected by the instructor.

   evaluate a polynomial
   generate prime numbers
   solve a quadratic
   calculate the GCD or the LCM of two numbers
   solve two linear equations in two unknowns

3. The student will demonstrate his ability to use the computer as a mathematical tool by identifying a problem from some

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[1] Knipschild and Smith, "Performance Goals."

academic discipline and apply the computer to the solving of the problem.[1]

The first effort to develop and organize a complete systemwide program for computer mathematics took place in the summer of 1973 when a workshop was held to: (1) re-write the computer mathematics objectives, (2) identify the computer mathematics curriculum, (3) create problem sets, and (4) outline a second semester course.[2] During the workshop, which involved representatives from each of the high schools, the tasks were completed to the extent that the Specialist for Computer Education could oversee their completion during the first semester of 1973-74. The second computer course was implemented as a pilot course at both Bentley and Stevenson High Schools. Based on the favorable experiences in these pilot sections, approval to include this course as a part of the mathematics program was granted by the Board of Education. With the adoption of Communicating with the Computer-BASIC by Jacobs and others, as a common text for computer mathematics in June 1975, the district had a common program and set of materials in use in all four high schools.[3]

A problem throughout the existence of the computer program was the expansion of experiences to include junior high school students. The cost of placing equipment in all of the junior high schools was considered prohibitive and as a result other alternatives

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[1] Ibid.

[2] Lary R. Smith to Computer Math Teachers, "Meeting to Organize Workshop," Livonia, Mich., 23 March 1973.

[3] Jacobs et al., Communicating with the Computer-BASIC.

were tried. Arrangements were made for groups of junior high school students to make use of the equipment at the high schools on an after school basis. Also, special classes were offered through the summer school program to teach junior high students to program and operate the computer. Both of these methods, which reached only limited numbers of students, were successful in teaching these students some elementary concepts and programming skills. In the spring of 1974 a "Digi-Log" was purchased for use in the junior high schools. This was a light-weight, portable device which could project a visual display of the communication with the computer by means of a television screen. This device received extensive use at the junior high schools and was a satisfactory means of introducing students to some of the computer concepts and capabilities.

Throughout its existence the computer mathematics program has experienced increasing enrollments. A listing of the enrollments at each of the high schools, since Computer Uses in Mathematics was established as a credit course in 1966-67, is shown in table 27. Only in 1971-72 when restrictions were placed on computer offerings was there a decrease in enrollment.

As a result of the increasing enrollments in computer classes and the work necessary to maintain the Hewlett-Packard system, the position of Specialist in Computer Education was expanded to a full-time position in 1973-74. In June 1975 when the decision was made to terminate the use of the Hewlett-Packard 2000E in the system, it was decided that the Wayne County Intermediate School District computer facilities would be used for Livonia's computer instruction. The position of Specialist for Computer Education was then reduced

TABLE 27

ENROLLMENT IN COMPUTER MATHEMATICS
1966-67 THROUGH 1974-75

Year	Semester	Bentley	Franklin	Stevenson	Churchill	All Schools
1966-67	1st	0	17	0		17
	2nd	41	0	15		56
1967-68	1st	50	68	28		146
	2nd	63	--*	24		87
1968-69	1st	50	49	17	0	116
	2nd	31	--*	23	7	61
1969-70	1st	17	45	18	0	80
	2nd	17	34	22	30	103
1970-71	1st	16	27	12	37	92
	2nd	26	48	24	50	148
1971-72	1st	25	33	0	42	100
	2nd	0	0	20	0	20
1972-73	1st	23	21	29	75	148
	2nd	20	30	59	0	109
1973-74	1st	49	32	48	67	196
	2nd	66	35	93	27	221
1974-75	1st	84	64	117	84	349
	2nd	56	52	109	47	264

*Data for Franklin High School is not available for the years 1967-68 and 1968-69.

to a half-time position and Lary Smith resigned and took a position with the Intermediate District to oversee the educational uses of their facility. Smith continued to serve as a resource person and workshop leader for the district during the conversion period. As had happened in 1969, no immediate plan was implemented to fill the vacated position and some of the responsibilities reverted by default to the Coordinator of Mathematics.

Because of the many time consuming tasks related to the coordination of this program and the rapid changes in this field, the extent to which computer mathematics continues to be a viable and growing program in Livonia seems to be closely connected to the ability of the district to provide a person with clearly defined responsibilities for coordinating the instructional uses of the computer.

CHAPTER VII

PROVISION FOR IN-SERVICE TRAINING

Introduction

The study of curricular problems and the introduction of innovations in the Livonia Public Schools have tended to involve sizeable groups of teachers. In many instances these activities included special in-service training sessions or opportunities for staff members to become acquainted with activities taking place outside the school district.

The planning of in-service training in mathematics education belonged to general administrative personnel until 1964. From 1964 through 1975 the provision of systemwide or regionwide in-service training opportunities in mathematics was the direct responsibility of the Mathematics/Science Coordinators. They were also responsible for providing in-service training to individual building staffs as requests were received from building principals.

The Livonia Public Schools has provided money for the support of in-service activities of two types: (1) those designed to provide training for teachers, and (2) those designed for the production of materials. The yearly decisions as to how money would be expended were made on the basis of the most pressing curricular needs. Thus, mathematics education, as with all curricular areas, was not assured of a fixed amount of money for in-service training during any one year

but applied for and was allocated funds in competition with all other curricular areas.

While this section is devoted to summarizing the efforts of the district to provide in-service training directly related to mathematics education, it is recognized that many of the in-service activities of the district, even though not designed to directly effect the mathematics program, did have an effect. A significant example of this was the in-service efforts related to implementing modular scheduling at Franklin and Stevenson High Schools. Training was provided for teachers in the methodologies of large and small group instruction and the provision of individualized instructional opportunities. Mathematics teachers were included in this training. The resulting implementation of modular scheduling and varying instructional group sizes at these schools effected the organizational pattern for teaching mathematics. In those course with a total enrollment of 150 or more, such as Plane Geometry and Algebra II, large group instruction of 75 to 100 students and small group instruction of groups of 10 to 15 students were both employed. It is doubtful that this type of instruction would have been employed in the high school mathematics programs if there had not been a total movement of each building in this direction.

The in-service efforts of the district directly related to mathematics education can be described in five categories: (1) regularly scheduled systemwide activities, (2) specially scheduled system or region workshops, (3) specially scheduled building workshops, (4) experiences outside the district, and (5) special considerations.

Regularly Scheduled Systemwide Activities

From the beginning of the district there existed a commitment to provide in-service training for teachers. Until the mid 1960s in-service activities were planned to occur on a regular basis during a pre-school conference period or on monthly curriculum days. This type of plan seemed to work effectively during the time that the district was relatively small in size and the staff was such that districtwide meetings could be held without great difficulty. As the district grew and as the planning unit for curriculum became the local building during the early 1960s, the attempts to provide districtwide in-service activities were replaced by increased provisions for local building planning and in-service. Both the pre-school conference begun in 1944 and the monthly curriculum days which started in 1948 were eliminated or significantly altered following the adoption of collective bargining in the late 1960s. Teacher attendance at pre-school conferences was eliminated for returning teachers and provisions for curriculum days or released time changed from contract to contract. In the contract for 1968-69 curriculum days were completely eliminated in elementary schools and were replaced with a time bank upon which the schools could draw to release teachers for in-service activities.[1] From that time through 1974-75, varying combinations of time bank days, generally one or two per staff member, and curriculum days were established in

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[1] Professional Agreement Between the Livonia Public Schools School District and the Livonia Education Association MEA-NEA: 1968-69 (Livonia, Mich.: Livonia Public Schools, 1968) p. 46.

The contracts. The use of time bank days allowed for the release of teachers from classroom duties to participate in specially planned training sessions which replaced the monthly meeting provided under the curriculum day plan.

Systemwide Workshops

The in-service training provided in Livonia varied extensively in format, size and purpose depending upon the level of the teachers for which the programs were provided. For secondary teachers in-service workshops can be identified as having three major points of focus: (1) "modern mathematics," (2) computer mathematics, and (3) the slow learner in mathematics.[1]

At the junior high school level the greatest amount of in-service was provided during the introduction of "modern mathematics" in the early 1960s. At that time teachers at the seventh and eighth grades taught mathematics/science blocks. This required them to remain current in both mathematics and science during what was a period of rapid change in both areas. The district felt it was necessary to provide the opportunity for all teachers to obtain training in the content and methodology of "modern mathematics." As a result, the district provided paid in-service courses for such teachers in the summers of both 1961 and 1962. The emphasis of these courses was on the SMSG materials which were being piloted in the district.[2] They were directed at those teachers who had not been

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[1]For a complete list of secondary workshops see appendix I.

[2]Mathematics Workshop Committee to Secondary Principals, "Livonia Mathematics Workshop, Summer 1961, July 31-September 1," Livonia, Mich., 7 March 1961.

involved in NSF institutes. In this way the district attempted to insure that all secondary mathematics teachers would have a formal introduction to "modern mathematics" prior to the adoption of a text series having a "modern" approach.

A second focus of in-service training at the secondary level, and one which continued from 1964 through 1975, was the computer mathematics program. In-service education in this area served two purposes. It was used to train the teachers of the computer mathematics classes as changes in the computer and in computer languages occurred. It was, also, used to instruct interested mathematics teachers to operate and program the computers. It was intended that this training would spread the use of the computer into additional mathematics classes. Special training sessions for these purposes were held in 1964, 1966, 1967, 1972 and 1975. Computer mathematics was the primary area of in-service for high school teachers. All other major changes, either related to the introduction of new courses or text adoptions, were implemented without providing in-service to retrain or upgrade teachers.

The third major area for which in-service training was provided at the secondary level was in working with the slow learner in mathematics. Workshops for junior and senior high school teachers were held on this topic in both 1967 and 1968. Also, a 1971 workshop on the use of mathematics laboratories provided direction for working with this same type of student. The activities in 1967 and 1968 were specifically designed to support the implementation of classes for slower mathematics students at the seventh and eighth grades.

In-service training activities for elementary teachers were more extensive both in number and variety than those for secondary teachers.[1] Workshops were held to provide training in content and/or mehodology, to introduce new text materials and to prepare teachers to serve as instructors or specialists to work with other groups of teachers. The earliest workshop for elementary mathematics teachers was held during the summer of 1959. This was one of the first attempts of the district to provide in-service training in any curricular area outside the regular school year.

Workshops in 1960, 1961, 1964, 1966 and 1973 were held to acquaint elementary teachers with new or revised materials which were being introduced into the district. In general, these workshops involved teachers in one or two sessions held either after school or on released time. Their purpose was to provide an overview and an understanding of how the new program differed from that which teachers had previously used.

Other in-service sessions for elementary teachers had a sharper focus in terms of participants then did these general meetings. One-day workshops for kindergarten teachers in 1964 and 1973 are illustrative of those workshops which were designed for teachers at a given grade level. Sessions in 1971 on the teaching of fractions and in 1972 on the teaching of addition and subtraction in grades 1-3 both had a narrow focus on content. Workshops of this type were established at times that a need or weakness was identified by the district.

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[1]For a complete list of elementary workshops see appendix I.

Classes in "modern mathematics" offered in 1963-64 and the courses offered in connection with Eastern Michigan University in 1971-72 were attempts to provide teachers with content training. In each instance participation by teachers was good and attendance by participants remained high to the end of the courses.

The Elementary Mathematics Study Group which met during 1962-63 was a unique mathematics in-service activity for Livonia.[1] This group consisted of voluntary participants who met on a weekly basis over a period of several months. Although William Kumbier served as a leader for the group, all members shared in making presentations. This was the only non-paid in-service activity of such an extensive nature to occur in the district.

The adoption of texts with a "modern" approach during the middle 1960s required an intensive in-service effort because of the "traditional" and generally weak mathematics background of most of the elementary teachers. The system attempted to meet this problem in two ways. A course which met weekly for a period of approximately three months was offered during 1963-64 to provide training in the content of "modern mathematics."[2] This course enrolled approximately 20 percent of the elementary teachers in the system. The other method employed was to train a select group of teachers who in turn trained other teachers. When this was done in 1964 and again in 1965 and 1972, it was possible to provide training for a majority of

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[1]Henry C. Heusner, Annual Report for the School Year 1962-63 (Livonia, Mich.: Livonia Public Schools, June 1963), p. 9.

[2]For other references to this course see page 121 above.

the teachers in the district during the following year. In August 1964 twenty-four teachers attended a workshop to train them to serve as leaders during the following school year.[1] During 1964-65,

> The program used nineteen different classroom teachers and the elementary mathematics specialist as instructors. There were four centers; Hull, Jackson, Garfield, and McKinley schools, each serving an area covering six to eight elementary staffs.[2]

At each center a series of three sessions was held for each grade level 1-6. The sessions involved approximately 200 teachers who attended on a voluntary non-paid basis. In 1965 six teachers, several of whom had served as leaders the previous year, received training to enable them to conduct in-service sessions for teachers during 1965-66.[3]

In 1972-73 a third attempt was made to multiply the effects of in-service training. At that time training was provided for a group of thirty teachers. The cost of this training was covered by an NSF grant which had been awarded to Eastern Michigan University and the Livonia Public Schools. The teachers attended a six-week summer school session and then net monthly during the 1972-73 school year for additional instruction. Following the summer session the participants were divided into teams of three members each. These teams were on call to individual schools or clusters of schools to provide instruction and help for teachers. On a survey, twenty-one

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[1]William K. Kumbier, "Summary--Elementary Mathematics Workshop," Livonia, Mich., September 1964.

[2]Elementary Math-Science Office, "Summary of In-service Center Activities," Livonia, Mich., n.d.

[3]Henry C. Heusner, Annual Report for the School Year 1965-66 (Livonia, Mich.: Livonia Public Schools, August 1966), p. 31.

of these teachers reported that during 1972-73 they conducted 38 workshops within their own buildings, 15 in other buildings, and 19 workshops for groups of teachers from several buildings.[1] The teachers felt that their work with other teachers in the system had been well received and they indicated a need for the workshops to continue. One of the teachers stated,

> Many teachers have been exposed to the ideas of a math lab. However, it will be necessary to have more workshops for teachers and materials available. One year's exposure without reinforcement may not be as beneficial as a continued program. It is a good program and I feel it is a good thing for the Livonia School program.[2]

The training sessions conducted by fellow teachers seem to have been well received each time they were attempted in Livonia. In each case, however, there is no indication that the district made use of the specially trained teachers in any way beyond the first year following their training. After one year either funds were no longer available to release teachers or priorities for providing in-service shifted to other curricular areas and little or no use was made of these trained teachers.

At various times the district also made use of consultants from neighboring universities and from publishing companies whose texts had been adopted by the district. The consultants from the publishing companies were most often used at the time that texts were being introduced into the system. They generally met with large groups of teachers to provide an overview of the materials

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[1] Allan A. Edwards, "E.M.U. Institute and Workshop Evaluation," Livonia, Mich., 12 September 1973.

[2] Ibid., p. 12.

or to answer questions based on the teachers' use of the materials during the first several months of the school year. The faculty members from the universities were used to conduct sessions designed to train teachers in special methodologies or to provide training related to specific problem areas which had been identified.

Building Workshops

In addition to the systemwide in-service activities, many buildings conducted their own in-service activities. They were conducted in several ways: (1) as curriculum day activities, (2) as non-paid after school activities, (3) as released time activities during the school day, or (4) as paid workshops during the summer. Such activities generally involved a Mathematics Coordinator in the planning. The leadership for the workshops was provided by a building principal, a curriculum representative, the Mathematics Coordinator, one or more of the specialists trained in the systemwide workshops, or in the case where funds were available an outside consultant or resource person.

The purpose of building level workshops and activities was not always so clear cut that a distinction in their purposes could be made between teacher training and materials production. Often both purposes were served in one workshop setting. Table 28 contains a list of some of the elementary and junior high school building level activities in mathematics education which took place during the summers of 1969 and 1970. This list is typical of the number of building level activities that occurred yearly from 1960 to 1975. The focus of the listed activities on individualized math is representative of the emphasis on individualization during the late 1960s and early 1970s.

TABLE 28

BUILDING LEVEL IN-SERVICE ACTIVITIES
SUMMERS 1969 AND 1970

School	Date	Activity or Group
Cass El	Summer 1969	Individualizing math--Grades 1,2 & 6
	Summer 1970	Individualizing math--Grades 1,2 & 3
Kennedy El	Summer 1969	Individualization project in math
	Summer 1970	In-service math workshop
Madison El	Summer 1969	Individualization using Kennedy IPI
	Summer 1970	Individualized math program
Washington El	Summer 1969	Mathematics activities--grades 2-6
Coolidge El	Summer 1970	Individualized Math and Reading
Buchanan El	Summer 1970	Upper grade mathematics
Riley JH	Summer 1969	Workshop for math teachers
	Summer 1970	Mathematics project
Holmes JH	Summer 1969	Learning unit program in math
	Summer 1970	Continue learning units program
Bryant JH	Summer 1970	8/9 Math team
Dickinson JH	Summer 1970	9th grade Basic Math and Basic Alg
	Summer 1970	7th grade individualization of math
Frost JH	Summer 1970	Preparation of math laboratory

Experiences Outside the District

The Livonia Public Schools financial support for the attendance of staff members at conferences and in visitations to other districts has varied greatly. At any given time the extent of support depended upon current district policy, the funds available and the contractual conditions negotiated with the LEA.

Starting in the middle 1950s and continuing through the 1960-61 school year, funds for conference attendance were controlled and allocated through the central office administrators upon the request of the building principals. During the period from 1955-56 through 1960-61, funds were supplied for both junior and senior high school teachers to attend meetings of the MCTM. Also, from 1958-59 through 1960-61 funds were available for from two to four teachers to attend the annual meetings of the NCTM.

Beginning in 1961-62 funds for conference attendance were allocated to each building on a per capita basis.[1] This allotment varied between $3 and $4.50 per teacher over the next ten years. As a result of the building allotments and the increasing number of staff members, the number of teachers who expenses could be paid to attend conferences decreased over this period. After 1961 no district allocations of funds were made to send teachers to the annual meetings of the NCTM.

While the system did not have large amounts of money available to support conference attendance, efforts were made to involve as many

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[1]Paul E. Johnson to Administrative Staff, "Allotment of Funds to Schools and Departments for Conference and Travel Expense Outside the School District," Livonia, Mich., 30 November 1962.

teachers as possible in these activities. Materials related to the annual MCTM meetings, the Annual Mathematics Conference at The University of Michigan and the Eastern Michigan University Conference on Mathematics Education were distributed each year and teachers were urged to attend. Attendance at these conferences by Livonia teachers followed no consistent pattern but seemed to be related to the availability of funds to cover registration fees and the extent to which a particular conference was publicized by the Mathematics Coordinators.

Special Considerations

At two different times the school district made efforts to provide teachers of mathematics and science with considerations that were not extended to teachers in other curricular areas. In each case these efforts were provided through the Livonia Adult Education Program. In the early 1960s, at the time that "modern mathematics" was being introduced, it was indicated that, "Dr. Johnson reaffirmed the Board's approval of the practice of waiving local adult education fees for teachers taking mathematics and science courses for purposes of educational improvement."[1] The number of teachers who took advantage of this opportunity is not known. This same consideration was also given to mathematics and science teachers in 1973-74 when courses on the use of the computer and programming in the BASIC language were offered through the adult education program. At that time approximately fifteen teachers took this course without cost.

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[1] Livonia Public Schools, Minutes of Meetings of the Board of Education, Meeting of 24 November 1964.

Summary

The Livonia Public Schools have maintained a consistent, strong commitment to in-service training. From 1944 to 1959 this training was conducted through pre-school activities and monthly curriculum days. After 1959 a wider variety of in-service activities were employed. The position of the National Advisory Committee on Mathematical Education that,

> School district administrators must have a serious commitment to continuing teacher education responsibilities and provide the means in time and funding to enable teachers to take advantage of in-service education opportunities whenever available.

generally held true in Livonia.[1] When limitations of in-service activities occurred, it was the result of reduced financial resources.

Districtwide in-service activities were most often associated with the implementation of a new program or a new emphasis at the district level. The district provided a continuing program of in-service to meet the needs of the many elementary teachers who were viewed as generally weak in mathematics. In-service activities, consisting mainly of workshops and courses in content and methodology, were offered almost every year from 1959 to 1975. These workshops covered a wide variety of topics which were related to the needs identified with each change in the elementary program.

A special feature of the elementary in-service program was the use of specially selected and trained teachers to serve as instructors for other teachers. Such groups of teachers were selected in 1964,

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[1]National Advisory Committee on Mathematical Education, Overview and Analysis of School Mathematics: Grades K-12, p. 95.

1965 and 1972. The use of these specially trained teachers was generally well received and proved effective in meeting shor term goals. Such leaders, however, were generally not use d for longer than one year. Once the short term goals were achieved, priorities for in-service shifted to other curricular areas and funds were not available to extend mathematics in-service programs.

Districtwide workshops for the in-service training of secondary teachers were more limited than were those for elementary teachers. The emphasis for secondary teachers was more often on workshops designed for the production of materials. Between 1960 and 1975, in-service training for secondary teachers was primarily directed at three areas: (1) "modern mathematics," (2) computer mathematics, and (3) the slow learner in mathematics. In each of these areas workshops were held in two or more years and a total of between thirty and fifty secondary teachers received training in each area.

CHAPTER VIII

SUMMARY AND CONCLUSIONS

The Problem

The purpose of this study was to trace the development of the mathematics program of the Livonia Public Schools from 1944 to 1975. This was a period of rapid growth and change in the suburban areas of the country and a period of "revolution" in the mathematics program for grades K-12 across the country. The study was an attempt to examine the following questions concerning the development of the mathematics program of one district during this period.

1. What were the significant changes in course offerings, required mathematics courses and student enrollments in mathematics courses in the Livonia Public Schools?

2. What was the relationship of textbook changes to the changes in the mathematics program of the Livonia Public Schools?

3. What were the significant forces which effected the development of the mathematics program of the Livonia Public Schools?

4. What special programs and innovations in mathematics education were introduced by the Livonia Public Schools and which of these programs were retained or extended by the district?

5. What processes were used to implement or establish innovations or changes in the mathematics program of the Livonia Public Schools?

6. What role did the teaching staff and the administrative personnel have in the development of the mathematics program of the Livonia Public Schools?

7. Who were the leaders in the development of the mathematics program of the Livonia Public Schools and what were their contributions?

To provide a background for the examination of these questions, answers were sought for three broad questions.

1. What were the major curricular forces in the United States prior to and during the development of the mathematics program of the Livonia Public Schools?

2. What were the major curricular developments in mathematics education in the United States prior to and during the development of the mathematics program of the Livonia Public Schools?

3. What state-wide or regional forces added direction or impetus to changes in the development of the mathematics program of the Livonia Public Schools?

Procedures Used and Sources of Data

A search was made for available materials pertaining to or related to the mathematics program of the Livonia Public Schools. The primary focus of this search was the offices of the departments and schools of the school district.

The data collected were organized into chronological and topical order. Following this organization the materials were subjected to internal criticism and were examined for their significance as a source of information.

The primary sources of data consisted of the minutes of the Livonia Board of Education, the annual reports of school administractors, notices of the various departments, minutes of the mathematics committees, special materials and guides published by the district, and internal memorands and letters received and sent by members of the staff of the Livonia Public Schools. This information was supplemented by data obtained from articles describing the

mathematics program in Livonia and from the textbooks and materials approved for use in Livonia.

For the historical development of the mathematics curriculum in the United States, data were gathered from the publications of the NCTM, reports of national organizations and committees, and texts on mathematics education. The historical data on general curricular development was obtained primarily from reports of national organizations and committees and from textbooks on curriculum development.

Major Findings and Conclusions

National Curricular Forces and Developments in Mathematics Education

Education during the period from 1945 to 1975 reflected the changes and pressures which were a part of the national scene. The economic, social and technical forces which developed as a result of World War II directly affected education. The relatively slow changes in education which had preceded the 1940s gave way to a period of change, experimentation and innovation beginning in the 1950s. Much of this experimentation was supported by the federal government through programs such as NSF and NDEA.

Many of the changes proposed in the 1950s and 1960s moved away from a practical emphasis to the curriculum and toward an academic orientation. As a result, in the early 1960s new content with a highly structured organization was proposed for the elementary and secondary schools. During the later 1960s the emphasis of curricular revision changed. The problems of the disadvantaged student, the slow

learner, and concerns for individual differences received emphasis. Basic questions concerning the role of the schools and the anticipated outcomes for students were generated as a part of the change process. This was reflected in the 1970s as increased concerns about skill development, minimal objectives, career education, consumer skills and the use of behavioral objectives and objective referenced tests to measure the achievement of such objectives.

The first reactions of the mathematics community to the forces of the 1940s were the establishment of the reform projects such as UICSM and the Ball State program in the early and middle 1950s. These projects accepted as a starting point the revision of the content of school mathematics and to some extent the methodology associated with the teaching of mathematics. In 1958 SMSG, the most influential of the projects, was formed and operated from similar premises. The collective changes proposed by and implemented in the materials developed by all of the projects of this period came to be called "modern mathematics" or "new mathematics." Among these projects the materials developed by Ball State, SMSG, GCMP, UMMaP, and the Madison Project all received use in the Livonia Schools. The first materials developed by these groups for use at the secondary level were all oriented toward the average or above average mathematics students. During the later 1960s the groups moved toward developing materials for the below average and the disadvantaged.

Other significant national and regional developments which influenced the development of the mathematics program in Livonia were: the CEEB published in 1959, the Advanced Placement Program which began during the 1950s, the development of computers, individualized

instructional programs such as the IPI program and the use of behavioral objectives and objective (or criterion) referenced tests.

Changes in Course Offerings, Required Courses and Student Enrollments

Mathematics has always been offered at each grade level taught in the Livonia Public Schools. It has been a required part of each student's program through the eighth grade. Except for 1969-70, ninth grade students have also been required to elect a mathematics course. Prior to 1961 there was no requirement of any mathematics at the high school or for graduation. From 1961 to 1975 all graduates were required to have completed one unit of mathematics in grades 9-12. In 1975 new graduation requirements were adopted, beginning with the class of 1978, which require each student to complete $\frac{1}{2}$ unit of mathematics in grades 10-12 or to pass a proficiency test in mathematics.

The mathematics course offerings in 1950, when Livonia graduated its first senior class, were similar in pattern to the courses offered in many small school districts across the country. All students took the same mathematics course through the eighth grade. In the ninth grade students either elected Algebra I or General Mathematics. In grades 10-12 the courses offered were Plane Geometry, Advanced Algebra, Trigonometry and Solid Geometry. In 1956 General Mathematics was dropped from the program and Basic Mathematics and Applied Mathematics I were added in the ninth grade. The following year Applied Mathematics II was added in the tenth grade. This two year Applied Mathematics sequence, renamed Basic Algebra in

1968, was intended to provide algebra credit upon its completion. In 1958 the first year of a three-year sequence of Advanced Placement courses was added in grade ten. During the next two years the succeeding courses were added to complete the sequence.

During the 1960s courses were added in response to a variety of forces. Courses entitled Applied Math III, a course whose central focus was numerical trigonometry, and Senior Mathematics, a consumer oriented skills course, were added to the program for the 10th and 12th grades, respectively, in 1960. In 1961, Modern Topics in Mathematics, which was a course in probability and statistics similar to that recommended by CEEB, was added in grade 11. Refresher Mathematics, a remedial course, was added to the 10th grade program in 1964. The increasing importance of the computer was recognized with the addition of Computer Uses in Mathematics during 1966. In 1969 Technical Mathematics was added to the program in grade 10 as an alternative to Basic Algebra for students planning to enter a technical field. The junior high school program was expanded with the adoption of an accelerated algebra program in 1970. In 1973 the last two additions to the district's program took place. A second one-semester course in computer mathematics was added and Practical Geometry was added as an alternative to Plane Geometry.

The program changes of the Livonia Schools have been almost entirely additive. The only course dropped from the program was General Mathematics which was dropped in 1956.

Since enrollment in high school mathematics in Livonia is elective, changes in enrollment at this level reflect the changing position of mathematics in the educational program. In Livonia the

peak enrollments of 63 percent of the total high school population occurred in 1964-65 and 1965-66. This enrollment reflects the national emphasis being given to the teaching of mathematics and science during the early 1960s. The greatest increase in enrollment occurred between 1960-61 and 1961-62. In the five years prior to 1961-62 the enrollment of high school students in mathematics had varied from 32 to 51 percent. After 1961-62 the enrollment varied between 57 and 63 percent of the student population.

During the period following 1961-62 the addition of new courses to the mathematics program apparently did not attract new students to mathematics. Rather, it allowed those students who elected to take mathematics a larger selection of courses from which to choose. Hopefully, this meant that their needs were more closely met.

The most significant shifts of students from one course to another occurred between Algebra I and Applied Math II (Basic Algebra II) in grade 10. From 1957-58 to 1959-60 less than 50 percent of the students enrolled in these two courses were in Algebra I. Between 1960-61 and 1963-64 from 60 to 75 percent of the students enrolled in Algebra I each year. In 1964-65, only 20 percent of the students in the two courses enrolled in Algebra I. In succeeding years this enrollment dropped until in 1970-71 a total of only two sections of Algebra I were offered in the four high schools. These changes in enrollment were all the direct result of changes in the type of credit, algebra or non-algebra, which was awarded in the Applied Mathematics sequence. These changes in credit were the results of attempts to organize the mathematics program to accomplish

two things: (1) to meet students at their level of achievement and (2) provide students with the prerequisites to take Plane Geometry. By 1973-74 and 1974-75 this trend in enrollment had begun to reverse itself and increasingly larger numbers of students were electing to take Algebra I.

Enrollments in most other mathematics courses have been relatively stable once they were an established part of the mathematics program. Some trends, however, are evident over a period of time. The enrollment in Advanced Placement Mathematics in the 12th grade has shown an upward trend over the period from 1961-62 to 1974-75. In 1961-62, 1.6 percent of the senior class was enrolled in this course. For the senior classes of 1974-75 the figure was 4.6 percent. At Franklin High School the Senior Mathematics course shows a steady decline in enrollment from 1969-70 to 1974-75. This drop accounts, in large part, for a decline in the total enrollment in mathematics at this school over the same period of time.

Relationship of Textbook and Program Changes

The mathematics program of the Livonia Public Schools during the period prior to 1959-60 existed only in terms of the textbooks in use and informal agreements arrived at by the teachers of each mathematics course. A change in textbook, therefore, represented a possible change in program. In 1959-60 a description of the complete secondary mathematics program was undertaken and an outline for each course was written. The outlines prepared were, with only minor exceptions, the table of contents of the textbook in use. Over the

next several years as new texts were adopted any changes in course outlines reflected the contents of the new texts.

In 1966-67 a 7th and 8th grade curriculum guide was compiled which for the first time did not duplicate the outline of the texts in use but rather was based on the judgement of the teachers in the system. During the next four years, sets of objectives were written for all secondary mathematics courses. While the use of these sets of objectives in the classroom was probably limited, they represented a movement away from the textbook as the determiner of the mathematics curriculum for a specific course and an attempt to implement a formally agreed upon mathematics program. Evidence of this movement appears in the reports of the mathematics instructional materials committees beginning in the late 1960s. These committees began to use the sets of objectives as the criteria for the selection of new materials. As a result, recommendations for the adoption of multiple sets of materials began to appear. These recommendations eventually resulted in the adoption of co-basic texts or multiple sets of materials for all junior high school mathematics courses, including Algebra I, and for Refresher Mathematics in the high school.

In the elementary schools a 1961-62 outline of the elementary mathematics program was included as a part of a guidebook for elementary teachers. This outline reflected the contents of the adopted text series. The adoption of a new text series in 1965-66 resulted in no significant departure from this procedure and the first real change in establising the content of the elememtary program separate from the text did not occur until the 1970s.

The development of the individualized mathematics program at Kennedy Elementary School in the late 1960s included the development of a set of objectives for grades K-6 as an integral part of the program. Following the regionalization of the district in 1970 this set of objectives was expanded upon in the Bentley/Stevenson Region and was combined with the existing 7th and 8th grade objectives to form a set of objectives for grades K-8. In the Franklin/Churchill Region a completely separate undertaking developed a set of priorities for the teaching of the content of the adopted text materials in grades K-8. When a new elementary text series was proposed by this region, the priorities were used as criteria in the selection. Following the adoption of the new series in 1973-74, its content was then keyed to the established objectives and priorities of the two regions.

Thus, at all levels of the mathematics program in Livonia, there has been a movement away from the position of the 1950s where the adopted text defined the program. This has been replaced by a position where the district has adopted a set of objectives for a given course and the selection of a text and the content to be taught in the course are determined by the objectives. This position appears to have resulted both as a natural outcome of the growth of the district and the resulting need for more formal structures and as a part of a long range movement in the district to have textbooks viewed as only one of a number of instructional tools.

Significant Forces Effecting the Livonia Mathematics Program

The forces and events which helped shape the mathematics

program in Livonia were varied. National movements and trends are clearly reflected in changes in the mathematics program. The concerns for the gifted of the 1950s were responded to in Livonia by the adoption of the Advanced Placement Program in 1958 and much later by the adoption of accelerated algebra in the junior high schools. The movement in the early 1960s to a "modern mathematics" program was quickly accepted in Livonia although the implementation was undertaken with some deliberation. The concerns for individual differences which developed nationally in the late 1960s brought response from Livonia with (1) the development of the Kennedy-Madison individualized mathematics program, (2) the development of individualized mathematics programs in the junior high schools, and (3) the pilot use of the IPI mathematics program at Taft Elementary School. During the 1970s the Michigan Department of Education through MEAP has exerted a significant force in the district. The development of behavioral objectives, their use in defining the program and the development of an associated set of testing materials for the district have all been accelerated by the movement of the state to the testing of minimal objectives in a criterion referenced format.

The NSF has had both direct and indirect effects on the local program. The grant of $33,000 for the training of teachers in the use of math laboratory materials and the methods of individualized instruction received in 1972 had a direct effect on the direction of the program. Indirect effects occurred through the teachers from the district who attended NSF sponsored institutes during the 1950s and 1960s and who played a significant role in the decisions concerning the implementation of "modern mathematics."

Not all of the forces and events which influenced the mathematics program came from outside the district. Two recurring events within the district which resulted in forces leading to program changes were low standardized test scores and high failure rates. Low test scores resulted in program examination and change at three specific times. In 1965 low test scores resulted in an examination of the Algebra I - Advanced Algebra sequence. In 1967 additional efforts were made to improve computational skills in the elementary schools as a result of low test scores. In 1972 district-wide efforts to improve standardized test scores on computation were implemented at the direction of the Assistant Superintendent.

High failure rates in the high schools generated the implementation of several courses and pilot programs. Applied Math III was developed in 1960 to meet the needs of students who failed the first semester of Plane Geometry. The TEMAC programed materials were piloted in the hopes that they would reduce the failure rates in Algebra I. The changes in objectives for the Applied Math (Basic Algebra) sequence in 1960 and in 1965 were in response to the failures in these courses.

Two other forces which do not show up as clearly in terms of specific events but which were important were the rapid growth of the district and the varying levels of financial support in the district. The rapid growth of the district was a positive factor in allowing innovation and change to take place because it was possible to select staff members and build facilities designed to permit such innovations to take place.

During periods of limited financial support, the greatest effect on the mathematics program seems to have been a reduction in the opportunity to implement new programs or materials as planned. The computer mathematics program is a major exception to this. Because of the high cost of this program, cutbacks in facilities did occur resulting in program reductions. Also, twice during this time the position of Computer Specialist was not filled for extended periods of time. Another program reduction also occurred when grades 4-8 were placed on half-days as the result of a millage defeat in 1969. Other less evident changes with financial considerations were gradually increasing class sizes and the elimination of preparation time for advanced placement teachers.

Significant Programs and Innovations

Because of the "broken front" approach to curriculum development which operated extensively in Livonia, a large number of innovations and programs were tried in the district. The most significant of these were those programs which were implemented on a district-wide basis or had a direct effect on the program of more than one building.

The Advanced Placement Program was instituted at Bentley High School in 1958 and has provided a program for the more able high school mathematics students since that time. The program has been implemented at each high school and has enrolled slightly larger percentages of the senior class in calculus as the program has progressed.

The introduction of "modern mathematics" in Livonia was not

in reality a single program but a combination of several programs which functioned separately at elementary, junior high and high school levels. By 1965 text materials reflecting "modern mathematics" had been adopted for all levels of the program. Since that time, the objectives written for the mathematics program at each level and the materials adopted have placed greater emphasis on computational skills but have attempted to retain the spirit of this approach. In this process much of the work with sets and number bases which characterized - or caricaturized - "modern mathematics" was de-emphasized.

The computer mathematics program began as a pilot program in 1964-65. The first course was adopted in 1966 and a second one-semester course was added in 1973. This program was implemented at each high school and has enrolled increasingly larger numbers of students each year that financial difficulties have not necessitated a limitation of the program.

The innovations related to individualized mathematics and the programs which developed have had a significant impact on the total program of the district. As well as changing the instructional methods in the buildings using these programs at both the elementary and junior high levels, they had an effect on other buildings' programs. The sets of objectives written for these programs served as the basis for the writing of objectives for use on a district-wide basis. These programs also caused the buildings receiving these students to effect changes in their programs in order to accommodate the needs of these students. Thus, while the Kennedy-Madison program was dropped in 1974-75, the use of IPI is scheduled to end at

Taft in 1975-76 and the junior high school programs have been reduced in extent, the effects of these programs will continue to exist because of the role they played in shaping decisions regarding the mathematics program during their existence.

Programs which were introduced and still continue to operate are: accelerated algebra in the junior high schools and the use of special materials for slow learners in the junior high schools. Other programs which were implemented and have been discontinued included modular scheduling and team teaching which ended when the federal funds to support this project ended, the extensive use of UNIPACS which in general were used only by the individual teacher who wrote them, and the use of programed materials which failed on a classroom basis because of motivational and boredom factors.

The programs which survived are those which involved the implementation of a new course with well defined content. Those innovations which depended upon changes in methodology, the continuing support of the staff members who implemented them or on extensive amounts of materials or sizable financial support did not survive. The rapid turnover in personnel which was characteristic in Livonia was a positive factor in introducing such innovations. It was also a significant factor in the demise of several programs. As experienced staff members changed positions, two problems arose: (1) there did not exist a financial commitment to orient and train new personnel for the existing program and (2) there was a lack of commitment on the part of new personnel to the program.

Implementation of Changes in Mathematics Programs

The implementation of changes in the mathematics program of Livonia was often coordinated with special in-service activities. Because of differences in the extent of teacher involvement in determining changes, the numbers of teachers involved in implementing changes, and the level of readiness for changes, there were significant differences in the number and type of such activities provided for elementary and secondary teachers.

Along with each text change in the elementary schools from 1960 to 1974, an in-service program was instituted which ensured each teacher in the district the opportunity to attend at least one session outlining the new program as it pertained to their particular grade level. In addition principals and math/science representatives were responsible for providing additional in building orientation to each such text change. Additional in-service activities were also offered to help effect major program changes and innovations. In 1963-64, prior to the adoption of a "modern mathematics" program, an eight week course in the content of "modern mathematics" was offered for elementary teachers and administrators. In 1971-72 a content course and a methodology course focusing on the use of manipulative materials were offered in the hope of improving the mathematics instruction in the elementary schools. The expansion of the individualized mathematics program from Kennedy to other schools also involved the provision of workshop time to acquaint teachers with materials and to provide time to organize materials and facilities.

In the secondary program changes in texts were seldom accompanied by in-service programs. It was assumed that teachers were adequately prepared to use new text materials and to adapt them to the existing program. In three instances where major program changes were anticipated, special in-service was provided: (1) the implementation of "modern mathematics," (2) the implementation of computer mathematics, and (3) the introduction of special sections of 7th and 8th grade mathematics for slow learners.

The introduction of new mathematics programs or innovations in Livonia generally followed these steps.

1. A pilot program was conducted on a limited basis with a formal or informal evaluation of the outcomes.
2. Teacher representatives were involved in the decision to implement the program if they had not already been involved in the decision to implement the pilot.
3. A period of teacher in-service training was provided where it was felt necessary. This generally began prior to the implementation of the program and continued into the first year of the program.
4. The program was implemented and an initial one-time provision of additional funds for supplementary materials was made at the time of the implementation.

Role of Teachers and Administrators in the Development of the Mathematics Program

The implementation of program changes and changes of texts in Livonia has included a high level of teacher involvement. At the

elementary level every major text change was recommended by an instructional materials committee whose membership was at least 50 percent classroom teachers. At the secondary level, text selection committees seldom involved more than one or two administrative representatives including the Mathematics Coordinator. While these teacher dominated committees were only recommending committees, there is nothing which indicates that any of their recommendations were ever rejected in favor of other materials.

The manner in which decisions were made to introduce other types of changes at the elementary and secondary levels between 1961 and 1970 differed. At the elementary level such decisions were made by the Director of Elementary Education and the Elementary Mathematics/Science Coordinator in cooperation with individual building principals. No formal structure for teacher input in this process existed until the establishment of Mathematics/Science Curriculum Representatives in 1967. At the secondary level the Secondary Mathematics Committee, which contained teacher representatives from each building, served as a screening and recommending body for the Mathematics/Science Coordinator and the Director of Secondary Education. While the recommendations of this committee were not always accepted, as for example, in its 1965 recommendations for the adoption of algebra at the eighth grade, its existence did insure a high level of teacher input concerning program changes.

From 1970 to 1975 the regional organization of the district and the associated committee structures adopted by the two regions provided for different methods of teacher input. In the Franklin/Churchill Region, where numerous permanent committees were established,

these committees served an initiatory role with regard to mathematics curricular change. In the Bentley/Stevenson Region where committees were appointed to meet identified needs or problems, the initial identification of the problem was more likely to have been determined at the administrative level. In neither region, however, should it be assumed that considerations for program change and innovation developed in only a single pattern. In both regions several channels existed for the exchange of ideas between teachers and administrators.

Leaders in the Development of the Mathematics Program

The mathematics program of the Livonia Public Schools has developed from the efforts of many teachers and administrators to provide a program designed to meet the needs of its students. Among the many people who were involved in this process, the following persons provided the greatest degree of direction and consistency to the mathematics program of the district.

Charles Zoet, the present Mathematics Coordinator K-12, began teaching in Livonia in 1950. During the 1950s he was a significant figure in the establishment of the Advanced Placement Program in Livonia and was the first Livonia teacher to participate in an NSF summer institute. He was a leader in developing a systematic approach to the district's considerations of "modern mathematics" and served as the first chairman of the Secondary Mathematics Committee. In 1964 he was appointed Coordinator of Secondary Mathematics and Science and he served in this or a similar position through 1975. He has been a strong supporter of the involvement of teachers in the decision making process. He has been a strong voice for a mathematics

program which provides opportunities for all students to elect mathematics. As such, he was a leader in the establishment of both the accelerated algebra program in the junior high schools and the special selection of materials for slow learners at this level. He guided the original expansion of the computer mathematics program and has helped maintain the operation of this program when the position of Computer Specialist was not filled.

William Kumbier, the present Science Coordinator, served as Coordinator of Elementary Mathematics and Science from 1964 to 1975. He was instrumental in guiding the implementation of "modern mathematics" in the elementary schools. He is a strong advocate of hands-on experiences for both students and teachers and worked closely with individual building staffs in implementing programs. The extensive amount of in-service which was provided for elementary teachers after 1964 was done under his direction.

Paul Johnson, Assistant Superintendent from 1959 to 1975, played a major role in directing the curricular development of the district during this period. While his direct intervention in the mathematics program was limited, the overall plans for curriculum development he implemented gave direction to the mathematics program as a part of the total program of the school district. This began with the study and redefinition of the program of the district in 1959-60 and is exemplified, during the 1970s, by the direction given to the use and development of behavioral objectives and the development of objective referenced tests for district use.

Henry Heusner was a leading contributor to the shaping of the elementary mathematics program. As Director of Elementary Education,

he was instrumental in establishing the study of "modern mathematics" by the Elementary Mathematics Study Group in 1962 and the in-service training program for elementary teachers during 1963-64. In the latter 1960s he was a major figure in the development of individualized instruction in mathematics and was responsible for the expansion of this program from two to seven schools in 1970.

These four persons, who have been identified as leaders, exhibited a number of common characteristics which were important in the positions that they held. They were active in professional activities outside the district and this helped them maintain a high level of awareness of movements and trends in education across the state and the nation. They were willing to look ahead, to anticipate possible changes in the program of the district, and to start planning prior to the time that new programs needed to be implemented. They were committed to long range goals in program development and to the work required to reach these goals. Perhaps most important for Livonia, however, they were committed to a high level of teacher involvement and were willing to accept teacher input as a real, not theoretical, part of the process of program development.

Future Outlook for the Mathematics Program

This study has revealed that the mathematics program of the Livonia Public Schools has developed in response to two conditions. One is the set of forces operating at a given point in time and which control certain short range decisions. The other is a long range movement of the school district and the mathematics program toward certain goals. A knowledge of the past changes and the forces causing these changes is necessary to be able to examine

the effects of current changes and the probable future changes.

At the present time the district has come close to implementing a mathematics program, such as was proposed in 1962, which provides a course in mathematics for students at all levels of ability during each year of their education. With the current concerns about minimal objectives and proficiency in skills areas, it is likely that an additional course, such as a mathematics skills lab for senior students who have not demonstrated proficiency, may be provided. At the same time, however, the shrinking population of the school district may have the opposite effect on the high school program. Courses such as Practical Geometry or Technical Mathematics which have a limited enrollment may have such a small enrollment that the course will need to be dropped or possibly taught on an alternate year basis.

Computer mathematics courses can be expected to have increased enrollments as the computer continues to play an increasingly larger role in society. A possible result of this demand may be the integration of some training on the computer into the mathematics program of all students. In a similar manner the use of hand calculators can be expected to achieve acceptance at some level of the mathematics program. This acceptance will probably depend upon the establishment of one or more pilot programs directed at determining the effect of calculators on computational skills. The final decision regarding the role of calculators in the classroom, however, may be controlled more by the financial position of the district then by the outcomes of the pilots.

Increasing numbers of gifted students can be expected to progress through the mathematics program more quickly than has been true in the past. The individualized programs that have functioned opened the way for exceptional students to bridge the gap between what was considered elementary mathematics and junior high mathematics and between junior high and senior high mathematics. The completion of the Advanced Placement Program by several 11th grade students in 1975 is an indication that such students are already progressing through the present program at more rapid rates than in the past. In addition, increasingly larger numbers of students are completing accelerated algebra in junior high school and some special arrangements have been made for 9th grade students to study high school mathematics at the high schools.

Content changes seem possible in several areas. In geometry the continued pilot use of materials using a transformational approach could foretell a movement in this direction. At all levels of the program an increased emphasis on the use of the metric system can be anticipated.

The long term movement of the district to sets of objectives written in behavioral terms and the development of associated sets of objective referenced tests to measure these objectives can be expected to continue. Sets of minimal objectives, patterned after the state objectives, have been written for grades 4-9 and test items have been developed for grades 4-6. Corresponding test items will be written for grades 7-9. For those elective mathematics courses in the secondary schools which enroll several hundred students, the objectives written in the late 1960s will be rewritten and corresponding

sets of test items will be developed. These objectives and tests, which will be developed by the classroom teachers, will be used to insure that all students taking a given mathematics course will have been taught the same basic content and will have achieved some minimal set of objectives upon the completion of the course.

The high level of teacher involvement in the decision making process can only be assumed to continue. The establishment of a Department of Curriculum and the appointment of a Mathematics Coordinator K-12 in 1975 should improve the continuity of the mathematics program across the district. There will no longer be the possibility of two separate groups at different levels or in different regions working to solve similar problems.

The year-to-year effects of budget problems on the program can be expected to continue. As funds are limited, it can be supposed that class sizes will increase and that decisions to expand or implement changes in the program will be postponed. From past experience it can be anticipated that the plans to implement the changes will be continued and that such changes will occur when funds do become available.

Implications of the Study

While Livonia cannot be considered typical of all districts or even of all suburban districts during the period from 1944 to 1975, the development of its mathematics program does reflect many of the changes and forces in effect during this period. The major concerns of the district such as: (1) the gifted in the late 1950s, (2) "modern mathematics" in the early 1960s, (3) decreasing skills levels in computation in the late 1960s, (4) individual differences in the late

1960s and (5) the use of behavioral objectives and externally imposed assessment programs in the 1970s were all concerns common to districts across the country. The reactions to these concerns and the programs introduced to meet each one, whether or not they were unique to Livonia, provide clues to the manner in which such concerns should be met in the future.

The study would indicate that the high level of teacher involvement and the extensive in-service programs provided by the district were positive factors in the mathematics program changes which occurred in Livonia. The rapid growth and expansion of the district was also a positive factor in the introduction of innovations but at the same time proved to be a negative factor in the retention of some of these same programs. The staff often changed or moved prior to the time that new programs were completely developed and operational.

APPENDIX A

CHRONOLOGY OF EVENTS IN THE DEVELOPMENT OF THE LIVONIA MATHEMATICS PROGRAM

CHRONOLOGY OF EVENTS IN THE DEVELOPMENT OF THE LIVONIA MATHEMATICS PROGRAM

This chronology of events in the mathematics program of the Livonia Public Schools is based on the events that are described in this study and which have had a major role in shaping the program of the district. Where events or activities occurred over a period of several years the initial date at which the activity began is used. Text adoptions have not been included unless a particular adoption represented a significant change in the direction of the program.

Chronology

1944 The Livonia Public Schools School District established

1944 Pre-school conferences held to provide teacher in-service experiences

1948 Use of curriculum days for teacher in-service instituted

1950 First class graduated from Bentley High School

1955 Expenses paid for teachers to attend MCTM meetings

1956 General Mathematics dropped from the curriculum and Basic Mathematics and Applied Math I and II added

1956 Enriched Advanced Algebra classes offered in grade 11

1958 Advanced Placement Program in mathematics implemented beginning in grade 10

1959 First summer workshop in mathematics for elementary teachers offered

1959 Secondary curriculum extensively studied and complete set of course outlines prepared

1960 Applied Math III and Senior Math added to the high school program

1960 SMSG and UMMaP materials piloted in grades 7-9

1961 First class of students complete Advanced Placement Program

1961 Modern Topics in Mathematics added to the high school program

1961 Five week summer workshop in "modern mathematics" offered for secondary teachers

1961 TEMAC programmed materials introduced on a pilot basis at Bentley High School

1961 Pilot use of SMSG materials in Algebra I, Plane Geometry and Advanced Algebra courses begins

1962 The Committee on Secondary Mathematics issued a report regrading the inclusion of "modern mathematics" and the restructuring of the secondary mathematics program

1962 The Elementary Mathematics Study Group conducted an intensive study of "modern mathematics" at the elementary level

1962 First adoption of a "modern mathematics text, Modern Elementary Algebra, for Algebra I

1962 High School Department Chairmen received official status

1962 Livonia begins participation in NLSMA

1964 Refresher Mathematics added to the high school program

1964 The positions of Teacher Specialist (Coordinator) for Elementary Mathematics and Science and Coordinator of Secondary Mathematics and Science established

1964 The first computer, Burroughs E-103, purchased for instructional purposes

1964 Portion of the elementary program devoted to mathematics officially stated to be 10 and 15 percent for the primary and middle grades, respectively

1964 The content of Applied Math I and II changed to reflect "modern mathematics" and the focus of the course became the study of algebra .

1965 The "modern mathematics" series Elementary School Mathematics adopted for elementary school use

1965 Junior High School Department Chairmen received official status

1965 Experiment with accelerated algebra in the eighth grade initiated at Whitman Junior High School

1966 Computer Uses in Mathematics added to the high school program

1966 7th and 8th grade mathematics curriculum guide developed

1967 Extensive use of modular scheduling and team teaching begins at Franklin and Stevenson High Schools

1967 Text for Applied Math III written by district teachers

1967 The position of Elementary School Mathematics/Science Representative established

1967 Concerns developed over the level of computational skills of elementary school students

1967 Requirement for 7th and 8th grade mathematics and science to be taught in a block abolished

1967 Efforts to develop an individualized mathematics program begin at Kennedy Elementary School

1967 Workshop on teaching mathematics to slow learners held for secondary mathematics teachers

1968 Junior high schools begin development of individualized programs

1968 Special text materials adopted for use with slow learners in 7th and 8th grade mathematics

1968 The position of Teacher Specialist in Computer Education established

1969 Technical Mathematics added to the high school program

1969 Grades 5-8 placed on half-days following a millage defeat

1970 Sets of performance objectives completed for all secondary mathematics courses

1970 Kennedy-Madison individualized mathematics program expanded to five additional schools

1970 An accelerated algebra program approved for junior high school beginning in grade eight

1970 The district divided into two separate administrative regions

1971 Priorities for the teaching of mathematics content for grades K-8 established for the F/C Region

1972 Special efforts taken to improve standardized test scores on computational skills at the direction of the Assistant Superintendent

1972 The first new text for Algebra I proposed following regional organization created concerns about the extent to which curricular differences will be allowed in the two regions

1972 An in-service education project for thirty elementary and junior high school teachers jointly undertaken with Eastern Michigan University under a $33,000 NSF grant

1972 IPI mathematics program introduced at Taft Elementary School

1973 Work on a high school proficiency test begins in the F/C Region

1973 A second course in computer mathematics is added to the high school program

1973 Practical Geometry added to the mathematics program of the high schools

1974 Livonia Minimal Objectives in Mathematics for grades 4-9 developed

1974 District support for the use of Kennedy-Madison individualized mathematics program ended

1975 Regions disbanded and in the reorganization a position of Coordinator of Mathematics K-12 established and attached to the Department of Curriculum

1975 Work begins on the development of Criterion Referenced Tests for all Livonia Minimal Objectives in Mathematics for grades 4-6

APPENDIX B

ADMINISTRATIVE ORGANIZATIONAL CHARTS

ADMINISTRATIVE ORGANIZATIONAL CHARTS

Each of the figures 1-6, outlines the relationship of administrative personnel and teachers as it effected the supervision of mathematics education during the period indicated. Where specific positions existed for only a portion of this period, dates are given in the figure.

FIGURE 1

1945-1953

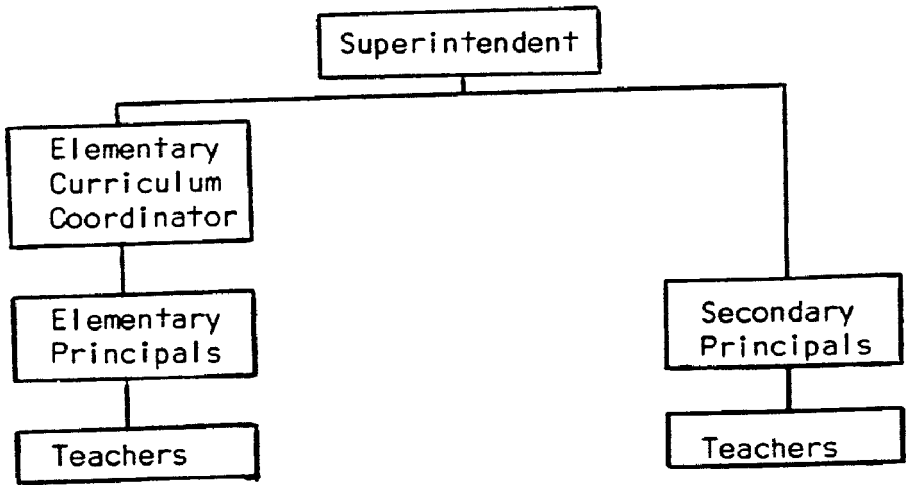


FIGURE 2

1953-1963

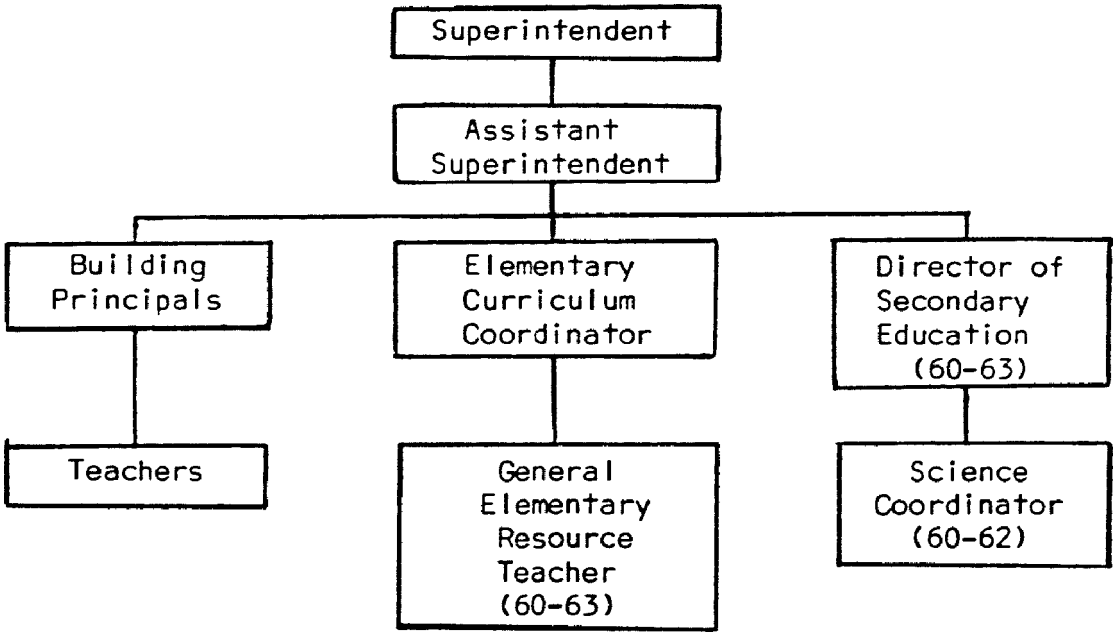


FIGURE 3

1963-1965

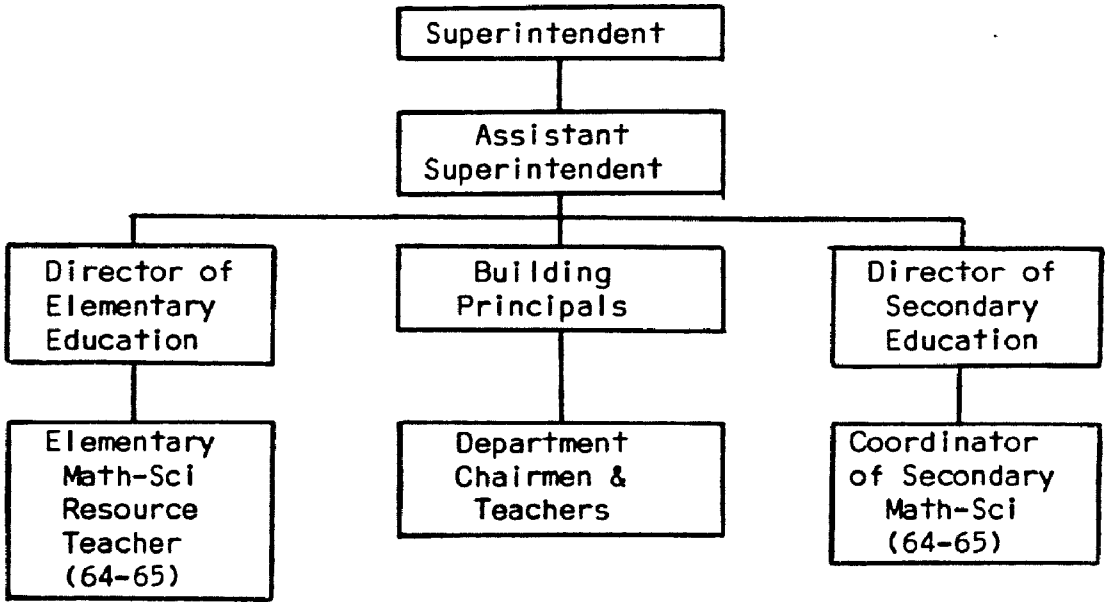


FIGURE 4

1965-1970

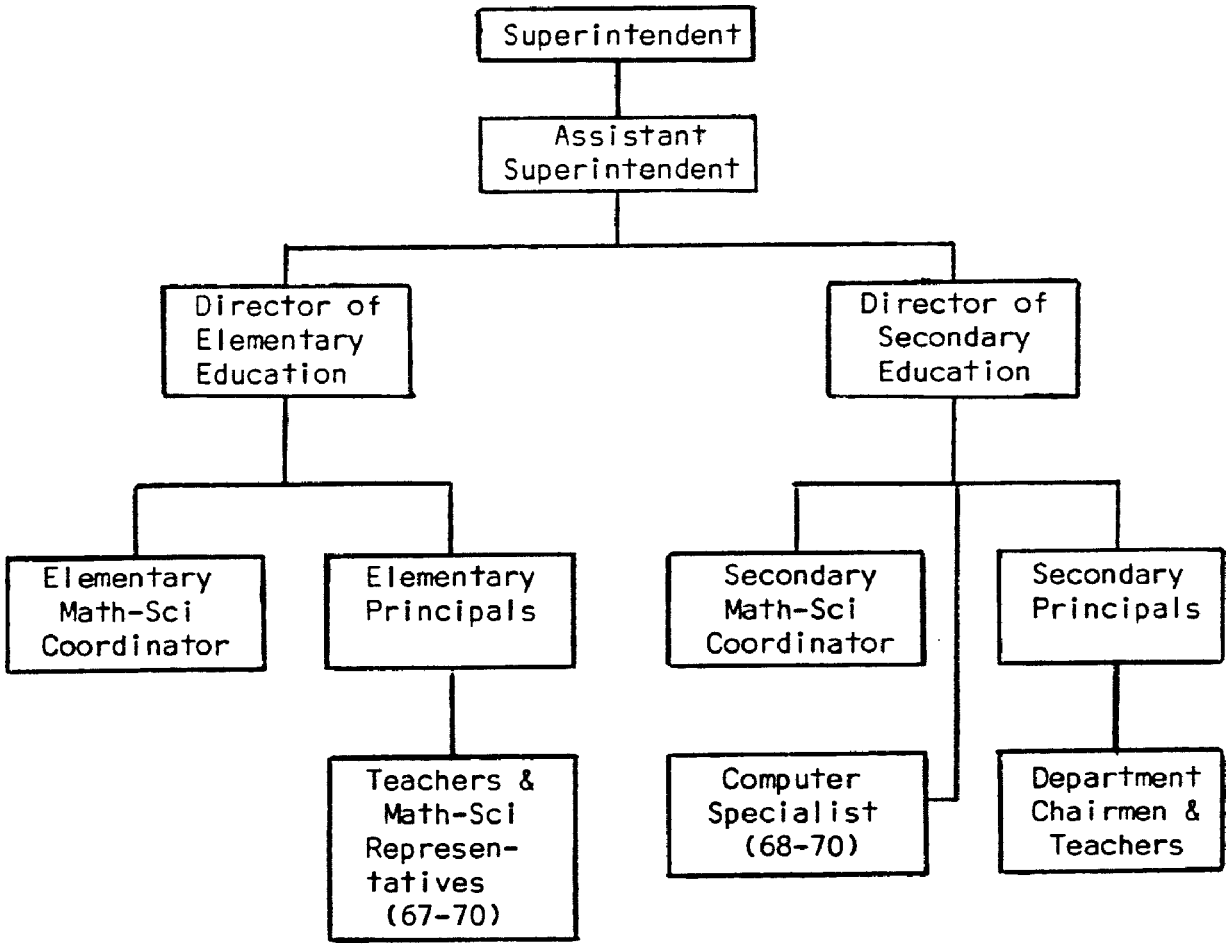


FIGURE 5

1970-1974

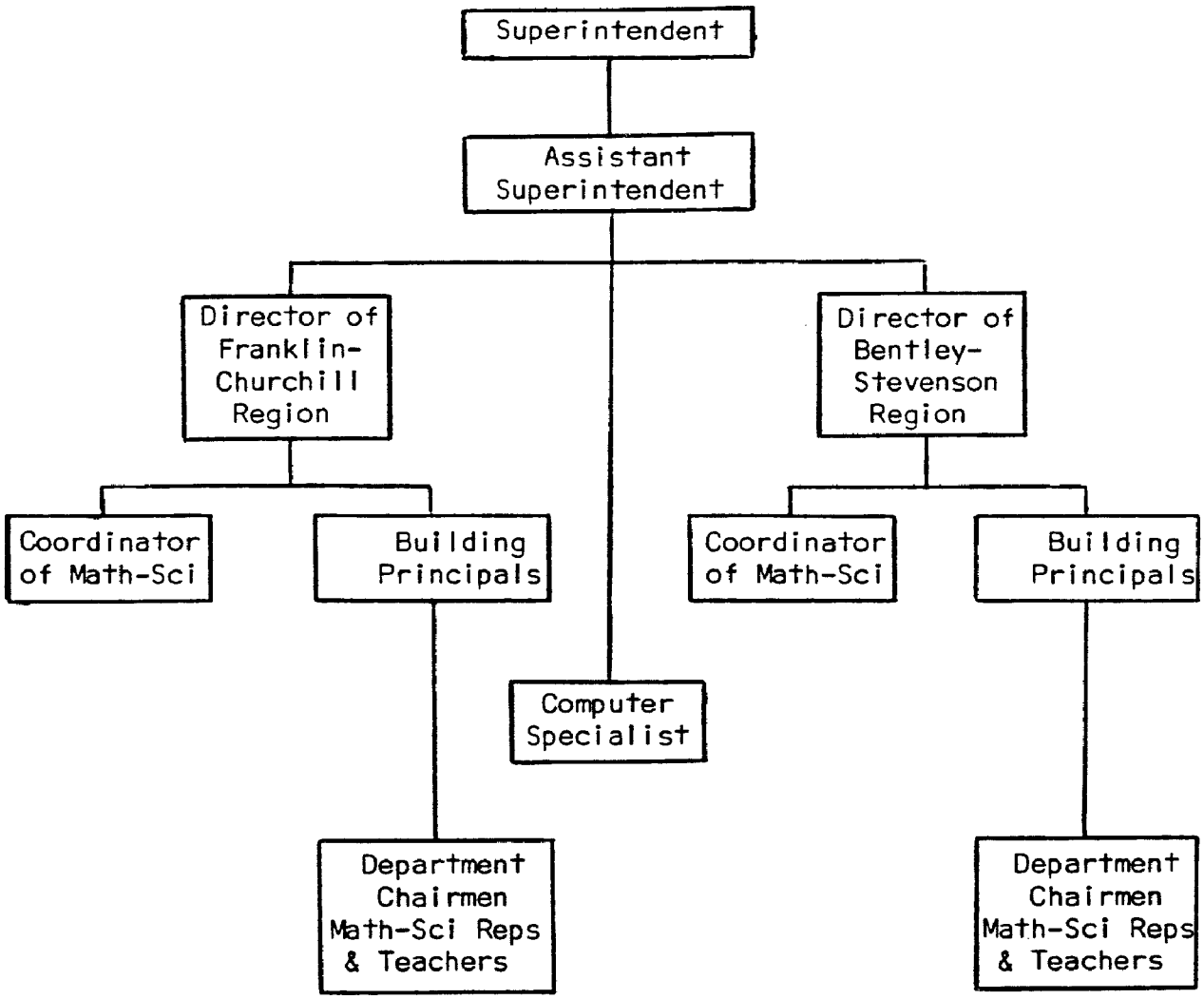
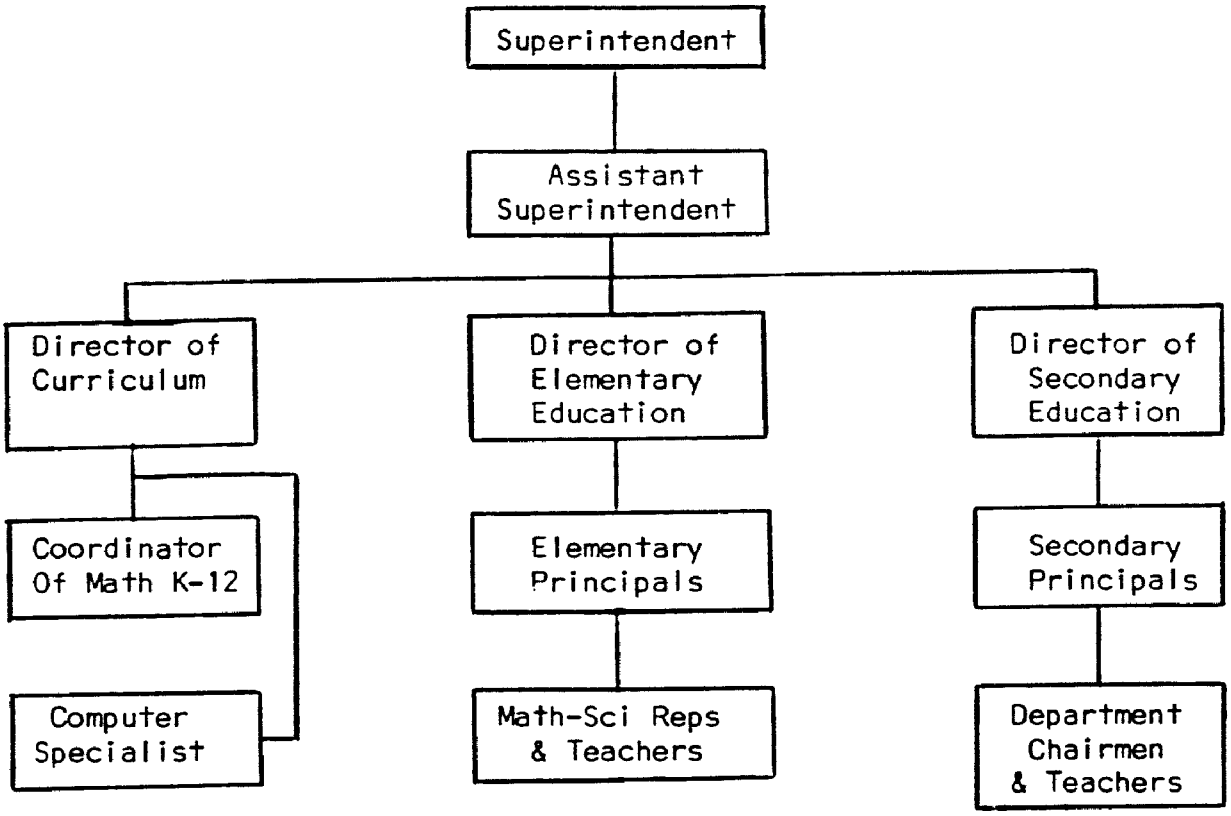


FIGURE 6

1975



APPENDIX C

CURRICULUM REPRESENTATIVES AND DEPARTMENT CHAIRMEN

MATHEMATICS-SCIENCE CURRICULUM REPRESENTATIVES

1966-67 THROUGH 1974-75

Adams Elementary School	
Betty Lantz	1967-68 through 1974-75
Buchanan Elementary School	
Mary Drolshagen	1967-68
Roy Willett	1968-69
Emily Kirshner	1969-70 through 1974-75
Cass Elementary School	
Jack Cleveland	1966-67
Lee Ann Duggan	1967-68 through 1974-75
Clay Elementary School	
Nancy Allen	1969-70
James McKibben	1970-71 and 1971-72
Richard Holt	1972-73
Sharon Frichman	1973-74 and 1974-75
Cleveland Elementary School	
Nancy Jacobs	1967-68 through 1969-70
Linda Hively	1970-71
James Welch	1971-72 through 1974-75
Coolidge Elementary School	
Mary Jane Emery	1967-68 through 1969-70
Karen Mort	1970-71 and 1971-72
Floyd Crowley	1972-73 and 1973-74
Lynda Neuroth	1974-75
Cooper Elementary School	
Nancy Allen	1967-68 and 1968-69
James McKibben	1969-70
Joyce Paradine	1970-71
Paul Derwich	1971-72 and 1972-73
Marsha Nicholl	1973-74 and 1974-75

Eisenhower Elementary School

Thomas Good	1969-70 through 1971-72
Catherine Worthen	1972-73
Mary Filip	1973-74
Marilyn Eschner	1974-75

Garfield Elementary School

Shirley Peterson	1967-68 through 1969-70
Linda (Wracan) O'Neil	1970-71 through 1974-75

Grant Elementary School

Karen Winters	1966-67 and 1967-68
Gary Newlin	1968-69 and 1969-70
Lawrence Hipschen	1970-71 through 1972-73
Ralph Debaske	1973-74 and 1974-75

Harrison Elementary School

Lillian Edney	1966-67 through 1968-69
Carolyn Jackson	1969-70 through 1973-74

Hayes Elementary School

Carolyn Phelps	1967-68 through 1970-71
Florence Belt	1971-72 and 1972-73
Bernard Grenda	1973-74 and 1974-75

Hoover Elementary School

Roberta Willing	1966-67 and 1967-68
Thomas Good	1968-69
Susan Bonner	1969-70 and 1970-71
Joanne Schleicher	1971-72
Leonard Roszak	1972-73 through 1974-75

Hull Elementary School

Larry Miller	1966-67
John Anderson	1967-68 through 1970-71
Anthony Catallo	1971-72 and 1972-73
Laureen Miller	1973-74 and 1974-75

Jackson Elementary School

James McKibben	1966-67
James McAmmond	1967-68
Karen Moscow	1968-69 and 1969-70
Richard Hellum	1970-71 through 1974-75

Jefferson Elementary School

Jay Lively	1966-67
Doris Brown	1967-68 and 1968-69
John Daniel	1969-70 through 1973-74
Samuel Long	1974-75

Johnson Elementary School

Patricia Davis	1966-67 through 1971-72
Douglas Thrush	1972-73 through 1974-75

Kennedy Elementary School

Fredrick Mack	1966-67
Sharon Evans	1967-68 through 1970-71
Bruce Sachs	1971-72 through 1974-75

Lincoln Elementary School

Joanne Stewart	1966-67 through 1970-71
Hans Newroth	1971-72 through 1974-75

Madison Elementary School

Alan Riegel	1966-67
Elizabeth Ervine	1967-68 and 1968-69
Virginia Minar	1969-70
Patricia (Kovach) Tannas	1970-71 through 1974-75

Marshall Elementary School

Richard Turnquist	1967-68 and 1968-69
Roberta Aimone	1969-70
Richard Turnquist	1970-71 through 1974-75

McKinley Elementary School

Gloria (Krolicki) Fontanesi	1966-67 through 1973-74
Virginia Zasavage	1974-75

Monroe Elementary School

Jean Chybinski	1966-67
Barbara Thomas	1967-68
Bennett Hylkema	1968-69 through 1972-73
Esther Williams	1973-74 and 1974-75

Nankin Mills Elementary School

Jean Klarich	1969-70 and 1970-71
Barbara (Barnum) Quinn	1971-72 through 1974-75

Perrinville Elementary School

Barbara Stadtmiller	1969-70 through 1972-73
Audrey Pleasant	1973-74 and 1974-75

Pierson Elementary School

Mary Drolshagen	1966-67
Alexander Saven	1967-68
Joyce Paradine	1968-69
Richard Turnquist	1969-70

Randolph Elementary School

Richard Holt	1966-67 through 1968-69
Gladys Scott	1969-70 through 1971-72
Michael Aleccia	1972-73 through 1974-75

Roosevelt Elementary School

Charles Johnston	1966-67 through 1968-69
Donna McNutt	1969-70
Harold Michaels	1970-71 through 1974-75

Rosedale Elementary School

Inez Stabnau	1966-67
Robert Schere	1967-68 and 1968-69
Rosemary Etue	1969-70
Marcia (Hall) Blair	1969-70 and 1970-71
Mary Jacobs	1971-72 and 1972-73
Robert Scherer	1973-74 and 1974-75

Stark Elementary School

Carolyn Phelps	1966-67
Carol Balogh	1967-68
Susan Gilman	1968-69
Marvel Decker	1969-70 through 1972-73

Taft Elementary School

Florence Belt	1967-68 through 1969-70
Joe Ann Rice	1970-71 through 1974-75

Taylor Elementary School

Doris Brown	1969-70 through 1972-73
Beverly Brown	1973-74 and 1974-75

Tyler Elementary School

William Green	1966-67 and 1967-68
Marilyn (Williams) Eschner	1968-69 through 1973-74
Phyllis Kelly	1974-75

Washington Elementary School

Georgia Larson	1967-68 through 1971-72
Daniel Burk	1972-73 through 1974-75

Webster Elementary School

Robert Litherman	1966-67
Ruth Horton	1967-68 and 1968-69
Edward Heikkila	1969-70 through 1972-73
Peter Komlen	1973-74 and 1974-75

Wilcox Elementary School

Donna Stern	1966-67

Wilson Elementary School

Duane Jennings	1967-68
Sharon Hooks	1968-69
Nancy Cucinella	1969-70 through 1971-72
Arthur Bakewell	1972-73 through 1974-75

JUNIOR HIGH SCHOOL MATHEMATICS DEPARTMENT CHAIRMEN

1966-67 THROUGH 1974-75

Bryant Junior High School

Henry Lundy	1966-68
David Westover	1968-69
Wayne Henry	1969-70
Donald Albertson	1970-71
Peggy Bosworth	1971-72 and 1972-73
David Butler	1973-74 and 1974-75

Dickinson Junior High School

Peter Pascaris	1967-68 through 1974-75

Emerson Junior High School

Lynwood Knudsen	1966-67 and 1967-68
Edward Segowski	1968-69
George Calder	1969-70 and 1970-71
Richard Burns	1971-72 through 1974-75

Ford Junior High School

Thomas Pobanz	1970-71 through 1973-74
Daniel Kinczkowski	1974-75

Frost Junior High School

Robert Cherry	1966-67
Jay Beck	1967-68
Thomas Lang	1968-69 through 1974-75

Holmes Junior High School

Leroy Bennett	1966-67 through 1970-71
James Rice	1971-72 through 1974-75

Lowell Junior High School

Ronald Pemberton	1966-67 through 1969-70
Fredrick Robinson	1970-71 through 1974-75

Riley Junior High School

John McConnell	1966-67
Philip Lyon	1967-68 and 1968-69
Adele Sobania	1969-70 and 1970-71
Kenneth Erkfitz	1971-72 through 1974-75

Whitman Junior High School

Harry Talley	1966-67
Eldon Price	1967-68 through 1973-74
Charles Morris	1974-75

Whittier Junior High School

Donald McMillan	1966-67
Terrance Noelke	1967-68 through 1974-75

SENIOR HIGH SCHOOL MATHEMATICS DEPARTMENT CHAIRMEN

1954-55 THROUGH 1974-75

Bentley High School

Wilma Kuhls	1954-55
Marion Silkworth	1955-56
Kenneth Haug	1956-57
Thomas Hartsig	1957-58
Wilma Kuhls	1958-59
Frank Harding	1959-60 and 1960-61
Allan Edwards	1961-62 and 1962-63
Thomas Hartsig	1963-64
Allan Edwards	1964-65
Thomas Hartsig	1965-66
Roger Strong	1966-67 and 1967-68
Kenneth Haug	1968-69
James Reeves	1969-70
Gary Vance	1970-71 through 1974-75

Churchill High School

Henry Lundy	1967-68 through 1974-75

Franklin High School

Harold Jackson	1961-62 and 1962-63
James Carey	1963-64 through 1972-73
Barton Moore	1973-74 and 1974-75

Stevenson High School

Allan Edwards	1965-66 and 1966-67
Robert Massey	1967-68
Allan Edwards	1968-69 through 1971-72
Frank Harding	1972-73 through 1974-75

APPENDIX D

MEMBERSHIP OF MATHEMATICS COMMITTEES

1959-60 THROUGH 1974-75

MEMBERSHIP OF MATHEMATICS COMMITTEES

1959-60 THROUGH 1974-75

Committees played a significant role in developing recommendations regarding the directions of the mathematics program of the Livonia Public Schools and in the selection of the materials to be used. The high level of staff involvement in the determination of curricular changes is demonstrated by the membership that teachers and administrators held on such committees. While the mention of individual committee members has been held to a minimum in the text, recognition of the many teachers and administrators who have helped form the program of the district should be made.

Prior to 1959-60 formal committees in mathematics were nearly non-existant. At the elementary level the only committee recorded was a text selection committee in 1952-53. This committee was chaired by Joseph Melton, a teacher at Stark Elementary School, but on other record of the other committee members exists. At the secondary level, prior to 1959-60, curricular decisions were made in department meetings rather than through formally appointed committees.

For the years 1959-60 through 1974-75, the committees cited in the text are listed. To the extent possible they are listed according to their initial date of operation and the tenure of the committee is indicated. For each committee, except the standing committees of the F/C Region, each member's position in the district and their home school or office at the time of their first appointment are listed.

Also, where a membership did not coincide with the tenure of the committee, the years in which a person served on the committee are indicated. If a committee had an offically appointed chairman, this person is identified with an asterisk.

Curriculum Committee Junior High Mathematics (1959-60)

Richard Burns	Teacher	Emerson
James Carey*	Teacher	Whitman
Lynwood Knudsen	Teacher	Emerson
Richard Martwick	Teacher	Riley
Karl Olson	Teacher	Riley
Eldon Price	Teacher	Whitman
Robert Selke	Teacher	Riley
Marion Silkworth	Teacher	Whitman
Beulah Wade	Teacher	Emerson

Committee to Study and Recommend Textbooks for Elementary Arithmetic for Grades 1-6 (1960-61)

Esther Brown	Teacher	Grant
Paul Campbell	Principal	Washington
Clyde Jack	Teacher	Garfield
Elayne Kardener	Teacher	Coolidge
Edward Leibson	Principal	Madison
Willard Meaders	Teacher	Pierson
Lucille Mikula	Teacher	Wilson
Bernice Roberts*	Coor of El Ed	C.O.
Virginia Roberts	Principal	Wilson
Edward Sage	Principal	Jefferson
Judy Thomas	Teacher	Washington

Committee on Mathematics Textbook Adoptions (1960-61)

George Calder	Teacher	Emerson
James Carey	Teacher	Whitman
Frank Harding	Teacher	Bentley
Kenneth Haug	Teacher	Bentley
Harold Jackson	Teacher	Bentley
William Kumbier	Teacher	Bryant
Barbara Laughlin	Teacher	Riley
William McMurtrey	Principal	Whitman
Raymond Olson*	Asst Prin	Bentley
Paul Ploutz	Sci Coor	C.O.
Roger Rood	Teacher	Riley

Committee on Mathematics Textbook Adoptions (continued)

Robert Sarver	Teacher	Bryant
Sandra Salinger	Teacher	Emerson
Marion Silkworth	Teacher	Whitman
Gary Vance	Teacher	Bentley
Virginia Waymire	Teacher	Bentley
Charles Zoet	Teacher	Bentley

Committee to Study "Modern Mathematics" (1961-62)

George Calder	Teacher	Emerson
James Carey	Teacher	Whitman
Robert Cherry	Teacher	Emerson
Susan Cuen	Teacher	Whittier
Allan Edwards	Teacher	Bentley
William Farlow	Teacher	Bryant
Barbara Laughlin	Teacher	Riley
Henry Lundy	Teacher	Bryant
Roger Rood	Teacher	Riley
Sandra Salinger	Teacher	Whittier
Robert Wilson	Teacher	Whitman
Charles Zoet*	Teacher	Bentley

Secondary Mathematics Committee (1961-62 through 1968-69)

George Calder	61-69	Teacher	Emerson
James Carey	61-63,65-69	Teacher	Whitman
Robert Cherry	61-62,66-67	Teacher	Emerson
Susan Cuen	61-62	Teacher	Whittier
Allan Edwards	61-67,68-69	Teacher	Bentley
William Farlow	61-62	Teacher	Bryant
Thomas Hartsig	61-66	Teacher	Bentley
Barbara Laughlin	61-65	Teacher	Riley
Roger Rood	61-62	Teacher	Riley
Sandra Salinger	61-63	Teacher	Whittier
Robert Wilson	61-65	Teacher	Whitman
Charles Zoet	61-69	Teacher	Bentley
Anthony Aquino	62-65	Teacher	Bryant
Theodore Bison	62-65	Teacher	Whittier
Richard Burns	62-65	Teacher	Emerson
Richard DeVries	62-66	Teacher	Riley
Frank Harding	62-63	Teacher	Franklin
Harold Jackson	62-64	Teacher	Franklin
Robert McGee	62-65	Teacher	Bryant
James Zunich	62-63	Admin Asst	C.O.
David Brown	63-65	Teacher	Frost
William McMurtrey	63-69	Principal	Whitman
Keith Geiger	65-66	Teacher	Frost
Kenneth Haug	65-66,68-69	Teacher	Bentley
William Kumbier	65-66	Coor El Math	C.O.

Secondary Mathematics Committee (continued)

Henry Lundy	65-69	Teacher	Bryant
Donald McMillan	65-66	Teacher	Whittier
Eldon Price	65-69	Teacher	Whitman
James Rice	65-69	Teacher	Holmes
Dean Waldfogel	65-67	Teacher	Franklin
Cale Bartshe	66-69	Teacher	Whittier
Donald Hollar	66-67	Teacher	Bentley
Carol Jack	66-68	Teacher	Riley
Diane Kabalka	66-67	Teacher	Lowell
Roger Strong	66-68	Teacher	Bentley
Jan Hale	67-69	Teacher	Franklin
Kenneth Knipschild	67-68	Teacher	Bentley
Robert Massey	67-68	Teacher	Stevenson
Donald Quashnie	67-68	Teacher	Frost
Adele Sobania	67-69	Teacher	Riley
Gary Vance	67-69	Teacher	Stevenson
Ellen Hansz	68-69	Teacher	Dickinson
Thomas Lang	68-69	Teacher	Frost
William Montgomery	68-69	Teacher	Lowell
Edward Segowski	68-69	Teacher	Emerson
Herbert Van Hooser	68-69	Teacher	Bentley
David Westover	68-69	Teacher	Bryant

Committee for Recommendation of Secondary School Mathematics Textbook Adoptions (1962-63)

Leslee Bishop	Dir of Sec Ed	C.O.
George Calder	Teacher	Emerson
James Carey	Teacher	Whitman
Robert Cherry	Teacher	Emerson
Susan Cuen	Teacher	Whittier
Allan Edwards	Teacher	Bentley
William Farlow	Teacher	Bryant
Thomas Hartsig	Teacher	Bentley
Henry Lundy	Teacher	Bryant
Barbara Laughlin	Teacher	Riley
William McMurtrey	Principal	Whitman
Roger Rood	Teacher	Riley
Sandra Salinger	Teacher	Whittier
Robert Wilson	Teacher	Whitman
Charles Zoet*	Teacher	Bentley

Textbook Recommendation Committee for 9th Grade Mathematics (1962-63)

Anthony Aquino	Teacher	Bryant
Richard Burns	Teacher	Emerson
George Calder	Teacher	Emerson
James Carey*	Teacher	Whitman
Richard DeVries	Teacher	Riley
Kenneth Haug	Teacher	Bentley
William McMurtrey	Principal	Whitman
Sandra Salinger	Teacher	Whittier
Marion Silkworth	Teacher	Whitman
William Swart	Teacher	Franklin
Leslee Bishop	Dir of Sec Ed	C.O.

Textbook Recommendation Committee for 7th and 8th Grade Mathematics (1962-63)

Leslee Bishop	Dir Sec Ed	C.O.
Theodore Bison	Teacher	Whittier
Robert Cherry	Teacher	Emerson
Eva Donovan	Teacher	Emerson
Barbara Laughlin	Teacher	Riley
Robert McGee	Teacher	Bryant
Eldon Price	Teacher	Whitman
Margaret Shea	Teacher	Bryant
William Warren	Principal	Emerson
Robert Wilson*	Teacher	Whitman

Committee to Recommend Advanced Algebra Textbooks (1963-64)

Frank Harding	Teacher	Franklin
Kenneth Haug	Teacher	Bentley
Hugh Leeper	Teacher	Franklin
Peter Moloney	Teacher	Bentley
Gary Vance	Teacher	Bentley
Virginia Waymire	Teacher	Franklin
Donald Wright	Asst Prin	Franklin

Committee to Recommend Plane Geometry Textbooks (1963-64)

Allan Edwards	Teacher	Bentley
Thomas Hartsig	Teacher	Bentley
Harold Jackson	Teacher	Franklin
Virginia Menz	Teacher	Franklin
Roger Strong	Teacher	Bentley
Donald Wright	Asst Prin	Franklin

Committee to Recommend Instructional Materials for Senior Mathematics (1963-64)

James Carey	Teacher	Franklin
Ronald Fedraw	Teacher	Bentley
Harold Jackson	Teacher	Franklin
Kenneth Knipschild	Teacher	Bentley
Donald Wright	Asst Prin	Franklin

Committee on Implications of Electronic Data Processing for Instruction (1963-64)

David Amerman	Principal	Franklin
Leslee Bishop	Dir Sec Ed	C.O.
Paul Campbell	Principal	Washington
Donald Friedrichs	Principal	Bentley
Albert Goldberg	Coor Inst Mat	C.O.
Thomas Hartsig	Teacher	Bentley
Laurel Holan	Teacher	Franklin
Harold Jackson	Teacher	Franklin
Paul Johnson	Asst Super	C.O.
Rose Kirkwood	Teacher	Bentley
Glen McAdam*	Asst Prin	Franklin
Vernon Oxender	Asst Prin	Bryant

Seventh and Eighth Grade Mathematics Sub-Committee (1964-65)

Robert Bach	Teacher	Frost
Barbara Laughlin	Teacher	Frost
Paul Mack	Teacher	Bryant
John McConnell	Teacher	Riley
Eldon Price	Teacher	Whitman
James Staley	Teacher	Whittier
Harry Talley*	Teacher	Whitman
Doris Treece	Teacher	Bryant
Buelah Wade	Teacher	Emerson
Jerome Witherill	Teacher	Emerson

Junior High Mathematics Leadership Sub-Committee (1964-65)

James Allan	Teacher	Riley
Anthony Aquino*	Teacher	Bryant
George Calder	Teacher	Emerson
James Carli	Teacher	Whittier
Keith Geiger	Teacher	Frost
Donald Quashnie	Teacher	Frost
Marion Silkworth	Teacher	Whitman

Basic Mathematics Sub-Committee (1964-65)

Richard Braun	Teacher	Whittier
James Carli	Teacher	Whittier
Jean Cogill	Teacher	Whitman
Ronald Fedraw	Teacher	Bentley
Keith Geiger	Teacher	Frost
Carol Jack	Teacher	Riley
Harold Jackson	Teacher	Franklin
Lynwood Knudsen	Teacher	Emerson
Murray Lyke	Teacher	Whitman
Beverly Norton*	Teacher	Bryant

Elementary Steering Committee on Mathematics (1964-65)

Corlan Bovee	Principal	Lincoln
Arthur Domalske	Principal	Madison
Henry Heusner	Dir El Ed	C.O.
William Kumbier	Coor El Math	C.O.
Joseph Melton	Principal	Coolidge
Cecelia Murphy	Principal	Wilson

Elementary Mathematics Textbook Selection Committee (1964-65 and 1967-68)

John Arbour	64-65	Teacher	Webster
Robert Badertscher	67-68	Asst Prin	Hull
Florence Belt	67-68	Teacher	Taft
Corlan Bovee		Principal	Cass
Arthur Domalske		Principal	Cooper
Lillian Edney	67-68	Teacher	Harrison
Elizabeth Ervine		Teacher	Madison
Henry Heusner		Dir El Ed	C.O.
Richard Holt		Teacher	Randolph
William Kumbier		Coor El Math	C.O.
Joseph Melton	64-65	Principal	Coolidge
Cecelia Murphy		Principal	Wilson
Dorothy Norton		Teacher	Cooper
Barbara Pelavin	64-65	Teacher	Lincoln
Barbara Phelps	67-68	Teacher	Hayes
Joan Tuffley	64-65	Teacher	Wilson

High School Planning Committee on Mathematics Facilities (1965-66)

James Carey	Teacher	Franklin
Allan Edwards	Teacher	Stevenson
Thomas Hartsig	Teacher	Bentley
Charles Zoet	Coor Sec Math	C.O.

Committee to Recommend Algebra--Advanced Algebra Instructional Materials (1966-67)

Anthony Aquino	Teacher	Stevenson
Cale Bartshe	Teacher	Whittier
James Bedenis	Teacher	Lowell
Theodore Bison	Teacher	Whittier
Richard Burns	Teacher	Emerson
Richard DeVries	Teacher	Riley
Keith Geiger	Teacher	Frost
Frank Harding	Teacher	Stevenson
Carol Jack	Teacher	Riley
Patricia Johnson	Teacher	Franklin
Hugh Leeper	Teacher	Franklin
Henry Lundy*	Teacher	Bryant
Donald Hollar*	Teacher	Bentley
James Rice	Teacher	Holmes
Roger Strong	Teacher	Bentley
Harry Talley	Teacher	Whitman
Charles Zoet	Coor Sec Math	C.O.

Committee to Recommend Instructional Materials for Applied Mathematics III (1966-67)

Jan Hale*	Teacher	Franklin
Robert Massey	Teacher	Stevenson
Marlene Vidmar	Teacher	Bentley
Charles Zoet	Coor Sec Math	C.O.

Second Year Algebra and Advanced Placement Mathematics II Instructional Materials Committee (1967-68)

James Carey	Teacher	Franklin
Keith Geiger	Teacher	Stevenson
Jan Hale	Teacher	Franklin
Roger Strong	Teacher	Bentley
Gary Vance*	Teacher	Stevenson
Herbert Van Hooser	Teacher	Bentley
Charles Zoet	Coor Sec Math	C.O.

Mathematics for Seventh and Eighth Grade Slow Learners
Instructional Materials Committee (1967-68)

David Brown	Teacher	Frost
Jean Cogill	Teacher	Whitman
Maureen Curtin	Teacher	Holmes
Wayne Henry	Teacher	Bryant
Diane Kabalka	Teacher	Lowell
Mary LeBlanc	Teacher	Emerson
Paul Leece	Teacher	Frost
Peter Pascaris*	Teacher	Dickinson
Thomas Pobanz	Teacher	Riley
Robert Selke	Teacher	Riley
Marjorie Wharton	Teacher	Whittier
Charles Zoet	Coor Sec Math	C.O.

Basic Mathematics Instructional Materials Committee (1967-68)

James Bedenis	Teacher	Lowell
Ellen Hansz	Teacher	Dickinson
John McIsaac	Teacher	Whittier
Edward Navoy	Teacher	Bryant
Gladys Rockind	Teacher	Riley
Harry Talley	Teacher	Whitman
Ruth Turley	Teacher	Frost
Charles Zoet	Coor Sec Math	C.O.

Basic Algebra Instructional Materials Committee (1967-68)

Cale Bartshe	Teacher	Whittier
Richard Burns	Teacher	Emerson
Dwight Doney	Teacher	Stevenson
Virginia Dunville	Teacher	Holmes
Kenneth Haug	Teacher	Bentley
Carol Jack	Teacher	Lowell
Lavergne Murphy	Teacher	Whitman
Barbara Janeczko	Teacher	Franklin
Kenneth Patterson	Teacher	Bryant
Adele Sobania*	Teacher	Riley
Donald Quashnie	Teacher	Frost
Virginia Waymire	Teacher	Franklin
Charles Zoet	Coor Sec Math	C.O.

Committee to Recommend Instructional Materials for Mathematics--Grades Seven and Eight (1968-69)

Susan Barr	Teacher	Riley
Ellen Hansz	Teacher	Dickinson
Maureen Herbert	Teacher	Holmes
Marjorie Ingram	Teacher	Dickinson
Daniel Kinczkowski	Teacher	Whittier
Robert Krueger	Teacher	Riley
Thomas Lang	Teacher	Frost
Mary LeBlanc	Teacher	Bryant
Paul Leece	Teacher	Frost
Judith Ludington	Teacher	Bryant
Barbara Mauller	Teacher	Holmes
William Montgomery*	Teacher	Lowell
Kathleen Schmitt	Teacher	Emerson
Brian Schulze	Teacher	Lowell
David Totten	Teacher	Whitman
Gwendolynne Walter	Teacher	Whitman
Marjorie Wharton	Teacher	Whittier

Committee to Recommend Instructional Materials for Geometry (1968-69)

Theodore Bison	Teacher	Churchill
Marilyn Capelli	Teacher	Franklin
Frank Harding*	Teacher	Stevenson
Barton Moore	Teacher	Franklin
Jurina Rugienius	Teacher	Bentley
Gary Vance	Teacher	Stevenson

Committee to Recommend Instructional Materials for Basic Algebra II (1968-69)

Karen Assenmacher	Teacher	Churchill
Mary Buda	Teacher	Franklin
Douglas Doney	Teacher	Stevenson
Keith Geiger	Teacher	Stevenson
Carol Kavalhuna	Teacher	Bentley
John Lidster*	Teacher	Bentley
Harry Talley	Teacher	Churchill
James Winebrener	Teacher	Stevenson

Refresher Mathematics Instructional Materials Committee (1969-70)

Marilyn Capelli	Teacher	Franklin
Bruce Ford	Teacher	Churchill
Jurina Rugienius	Teacher	Bentley
Roger Rood	Teacher	Stevenson
Robert Selke	Teacher	Franklin

Elementary Committee on Mathematics (1969 and 1969-70)

Sandra Adler	Teacher	Tyler
Robert Badertscher	Asst Prin	Hull
Patricia Davis	Teacher	Johnson
Arthur Domalske*	Principal	Cooper
Lillian Edney	Teacher	Harrison
Helene Georgiou	Teacher	Roosevelt
Henry Heusner	Dir El Ed	C.O.
Richard Holt	Teacher	Randolph
Ruth Horton	Teacher	Webster
Clyde Jack	Principal	Kennedy
William Kumbier	Coor El Math	C.O.
Robert Lentes	Librarian	Hoover
Carol Stam	Teacher	Hull

Modern Topics in Mathematics Instructional Materials Committee (1969-70)

Karen Assenmacher	Teacher	Churchill
Jan Hale	Teacher	Franklin
John Lidster	Teacher	Bentley
James Winebrener	Teacher	Stevenson
David Westover	Teacher	Churchill

Trigonometry, Solid and Analytical Geometry Instructional Materials Committee (1969-70)

Larry Dove	Teacher	Bentley
Allan Edwards	Teacher	Stevenson
James Probelski	Teacher	Franklin
Edward Segowski	Teacher	Churchill
Gary Vance	Teacher	Stevenson

Calculus Instructional Materials Committee (1969-70)

James Carey	Teacher	Franklin
Frank Harding	Teacher	Stevenson
James Reeves	Teacher	Bentley
Roger Strong	Teacher	Bentley
Harry Talley	Teacher	Churchill

High School Mathematics Advisory Committee (1969-70)

James Carey	Teacher	Franklin
Allan Edwards	Teacher	Stevenson
Jan Hale	Teacher	Franklin
Henry Lundy	Teacher	Churchill
James Reeves	Teacher	Bentley
Edward Segowski	Teacher	Churchill
Roger Strong	Teacher	Bentley
Gary Vance	Teacher	Stevenson
Charles Zoet	Coor Sec Math	C.O.

Junior High School Mathematics Advisory Committee (1969-70)

Donald Albertson	Teacher	Bryant
Cale Bartshe	Teacher	Whittier
George Calder	Teacher	Emerson
Marjorie Ingram	Teacher	Dickinson
Thomas Lang	Teacher	Frost
William Montgomery	Teacher	Lowell
William McMurtrey	Principal	Whitman
Eldon Price	Teacher	Whitman
James Rice	Teacher	Holmes
Adele Sobania	Teacher	Riley
Charles Zoet	Coor Sec Math	C.O.

F/C Regional Elementary Mathematics/Science Committee (1970-71 to 1974-75)

F/C Regional Junior High School Mathematics Committee (1970-71 to 1974-75)

F/C Regional High School Mathematics Committee (1970-71 to 1974-75)

F/C Regional Vertical Mathematics Committee for Churchill Subregion (1970-71 to 1974-75)

F/C Regional Vertical Mathematics Committee for Franklin Subregion (1970-71 to 1974-75)

The membership of these five committees from the F/C Region consisted of the department chairmen and curriculum representatives from each building within the area of interest of each committee. Since the names of all such persons are included in the listing of department chairmen and curriculum representatives in appendix C they are not listed here.

Committee on Instructional Materials for Algebra I
F/C Region (1971-72)

Cale Bartshe	Teacher	Whittier
Mary Buda	Teacher	Franklin
Lana Heinrich	Teacher	Emerson
Carol Jack	Teacher	Lowell
Donald Pratt	Teacher	Churchill
Eldon Price*	Teacher	Whitman
Adele Sobania	Teacher	Ford

Committee on Instructional Materials for Algebra II and
Advanced Placement - F/C Region (1971-72 and 1972-73)

James Carey	Teacher	Franklin
James Probelski	Teacher	Franklin
Edward Segowski	Teacher	Churchill
Merrilee Zawadski	Teacher	Churchill

Committee on Instructional Materials for Senior
Mathematics - F/C Region (1971-72 and 1972-73)

Charles Hebstreit	Teacher	Franklin
Karen Holmes	Teacher	Churchill
Eugene Krzeminski	Teacher	Franklin
Roger Strong	Teacher	Churchill

Committee on Instructional Materials for an Alternate
to Calculus - F/C Region (1971-72 and 1972-73)

James Carey	Teacher	Franklin
Charles Hebestreit	Teacher	Franklin
Henry Lundy	Teacher	Churchill
Edward Segowski	Teacher	Churchill

Instructional Materials Committee for Elementary School
Mathematics - F/C Region (1971-72 and 1972-73)

Deborah Brown	72-73	Teacher	Cleveland
Alfred Burke		Teacher	Nankin Mills
Susan Daniel	72-73	Teacher	Eisenhower
Marvel Decker		Teacher	Stark
Allan Edwards	71-72	Math Coor	F/C Off
Mary Filip	72-73	Teacher	Eisenhower
Janice Gibson		Teacher	McKinley
Jerome Gough	71-72	Teacher	Eisenhower
Donald Harris		Principal	Jefferson
Harriet Larson		Teacher	Garfield
Nonie Manchester	72-73	Teacher	Hayes

Instructional Materials Committee for Elementary School Mathematics (continued)

James McKibben	72-73	Teacher	Jefferson
Marie Nabrezny		Teacher	Grant
Marsha Nicholl		Teacher	Cooper
Candace Posey		Teacher	Perrinville
Shirley Poulton	71-72	Teacher	Cleveland
Elizabeth Robinson*		Teacher	Wilson
Linda Scherdt		Teacher	Monroe
Joan Seay	71-72	Teacher	Washington
Margaret Sievert*	71-72	Teacher	Jefferson
Cynthia Stice		Teacher	Rosedale
Elizabeth Warner		Teacher	Johnson
Charles Zoet	72-73	Math Coor	F/C Off

Instructional Materials Committee for Students in Grades 7-9 Who have Difficulty with Mathematics - F/C Region (1971-72 and 1972-73)

Claire Brugman	71-72	Teacher	Whittier
Michael Bullock		Teacher	Whittier
Diane Coleman		Teacher	Emerson
Carole Goldfarb		Teacher	Whittier
Clifford Laho		Teacher	Emerson
Paul McWilliams		Teacher	Lowell
Robert Raf		Teacher	Whitman
Adele Sobania*		Teacher	Ford
Michael Surdik		Teacher	Whitman
Gwen Walters	71-72	Teacher	Whitman
Marjorie Wharton	71-72	Teacher	Whittier

Bentley/Stevenson Regional Mathematics Committee (1972-73 and 1973-74)

Rosemary Allan	Teacher	Taylor
David Brown	Teacher	Frost
Peggy Bosworth	Teacher	Bryant
Allan Edwards	Eval Spec	B/S Off
Kenneth Erkfitz	Teacher	Riley
Marilyn Eschner	Teacher	Tyler
Frank Harding	Teacher	Stevenson
Kenneth Haug	Teacher	Bentley
Arthur Howell	Asst Prin	Riley
Clyde Jack	Principal	Kennedy
Patricia Kovach	Teacher	Madison
William Kumbier	Math Coor	B/S Off
Sharron Laing	Teacher	Roosevelt
Mary Lou LaPorte	Teacher	Hull
William Moorhead	Media Spec	Wilcox
Karen Moscow	Teacher	Jackson

Bentley/Stevenson Regional Mathematics Committee (continued)

Peter Pascaris	Teacher	Dickinson
Benjamin Ray	Asst Prin	Bentley
James Rice	Teacher	Holmes
Bruce Sachs	Teacher	Kennedy

Ad Hoc Committee to Formulate Minimal Objectives for K-3 Mathematics (1973-74)

Anthony Aquino	Eval Spec	B/S Off
Richard Burnham	Principal	Perrinville
Edna Devitt	Teacher	Taylor
Susan Irwin	Teacher	Eisenhower
William Kumbier	Math Coor	B/S Off
Harriet Larson	Teacher	Garfield
Karen Moscow	Teacher	Jackson

Ad Hoc Committee to Formulate Minimal Objectives for 4-6 Mathematics (1973-74)

Bernard Grenda	Teacher	Hayes
Donald Harris	Principal	Kennedy
Sharron Laing	Teacher	Roosevelt
Mary McNair	Eval Spec	C.O.
Katherine Overman	Teacher	Eisenhower
Bruce Sachs	Teacher	Kennedy
Charles Zoet	Math Coor	F/C Off

Ad Hoc Committee to Formulate Minimal Objectives for Junior High School Mathematics (1973-74)

David Brown	Teacher	Frost
George Calder	Teacher	Emerson
Allan Edwards	Eval Spec	F/C Off
Arthur Howell	Asst Prin	Riley
William Mair	Teacher	Holmes
Charles Morris	Teacher	Whitman
Charles Zoet	Math Coor	F/C Off

Computer Math I Delivery System Committee (1974-75)

John Andrews	Teacher	Bentley
Sally Goodwin	Teacher	Franklin
Henry Lundy	Teacher	Churchill
Lary Smith	Comp Spec	Curr Dept
James Winebrener	Teacher	Stevenson
Charles Zoet	Math Coor	Curr Dept

Junior High School Instructional Materials Committee
Grades 7 and 8 (1974-75)

Anthony Aquino	Eval Spec	Curr Dept
David Brown	Teacher	Frost
Michael Bullock	Teacher	Whittier
David Butler	Teacher	Bryant
Allan Edwards	Eval Spec	Curr Dept
Kenneth Erkfitz	Teacher	Riley
Lana Heinrich	Teacher	Emerson
Arthur Howell	Asst Prin	Riley
Clifford Laho	Teacher	Emerson
William McMurtrey	Principal	Lowell
Charles Morris	Teacher	Whitman
Peter Pascaris	Teacher	Dickinson
James Rice	Teacher	Holmes
Brian Schulze	Teacher	Lowell
Adele Sobania	Teacher	Ford
Charles Zoet	Math Coor	Curr Dept

High School Mathematics Committee (1974-75)

Frank Harding	Teacher	Stevenson
Charles Hebstreit	Teacher	Franklin
William Kumbier	Math Coor	B/S Off
Henry Lundy	Teacher	Churchill
Barton Moore	Teacher	Franklin
Gary Vance	Teacher	Bentley
James Winebrener	Teacher	Stevenson
Charles Zoet	Math Coor	F/C Off

Basic Algebra I and II Evaluation and Needs Assessment
Committee (1974-75)

Claire Brougman	Teacher	Whittier
Richard Burns	Teacher	Emerson
Richard DeVries	Teacher	Ford
Dennis Heinrich	Teacher	Dickinson
Brenda Husband	Teacher	Riley
Carol Jack	Teacher	Lowell
Jan Janigian	Teacher	Bryant
Herbert Hutchison	Principal	Whitman
Thomas Lang	Teacher	Frost
Robert Raf	Teacher	Whitman
Ferl Thomas	Principal	Emerson
Carl Wagner	Teacher	Holmes
Charles Zoet	Math Coor	Curr Dept

Senior High Curriculum Study Committee for Basic Algebra (1974-75)

Anthony Aquino	Eval Spec	Curr Dept
Mary Buda	Teacher	Churchill
James Carli	Principal	Churchill
Mary Hopkins	Teacher	Stevenson
Lynwood Knudson	Teacher	Bentley
Robert Selke	Teacher	Franklin
Larry Sroka	Teacher	Bentley
David Westover	Teacher	Churchill
Charles Zoet	Math Coor	Curr Dept

Senior High Curriculum Study Committee for Plane Geometry, Basic Geometry and Advanced Placement Math I (1974-75)

Allan Edwards	Eval Spec	Curr Dept
Kenneth Haug	Teacher	Bentley
Susan Haverkate	Teacher	Churchill
Barbara Mauller	Teacher	Stevenson
Barton Moore	Teacher	Franklin
James Reeves	Teacher	Bentley
Roger Rood	Teacher	Stevenson
Dale Rothenberg	Teacher	Franklin
Estelle Saarela	Teacher	Stevenson
Albert Zack	Principal	Bentley
Merrilee Zawadzki	Teacher	Churchill
Charles Zoet	Math Coor	Curr Dept

Senior High Curriculum Study Committee for Trigonometry and Analysis (1974-75)

Charles Hebestreit	Teacher	Franklin
Paul Mack	Teacher	Stevenson
Roger Strong	Teacher	Churchill
Gary Vance	Teacher	Bentley
Dean Waldfogel	Principal	Stevenson
Charles Zoet	Math Coor	Curr Dept

Senior High Curriculum Study Committee for Advanced Placement Mathematics III (1974-75)

James Carey	Teacher	Franklin
Larry Dove	Teacher	Bentley
Allan Edwards	Eval Spec	Curr Dept
Frank Harding	Teacher	Stevenson
Edward Segowski	Teacher	Churchill
Dean Waldfogel	Principal	Stevenson
Charles Zoet	Math Coor	Curr Dept

Steering Committee for CAP 4-6 Mathematics Project (1975)

Anthony Aquino	Eval Spec	Curr Dept
Beverly Brown	Teacher	Taylor
Robert Badertscher	Principal	McKinley
Gordon Draper	Principal	Madison
Allan Edwards	Eval Spec	Curr Dept
Norman Gosman	Teacher	Lincoln
Marsha Gutov	Teacher	Cooper
Bruce Sachs	Teacher	Kennedy
Harriet Larson	Teacher	Garfield
Charles Zoet	Math Coor	Curr Dept

APPENDIX E

DISTRICTWIDE STANDARDIZED TEST SCORES

FOR GRADES 4-8

DISTRICTWIDE STANDARDIZED TEST SCORES FOR GRADES 4-8

Tables 29-33 show the mean district grade equivalent scores obtained on standardized tests in grades four through eight for the years 1956-57 through 1974-75. During this period a total of our different tests were administered in these grades: (1) the Iowa Every Pupil Test (IEPT), (2) the Iowa Test of Basic Skills (ITBS), (3) the California Achievement Test (CAT), and (4) the Comprehensive Test of Basic Skills (CTBS). Not every grade was tested every year and in years where no test was administered or data was not retained this is noted in the tables. Blanks in the tables indicate that the subtest heading is not applicable to the test administered during that year.

The time of administration of each test is indicated by the norm given in the table, i. e., in table 29, 4.0 is September, 4.1 is October, 4.7 is April and 4.8 is May.

At each grade level there is a noticable drop in scores on the ITBS between 1963-64 and 1964-65 which is the result of a re-norming of this test by the publisher at that time.

TABLE 29

GRADE 4 DISTRICTWIDE STANDARDIZED TEST SCORES
EXPRESSED IN GRADE EQUIVALENTS

Year	Norm	Test*	Prob Solve	Concepts	Compu-tation	Appli-cations	Total
1956-57	4.1	IEPT	-	-			3.9
1957-58	4.1	ITBS	4.2	4.3			4.3
1958-59	4.1	ITBS	4.3	4.6			4.5
1959-60	4.1	ITBS	4.4	4.5			4.5
1960-61	4.1	ITBS	4.4	4.6			4.5
1961-62	4.1	ITBS	4.3	4.6			4.5
1962-63	4.1	ITBS	4.4	4.6			4.4
1963-64	4.1	ITBS	4.3	4.6			4.5
1964-65	4.1	ITBS	3.9	4.2			4.1
1965-66	4.1	ITBS	3.9	4.2			4.0
1966-67	4.1	ITBS	3.8	4.2			4.0
1967-68	4.1	ITBS	3.9	4.2			4.0
1968-69	4.1	ITBS	3.9	4.1			4.0
1969-70	4.0	CTBS		4.4	4.0	4.4	4.1
1970-71	4.0	CTBS		4.3	3.9	4.2	4.0
1971-72	4.7	CTBS		5.4	4.9	5.0	5.0
1972-73	4.8	CTBS		5.4	4.8	5.1	5.0
1973-74			GRADE 4 WAS NOT TESTED				
1974-75	4.8	CTBS		5.5	5.0	5.2	5.2

*IEPT-Iowa Every Pupil Test
ITBS-Iowa Test of Basic Skills
CTBS-Comprehensive Test of Basic Skills

TABLE 30

GRADE 5 DISTRICTWIDE STANDARDIZED TEST SCORES
EXPRESSED IN GRADE EQUIVALENTS

Year	Norm	Test*	Prob Solve	Concepts	Compu-tation	Appli-cations	Total
1956-57	5.1	IEPT	-	-			4.8
1957-58	5.1	ITBS	5.2	5.4			5.3
1958-59	5.1	ITBS	5.1	5.3			5.2
1959-60	5.1	ITBS	5.5	5.7			5.6
1960-61	5.1	ITBS	5.3	5.5			5.4
1961-62	5.1	ITBS	5.6	5.7			5.6
1962-63	5.1	ITBS	5.4	5.4			5.4
1963-64	5.1	ITBS	5.4	5.6			5.5
1964-65	5.1	ITBS	5.0	5.2			5.1
1965-66	5.1	ITBS	4.8	5.2			5.0
1966-67	5.1	ITBS	4.7	5.2			5.0
1967-68	5.1	ITBS	4.8	5.1			4.9
1968-69	5.1	ITBS	4.8	5.1			5.0
1969-70	5.0	CTBS		5.4	4.8	5.4	5.1
1970-71	5.0	CTBS		5.3	4.8	5.3	5.0
1971-72	5.7	CTBS		6.6	6.1	6.4	6.3
1972-73	5.8	CTBS		6.4	6.1	6.3	6.2
1973-74	5.8	CTBS		6.5	6.0	6.3	6.2
1974-75	5.8	CTBS		6.5	6.1	6.4	6.3

*IEPT-Iowa Every Pupil Test
ITBS-Iowa Test of Basic Skills
CTBS-Comprehensive Test of Basic Skills

TABLE 31

GRADE 6 DISTRICTWIDE STANDARDIZED TEST SCORES
EXPRESSED IN GRADE EQUIVALENTS

Year	Norm	Test*	Prob Solve	Concepts	Compu-tation	Appli-cations	Total
1956-57	6.1	IEPT	-	-			5.6
1957-58	6.1	ITBS	6.4	6.5			6.5
1958-59	6.1	ITBS	6.5	6.5			6.5
1959-60	6.1	ITBS	6.5	6.5			6.5
1960-61	6.1	ITBS	6.9	6.8			6.9
1961-62	6.1	ITBS	7.1	6.7			6.7
1962-63	6.1	ITBS	6.6	6.5			6.6
1963-64	6.1	ITBS	6.6	6.6			6.6
1964-65	6.1	ITBS	6.4	6.3			6.3
1965-66	6.1	ITBS	6.1	6.1			6.1
1966-67	6.1	ITBS	6.0	6.0			6.0
1967-68	6.1	ITBS	5.9	5.9			5.9
1968-69	6.1	ITBS	5.9	5.9			5.9
1969-70	6.0	CTBS		6.5	5.7	6.6	6.0
1970-71	6.0	CTBS		6.5	5.5	6.4	6.0
1971-72	6.7	CTBS		7.5	7.3	7.4	7.3
1972-73	6.8	CTBS		7.3	7.3	7.4	7.3
1973-74	6.8	CTBS		7.4	6.9	7.1	7.0
1974-75	6.8	CTBS		7.4	7.0	7.2	7.1

*IEPT-Iowa Every Pupil Test
ITBS-Iowa Test of Basic Skills
CTBS-Comprehensive Test of Basic Skills

TABLE 32

GRADE 7 DISTRICTWIDE STANDARDIZED TEST SCORES
EXPRESSED IN GRADE EQUIVALENTS

Year	Norm	Test*	Prob Solve	Concepts	Compu-tation	Appli-cations	Total
1958-59	7.1	ITBS	7.5	7.5			7.5
1959-60	7.1	ITBS	7.6	7.7			7.7
1960-61	7.1	ITBS	7.4	7.5			7.4
1961-62	7.1	ITBS	7.6	7.8			7.7
1962-63	7.1	ITBS	7.5	7.6			7.5
1963-64	7.1	ITBS	7.5	7.6			7.5
1964-65	7.1	ITBS	7.2	7.5			7.4
1965-66			GRADE 7 WAS NOT TESTED				
1966-67			GRADE 7 WAS NOT TESTED				
1967-68			GRADE 7 WAS NOT TESTED				
1968-69			GRADE 7 WAS NOT TESTED				
1969-70			GRADE 7 WAS NOT TESTED				
1970-71	7.0	CTBS		7.1	6.6	7.0	6.8
1971-72	7.7	CTBS		8.4	8.5	8.0	8.3
1972-73	7.8	CTBS		8.6	8.6	8.1	8.4
1973-74	7.8	CTBS		8.5	8.5	8.1	8.4
1974-75	7.8	CTBS		8.4	8.4	8.1	8.3

*ITBS-Iowa Test of Basic Skills
CTBS-Comprehensive Test of Basic Skills

TABLE 33

GRADE 8 DISTRICTWIDE STANDARDIZED TEST SCORES
EXPRESSED IN GRADE EQUIVALENTS

Year	Norm	Test*	Prob Solve	Concepts	Compu-tation	Appli-cations	Total
1958-59	8.1	ITBS	8.3	8.5			8.5
1959-60	8.1	ITBS	8.6	8.7			8.6
1960-61	8.1	ITBS	8.5	8.7			8.6
1961-62	8.1	ITBS	8.5	8.6			8.6
1962-63	8.1	ITBS	8.5	8.6			8.6
1963-64	8.1	ITBS	8.4	8.5			8.4
1964-65	8.1	ITBS	8.0	8.3			8.1
1965-66	8.1	CAT	SYSTEMWIDE DATA WAS NOT COLLECTED				
1966-67	8.1	CAT	SYSTEMWIDE DATA WAS NOT COLLECTED				
1967-68	8.1	ITBS	7.5	8.0			7.8
1968-69	8.1	ITBS	7.5	7.9			7.7
1969-70	8.1	ITBS	7.5	8.0			7.8
1970-71	8.7	CTBS		8.9	8.8	8.7	8.8
1971-72	8.7	CTBS		9.1	8.8	8.6	8.9
1972-73	8.8	CTBS		9.3	8.9	8.7	9.0
1973-74	8.8	CTBS		9.1	8.8	8.5	8.9
1974-75	8.8	CTBS		9.1	8.8	8.5	8.9

*ITBS-Iowa Test of Basic Skills
CAT -California Achievement Test
CTBS-Comprehensive Test of Basic Skills

APPENDIX F

PILOT PROGRAMS IN MATHEMATICS

LIVONIA PUBLIC SCHOOLS PILOT PROGRAMS IN MATHEMATICS EDUCATION: 1955 TO 1975

This section contains a list of pilot programs in mathematics education in the Livonia Public Schools between 1955 and 1975. The pilots included are listed because of their significance in the development of the total program of the district. The years in which each pilot occurred are listed together with a brief description of the program and its effects. For each program the page(s) in this dissertation on which the program is mentioned or described is also indicated.

Grade 9 Remedial Mathematics (1954-55)

A pilot section of remedial mathematics was formed and taught in the 9th grade at Bentley High School. This section was formed from the less able students who had enrolled in General Mathematics. Based on the success of teaching this one section, a new course, Basic Mathematics, was added to the mathematics program and was taught for the first time in 1956-57. (p. 103)

Enriched Mathematics (1956-57 and 1957-58)

During the second semester of 1956-57 a special section of Advanced Algebra students was formed in order to provide an enriched mathematics experience to the more able eleventh grade students at Bentley High School. The following year such sections were formed

in both the eleventh and twelfth grades. These enriched classes were felt to be highly successful but were phased-out when the Advanced Placement Program was established in the high school between 1958-59 and 1960-61. (pp. 105-6)

Numberaid Program (1960-61)

The Numberaid program was introduced at Coolidge Elementary School in 1960-61. The program was received negatively by the community. The materials and the program, however, did receive positive response from the staff and continued to be used concurrently with the adopted texts for a period of about five years. The use of this program in Livonia was largely restricted to this one school. (pp. 113-4)

SMSG and UMMaP Materials Used in Grades 7-9 (1960-61)

Thirteen sections of mathematics in grades 7-9 were taught using SMSG and UMMaP materials during 1960-61. At the conclusion of this year it was agreed that the materials were very similar in content and the SMSG materials were choosen for an expanded use in these grades the following year. These pilots led to the decision to adopt a "modern mathematics" program for grades seven and eight and to select a commercial text series of a modern nature for the year 1962-63. (pp. 132-3)

TEMAC Programmed Materials (1961-62 and 1962-63)

One section of Algebra I at Bentley High School was taught using TEMAC programmed materials during 1961-62. Also, during the second semester a class consisting of students who had failed Plane

Geometry, Advanced Algebra, or Trigonometry was taught using the appropriate sets of TEMAC materials. This pilot use was extended for a second year and the materials were used in a similar manner. The use was discontinued after the second year because of the highly traditional content of the program and because of high student boredom after extended use of the materials. (pp. 138-40)

SMSG Geometry (1961-62)

SMSG Geometry materials were piloted in several classes during 1961-62. Based on the favorable results of these pilot sections these materials were used as the basic text for Plane Geometry for both 1962-63 and 1963-64.

SMSG Intermediate Mathematics (1962-63)

SMSG Intermediate Mathematics materials were piloted in several Advanced Algebra classes during 1962-63. Based on the favorable results of these pilot sections these materials were used as the basic text for Advanced Algebra for 1963-64. The following year a commercial text was adopted for the course. (p. 145)

Elementary Text Materials (1962-63, 1963-64 and 1964-65)

Over the three year period from 1962 through 1965, selected sections of elementary school students at Coolidge, Lincoln and Harrison Elementary Schools were taught using materials published by SMSG and GCMP. The classes at these schools served as examples of the possibility of teaching "modern mathematics" programs in the elementary school. The materials were discontinued when a new elementary mathematics program was selected for 1965-66. (pp. 120-1)

Wilson Elementary School Comparative Pilots (1964-65)

The Wilson Elementary School staff was selected to conduct a comparative pilot study using sets of materials published by the Winston, Laidlaw, and Addison-Wesley Publishing Companies during 1964-65. These pilots together with those at Lincoln, Harrison and Coolidge served as a basis for the selection of a new text series for 1965-66. (p. 159)

Individualized Instruction in Trigonometry (1965-66 and 1966-67)

During both 1965-66 and 1966-67 one section of Trigonometry at Bentley High School was taught on an individualized basis. Students were given units of work with minimal class direction and were allowed to work at their own pace to complete each unit assigned. The results of these two efforts showed no significant advantage in the learning of the course content and the pilots were discontinued after the second year. (pp. 208-10)

Accelerated Algebra (1965-66 and 1966-67)

One section of Algebra I was formed in the eighth grade at Whitman Junior High School in 1965-66. This group was then taught a second year of algebra during the ninth grade. This pilot was extensively evaluated and these students were followed through the twelfth grade. The results of this evaluation were positive at all levels. As a result Whitman formed another class in 1967-68 and in 1969-70 the district officially adopted eighth grade algebra as an alternative for each junior high school. (pp. 192-6)

Remedial Mathematics (1965-66)

At Franklin High School a teacher, John Bingham, developed and piloted the use of single concept audio-visual materials for remedial mathematics students. The materials were positively received by the students. The development was discontinued when the grant which financed this work was ended. The use of the materials ended the following year when Bingham left the system. (p. 210-11)

Elementary Curriculum Representatives (1966-67)

During 1966-67 a pilot program was conducted in which elementary schools were able to appoint Elementary Curriculum Representatives to work directly with the subject matter coordinators of the district and to serve as in-building leaders in either math/science or language arts/social studies. The results of this program were positive and in 1967-68 each elementary school was assigned two such positions. The position was retained by the district through 1974-75. (pp. 90-91)

Technical Mathematics (1967-68 and 1968-69)

Pilot sections of a new course, Technical Mathematics, were taught at Bentley and Franklin High Schools in 1967-68 and 1968-69. This course was designed as an alternative to Basic Algebra and included a much greater emphasis on applied and practical problems. As a result of these pilot efforts the course was adopted as a part of the district mathematics program for 1969-70. (p. 214)

UNIPACS (1967-68 through 1969-70)

UNIPACS were written and used to teach selected concepts in algebra, geometry, and trigonometry during the time that modular scheduling was operating in the Livonia High Schools. Only one of the UNIPACS was evaluated in a comparative study. The results of the study were favorable to the use of the UNIPAC. The extensive use of UNIPACS in the high schools was discontinued at the time that modular scheduling was discontinued and teachers returned to more traditional patterns of teaching. (pp. 213-14)

Alternative Approach to Basic Algebra (1968-69)

During 1968-69 one section of Basic Algebra I at Bentley High School was taught from a point of view which placed the greatest stress on student attitudes rather than on mathematical content. The evaluation of this pilot effort reported significantly positive results with regard to both attitude and knowledge of content. The approach was not continued, however, because of philosophical differences between the principal and the teachers regarding the operation of the class. (pp. 215-16)

Elementary Individualized Mathematics (1968-69 and 1969-70)

In 1968-69 the staff of Kennedy Elementary School piloted the development and use of an individualized mathematics program. The following year they were joined in this project by the staff of Madison Elementary School. Based on a strong administrative commitment to individualization and the favorable results of these two years, the program was expanded to include four other schools in 1970-71. The program continued to operate in six schools through 1973-74. At that time the program was discontinued because of the

cost of the program and the lack of any demonstrable improvement in achievement of the students in the program. (pp. 169-72)

Junior High Individualized Programs (1968-69 and 1969-70)

During 1968-69 the staff of Holmes Junior High School began the development and use of a continuous progress model in its Algebra I and Basic Algebra courses. The following year the staff at Riley Junior High School introduced the same model for 7th grade mathematics. The results of the efforts of these two schools were positive and by 1971-72 three schools, Holmes, Riley, and Ford, were sharing materials for all grades 7-9. The retention of this method of instruction was determined on a building basis. In 1974-75 it was still in full operation at Ford. It was used on a reduced basis at Holmes and had been discontinued at Riley. (pp. 219-22)

IPI-Mathematics (1972-73)

The commercially produced Individually Prescribed Instruction materials in mathematics were introduced at Taft Elementary School on a pilot basis in 1972-73. The evaluation of these materials, which were supplemented by some math lab materials, was positive. The cost of this program was felt to be prohibitive and the program was not expanded to other schools. The use of this program will probably end with the planned closing of Taft following the 1975-76 school year. (p. 253-54)

Practical Geometry (1972-73)

After several years of initial work a course in Practical Geometry was developed and piloted at Bentley High School in 1972-73. Based on this pilot and similar work which was taking place in other high schools, this course was adopted as a part of the district program for 1973-74. (p. 256)

Elementary School Texts (1972-73 and 1973-74)

The two regions of the school idstrict conducted separate pilot studies of elementary text materials in 1972-73 and 1973-74. The Franklin/Churchill Region piloted Modern School Mathematics in 1972-73 following which time it was adopted as a co-basic text for the elementary program. In 1973-74 the Bentley/Stevenson Region piloted Heath Elementary Mathematics following which it was adopted as a co-basic text. In each case the text series under consideration was compared to the existing adoption(s) for the district. (pp. 236-37)

High School Texts (1974-75)

During 1974-75 the texts Advanced Mathematics and Geometry: A Transformational Approach were piloted in sections of Mathematical Analysis and Advanced Placement Math I, respectively. The results of these pilots were positive. A lack of funds, however, postponed any adoption and the pilot use of the texts was continued for 1975-76. (pp. 239-40)

APPENDIX G

UNIPACS DEVELOPED IN THE LIVONIA HIGH SCHOOLS

UNIPACS DEVELOPED IN THE LIVONIA

HIGH SCHOOLS

1. Proof by Mathematical Induction
2. Curve Sketching of the Trigonometric Functions
3. Developing the Trig. Functions Using the Unit Circle
4. Trigonometric Identities and their Solution
5. Multiple-Angle Identities
6. A Method of Solving Certain Inequalities
7. Factoring Quadratic Expressions Using Rational Numbers
8. Areas Found by Construction
9. Polygons
10. Indirect Proof
11. Properties of the Special Quadrilaterals
12. Special Cases of the Pythagorean Theorem
13. Special Products and Factoring
14. Factoring Quadratic Expressions Using Integers
15. Principles of Logical Reasoning

APPENDIX H

MATERIALS DEVELOPED AND USED IN THE LIVONIA INDIVIDUALIZED MATHEMATICS PROGRAMS

ABOUT THIS BOOK

This book, the third working paper, has been developed to assist those individuals who wish to meet the needs of the child more effectively. The book represents one part of the project - the instructional materials to be used in individualizing mathematics. Pre- and post-tests and inservice activities are under separate cover.

The program participants view this work and the objectives contained herein as a point of departure for future investigation. It is their desire to make the "stepping stones" to success even more precise so children may progress freely but surely through mathematics.

The pages that follow are divided into thirteen areas:

1. Numeration
2. Place Value
3. Addition
4. Subtraction
5. Multiplication
6. Division
7. Fractions
8. Money
9. Time
10. Systems of Measurement
11. Combination of Processes
12. Geometry
13. Special Topics

Each of the above areas is divided into sub-levels which indicate the relative difficulty of specific objectives which are contained at each level.

Suggested materials, found in most Livonia elementary schools, are coded to each objective. Teachers prepared special materials where there was a noticeable void in the commercial materials. The materials which appear with an asterisk (*) are instructional or discussion pages to which the participants should pay particular attention. Pages not marked with the asterisk are practice pages.

Materials are coded in such a way to give alternatives to the teacher for use with each child. The availability of materials does not mean the child must do everything.

The code of the materials used follows. Copyright dates are given for all coded materials. Note that the basic math book of Livonia, the Addison-Wesley series, is always in the first column on the left of all coded materials.

	CODE	MATERIAL
1.	AW	Addison-Wesley Textbooks, c. 1965
2.	GC	Greater Cleveland Books, c. 1961, 1962, 1964, 1965
3.	AWS 5	Addison-Wesley Supplementary Booklets, c. 1965
4.	AWS 8	Addison-Wesley Supplementary Booklets, c. 1968
5.	AWD	Addison-Wesley dittos, c. 1969
6.	TPM	Teacher-prepared materials
7.	HRW	Holt, Rinehart, Winston, c. 1965
8.	McM	McCormick-Mathers, c. 1968
9.	JENN	Jenn Publishing
10.	SS	Study Scope - Primary Mathematics - Intermediate Mathematics
11.	EM	Elementary Math (Lola May), c. 1966
12.	SK	Singer Kits, c. 1969
13.	MLM	Math Lab Materials, c. 1964
14.	SRAC	Science Research Associates Computational Skills Development Kit, c. 1965
15.	SRAF	Science Research Associates Arithmetic Fact Kit, c. 1969
16.	IPT	Imperial Primary Tape, c. 1967
17.	IIT	Imperial Intermediate Tape, c. 1970
18.	LSC	Learning System Corporation (Mini-system tapes)
19.	EFI	Electronic Futures, Inc., Self-Instructional Basic Math., c. 1969
20.	VM	Visual Approach to Math, Level I, c. 1967
21.	GE	Extending Mathematics Ideas, Ginn & Co., c. 1961
22.	GR 8	Getting Ready, Addison-Wesley, c. 1968

MULTIPLICATION - Level G

1. Given a whole number and a mixed decimal (to tenth), student will compute their product.

AW Bk 6	GC Bk 9-10	AWS5 Bk 6	McM Bk 5	SK Blk 13 DD
245	34(1-6)	79 A-1	119(4-5),	460,461
	Gc Bklt 9		170(1-5)	
	1-11			IIT
				Lesson 26

2. Given two decimal numbers (to tenth), student will apply the distributive property to compute their product.

AW Bk 6	GC Bk 9-10	McM Bk 7	SS	LSC
245	36,(7-15),	87(4-6)	Set 211-6	1088
	39			

3. Given one decimal number (to tenths) and another decimal number (to hundredths), student will estimate their product.

GC Bk 9-10	McM Bk 7	LSC	GE Bk 6
39	87(8-10)	1088	68
GC Bklt 9			
32			

Name _____ Pre Test Multiplication
Level G
Date _____ Skills 1, 2
Page 1 of 3

1) Multiply.

a) 23
x 1.4

b) 45
x 3.4

c) 1.8
x 64

d) 10.3
x 80

e) 678
x30.9

2) Find the product using the distributive principle.

Example: .5 x .6 = .5 x (.3 + .3)
= .15 + .15
= .30

a) .2 x .8 =
=
=

b) .7 x .9 =
=
=

APPENDIX I

MATHEMATICS IN-SERVICE TRAINING ACTIVITIES

1959 TO 1975

DISTRICTWIDE ELEMENTARY TEACHER IN-SERVICE TRAINING ACTIVITIES: 1959 TO 1975

Workshop on the Teaching of Arithmetic (August 1959)

Purpose: to update teachers on the teaching of arithmetic

Length: 2 weeks

Size: approximately 30 teachers

Paid: Yes

Leadership: Bernice Roberts, Elementary Curriculum Coordinator

Elementary Arithmetic Workshop (August 1961)

Purpose: to review new materials for teaching arithmetic and to explore implications of changes at junior and senior high levels

Length: 2 weeks

Size: 30 teachers

Paid: Yes

Leadership: Bernice Roberts, Elementary Curriculum Coordinator

Arithmetic Workshop (October 1961)

Purpose: to acquaint teachers with the newly adopted Winston arithmetic program

Length: 4 after-school sessions during one week

Size: open to all teachers K-6

Paid: No

Leadership: consultant from Winston Publishing Co.

Elementary Mathematics Study Group (1963)

Purpose: to study fundamental processes etc. as presented in SMSG and other new programs

Length: January to June 1963 (weekly meetings)

Size: 37 teachers, principals, and resource persons

Paid: No

Leadership: William Kumbier, System Administrative Intern

Modern Mathematics Classes (1963-64)

Purpose: to teach the basic content of "modern mathematics"

Length: 12 weekly meetings after school

Size: approximately 125 teachers and principals

Paid: No

Leadership: Anthony Aquino, James Carey, William McCalla and Eldon Price, Junior High Teachers

Elementary Mathematics Workshop (August 1964)

Purpose: to provide an additional stimulus, acquaint teachers with the Revised Winston materials and build a core of mathematics specialists in the district

Length: 2 weeks

Size: 24 teachers from 20 elementary schools

Paid: Yes

Leadership: William Kumbier, Elementary Mathematics Coordinator

In-service Math Center Activities (Fall 1964)

Purpose: to use the revised Winston as a base to broaden concepts and relate major concepts to "modern mathematics"

Length: 3 after-school sessions

Size: approximately 200 teachers

Paid: No

Leadership: a total of 19 different instructors including a number of those trained in the August workshop

Kindergarten Mathematics Workshop (November 1964)

Purpose: to provide information about GCMP materials

Length: 1 half-day session

Size: all kindergarten teachers

Paid: No

Leadership: William Kumbier, Elementary Mathematics Coordinator

Summer Workshop (August 1965)

Purpose: to prepare persons to serve as leaders for sessions concerning the newly adopted Addison-Wesley series during the 1965-66 school year

Length: 1 week

Size: 6 teachers

Paid: Yes

Leadership: William Kumbier, Elementary Mathematics Coordinator

Elementary Mathematics Orientation Programs (January 1966)

Purpose: to provide help with new Addison-Wesley materials

Length: 2 after-school sessions

Size: approximately 80 teachers

Paid: No

Leadership: the six teachers trained in August 1965

Workshop on Mathematics Skills Diagnosis-Remediation (April 1970)

Purpose: to train participants to return to building and help teachers with diagnosis-remediation in the classroom

Length: 2 after-school sessions

Size: math/science representatives from each elementary school

Paid: No

Leadership: Joseph Payne and Paul Trafton, The University of Michigan

Training Session on Teaching of Fractions (February 1971)

Purpose: to inable participants to return to building and provide assistance to classroom teachers

Length: 1 half-day session

Size: all Bentley/Stevenson Region mathematics/science representatives and junior high school department chairmen

Paid: No

Leadership: William Kumbier, B/S Mathematics/Science Coordinator

Summer Workshop (August 1971)

Purpose: to provide training in the teaching of mathematics

Length: 2 weeks

Size: 30 teachers

Paid: Yes

Leadership: Donald Buckeye and John Ginther, Eastern Michigan University

Credit Course "New Topics in Modern Mathematics" (1971-72)

Purpose: to increase content knowledge of teachers

Length: weekly during 1st semester

Size: 30 elementary and junior high teachers

Paid: No

Leadership: James Northey, Eastern Michigan University

Credit Course "Modern Mathematics Methods" (1971-72)

Purpose: to increase teachers' knowledge of methodology in teaching mathematics

Length: weekly during 2nd semester

Size: 30 elementary and junior high teachers

Paid: No

Leadership: Donald Buckeye, Eastern Michigan University

Workshop on Addition and Subtraction in Grades 1-3 (January 1972)

Purpose: to improve skills of teachers in teaching addition and subtraction

Length: 1 half-day session

Size: interested early elementary teachers

Paid: No

Leadership: Donald Buckeye, Eastern Michigan University

Summer Institute and Academic Year Workshop in Mathematics (1972-73)

Purpose: to provide a core of persons with specialized mathematics training at the elementary and junior high levels in the Livonia Schools

Length: 6 weeks during the summer of 1972 and monthly during the 1972-73 school year

Size: 23 elementary and 7 junior high teachers

Paid: Yes

Leadership: Donald Buckeye and John Ginther, Eastern Michigan University

Kindergarten Workshop (January 1973)

Purpose: to improve methods of introducing mathematics concepts

Length: 1 half-day session

Size: all kindergarten teachers

Paid: No

Leadership: John Ginther, Eastern Michigan University

Elementary Mathematics Workshops (1973-74)

Purpose: to help teachers with the Houghton-Mifflin text adoption

Length: 2 half-day meetings

Size: all F/C Region teachers

Paid: No

Leadership: Edith Buckingham, Consultant for Houghton-Mifflin

DISTRICTWIDE SECONDARY TEACHER IN-SERVICE TRAINING ACTIVITIES: 1961 TO 1975

Junior and Senior High School Mathematics Workshop (August 1961)

Purpose: to study SMSG materials, particularly as they apply to instruction in grades 7, 8 and 9

Length: 4 weeks

Size: 20 junior high and 5 senior high teachers

Paid: Yes

Leadership: Eugene Smith, Wayne State University

SMSG Mathematics Workshop (August 1962)

Purpose: to orient teachers to modern mathematics and for introduction to materials at grade levels teachers would be teaching

Length: 2 weeks

Size: 34 junior high and 5 senior high teachers

Paid: Yes

Leadership: James Carey and George Calder, Livonia junior high teachers

E-103 Training Sessions (August 1964)

Purpose: to train teachers to program the E-103 Computer

Length: 1 week

Size: 4 teachers

Paid: Yes

Leadership: Instructor from Burroughs Corporation

Study Sessions (1964-65)

Purpose: to assist 7th and 8th grade teachers with materials related to new texts

Length: weekly after school sessions from October to February

Size: varied size groups

Paid: No

Leadership: Charles Zoet, Secondary Mathematics Coordinator

FORTRAN Workshop (1966)

Purpose: to acquaint teachers with the use of this computer language on the IBM 1440 computer

Length: 5 weekly classes after school

Size: 5 teachers

Paid: No

Leadership: Kenneth Knipschild, Livonia high school teacher

E-103 Computer Workshop (1967)

Purpose: to teach teachers to program the E-103 computer

Length: 5 after school sessions

Size: 30 junior and senior high school teachers in two groups of 15

Paid: No

Leadership: Kenneth Knipschild, Livonia high school teacher

Workshop for Teaching Mathematics to Slow Learners (August 1967)

Purpose: to instruct teachers in methods and materials to be used with slow learners

Length: 1 week

Size: 15 junior high and 4 senior high teachers

Paid: Yes

Leadership: Allen Bernstein, Wayne County Intermediate School District; Eugene Smith, Wayne State University; and Roger Rood, Livoni high school teacher

Extension of Workshop for Slow Learners (1967)

Purpose:	to provide extended training for larger group of teachers as begun in summer workshop
Length:	8 weekly after school sessions during fall 1967
Size:	24 teachers
Paid:	Yes
Leadership:	Henry Lundy and John Bingham, Livonia high school teachers; and Terrance Coburn, graduate student The University of Michigan

Slow Learner Workshop (August 1968)

Purpose:	to involve teachers not included in previous years workshop
Length:	1 week
Size:	9 junior and 4 senior high school teachers
Paid:	Yes
Leadership:	Charles Zoet, Secondary Mathematics Coordinator

Workshop on Activities in a Mathematics Laboratory (November 1971)

Purpose:	to introduce junior and senior high school teachers to materials and concepts which can be used in a mathematics laboratory
Length:	1 all-day session
Size:	30 junior and 4 senior high school teachers
Paid:	No
Leadership:	Donald Buckeye and John Ginther, Eastern Michigan University

Computer Workshop (1972)

Purpose:	to instruct teachers in changes in BASIC language and in equipment from previous year
Length:	2 days
Size:	8 high school teachers
Paid:	Yes
Leadership:	Lary Smith, Specialist in Computer Education

Computer Workshop (August 1975)

Purpose:	to instruct teachers in changes in BASIC language and in ewuipment from previous year
Length:	2 half-day sessions
Size:	approximately 30 teachers from mathematics and business education in groups of 5 or 6
Paid:	Yes
Leadership:	Lary Smith, Wayne County Intermediate School District

BIBLIOGRAPHY

BIBLIOGRAPHY

A. LIVONIA PUBLIC SCHOOLS' PROGRAM

1. Published Reports, Newsletters and Public Documents

Bentley High School. Bentley High School Course Descriptions and Curriculum Outlines. Livonia, Mich.: Livonia Public Schools, 5 May 1960.

_____. Catalog of Courses, rev. Livonia, Mich.: Livonia Public Schools, 1960.

_____. Course Descriptions and Curriculum Outlines for 1962-63. Livonia, Mich.: Livonia Public Schools, July 1962.

_____. Programs of Study 1962-63. Livonia, Mich.: Livonia Public Schools, 1962.

_____. Programs of Study 1964-65. Livonia, Mich.: Livonia Public Schools, 1964.

_____. Programs of Study 1971-72. Livonia, Mich.: Livonia Public Schools, 1971.

_____. Programs of Study 1973-74. Livonia, Mich.: Livonia Public Schools, 1973.

_____. Programs of Study 1974-75. Livonia, Mich.: Livonia Public Schools, 1974.

Bentley High School Guidance Department. Program of Study Guidelines. Livonia, Mich.: Bentley High School, 1964.

Bentley High School Guidance Staff. Bentley High School Programs of Study. Livonia, Mich.: Livonia Public Schools, n.d.

Bentley/Stevenson Region. Performance Goals for Mathematics K-8. Livonia, Mich.: Livonia Public Schools, August 1971.

Bishop, Leslee J. Curriculum Development: Steering Committee Reports, Pilot Projects, and Study Committees. Livonia, Mich.: Livonia Public Schools, 1964.

_____. High School Textbooks Adopted By the Board of Education as of July 1964. Livonia, Mich.: Livonia Public Schools, 1964.

_____. Standardized Testing and Curricular Research in the Livonia Secondary Schools. Livonia, Mich.: Livonia Public Schools, July 1964.

_____. Year-End Report 1961-62. Livonia, Mich.: Livonia Public Schools, 1962.

_____. Year-End Report 1962-63. Livonia, Mich.: Livonia Public Schools, 1963.

_____. Year-End Report 1963-64. Livonia, Mich.: Livonia Public Schools, 1964.

_____. Year-End Report 1964-65. Livonia, Mich.: Livonia Public Schools, 1965.

_____. Year-End Report: Curriculum Activities and Projects 1964-65. Livonia, Mich.: Livonia Public Schools, July 1965.

Committee on Secondary Mathematics. Final Report and Recommendations of the Committee on Secondary Mathematics. Livonia, Mich.: Livonia Public Schools, June 1962.

The Coordinator. Livonia, Mich.: Department of Elementary Education, Livonia Public Schools, 15 September 1964-21 February 1968.

Department of Elementary Education. Individualizing Mathematics-Working Paper Number 3. Livonia, Mich.: Livonia Public Schools, June 1970.

Department of Secondary Education. Performance Goals for Advanced Placement Mathematics. Livonia, Mich.: Livonia Public Schools, June 1969.

_____. Performance Goals for Algebra I. Livonia, Mich.: Livonia Public Schools, July 1970.

_____. Performance Goals for Algebra II. Livonia, Mich.: Livonia Public Schools, June 1969.

_____. Performance Goals for Plane Geometry. Livonia, Mich.: Livonia Public Schools, 1970.

_____. Performance Goals for Seventh and Eighth Grade Mathematics. Livonia, Mich.: Livonia Public Schools, 9 April 1969.

_____. Performance Goals for Trigonometry, Solid and Analytic Geometry. Livonia, Mich.: Livonia Public Schools, May 1969.

_____. Report and Recommendations of the Basic Mathematics Committee. Livonia, Mich.: Livonia Public Schools, April 1965.

Division of Instruction. General Curricular Structure and Course Outlines for the Junior High Schools. Livonia, Mich.: Livonia Public Schools, 12 July 1960.

Eastern Michigan University and Livonia Public Schools. A Summer Institute and Academic Year for Teachers of Mathematics-Grades 1-8. Livonia, Mich.: Livonia Public Schools, n.d.

Elementary Subcommittee of the Educational Committee, University of Michigan Study of Livonia Public Schools. Elementary Education in Livonia. Livonia, Mich.: Livonia Public Schools, 1 November 1969.

E.M.S. G-Whiz! No. 1-12. Livonia, Mich.: Livonia Public Schools, 9 January-24 April 1963.

Friedrichs, Donald E. Junior and Senior High School Textbooks Adopted by the Board of Education. Livonia, Mich.: Livonia Public Schools, July 1970.

_____. Junior and Senior High School Textbooks Adopted by the Board of Education as of July 1966. Livonia, Mich.: Livonia Public Schools, 1966.

_____. Junior and Senior High School Textbooks Adopted by the Board of Education as of July 1969. Livonia, Mich.: Livonia Public Schools, 1969.

_____. "A Year For Assessment." Secondary Spotlight. Vol. 4, no. 1. Livonia, Mich.: Department of Secondary Education, Livonia Public Schools, n.d.

Heusner, Henry C. Annual Report for the School Year 1962-63. Livonia, Mich.: Livonia Public Schools, June 1963.

_____. Annual Report for the School Year 1963-64. Livonia, Mich.: Livonia Public Schools, July 1964.

_____. Annual Report for the School Year 1964-65. Livonia, Mich.: Livonia Public Schools, June 1965.

_____. Annual Report for the School Year 1965-66. Livonia, Mich.: Livonia Public Schools, August 1966.

_____. Annual Report for the School Year 1966-67. Livonia, Mich.: Livonia Public Schools, August 1967.

_____. Annual Report for the School Year 1967-68. Livonia, Mich.: Livonia Public Schools, August 1968.

_____. "Announcement of Pre-school In-service Activities for all Teachers in the Area of Language Arts and Mathematics." The Coordinate. Livonia, Mich.: Livonia Public Schools, 12 August 1966.

_____. "Our Changing Concept of Improving Instruction." The Coordinate. Livonia, Mich.: Livonia Public Schools, 15 September 1964.

Instructional Materials Committee. Report of Guidelines for Instructional Materials Committee. Livonia, Mich.: F/C Region Livonia Public Schools, 11 March 1971.

Johnson, Paul E. Instruction and Its Supervision. Livonia, Mich.: Livonia Public Schools, September 1960.

_____. Recommendations to the Board of Education Regarding the Secondary Curriculum. Livonia, Mich.: Livonia Public Schools, 11 February 1960.

Junior High Subcommittee of the Educational Program Committee, University of Michigan Study of the Livonia Public Schools. Junior High Education in Livonia. Livonia, Mich.: Livonia Public Schools, 15 November 1969.

Kumbier, William K. Annual Report of the Mathematics-Science Coordinator--1965-66. Livonia, Mich.: Livonia Public Schools, July 1966.

_____. Annual Report of the Mathematics-Science Coordinator--1967-68. Livonia, Mich.: Livonia Public Schools, June 1968.

_____. MATSCI Notes. Livonia, Mich.: Livonia Public Schools, November 1964-June 1970.

Livonia Public Schools. Elementary Education in Livonia. Livonia, Mich.: Livonia Public Schools, June 1964.

_____. The Junior High School Curriculum. Livonia, Mich.: Livonia Public Schools, June 1965.

_____. Livonia Public Schools Minimal Objectives for Mathematics Grades 4-6. Livonia, Mich.: Livonia Public Schools, June 1974.

_____. Livonia Public Schools Minimal Objectives for Mathematics Grades 7-9. Livonia, Mich.: Livonia Public Schools, June 1974.

_____. Minutes of the Meetings of the Board of Education. Livonia, Mich., 1944-75.

_____. Notice of Vacancy: Elementary School Science/Mathematics Resource Teacher. Livonia, Mich.: Livonia Public Schools, 20 March 1964.

_____. Notice of Vacancy: Secondary School Coordinator of Mathematics and Science Instruction. Livonia, Mich.: Livonia Public Schools, 25 May 1964.

_____. School District Table of Organization. Livonia, Mich.: Livonia Public Schools, 1970.

_____. 7th and 8th Grade Mathematics Curriculum Guide. Livonia, Mich.: Livonia Public Schools, June 1966.

Mathematics News. Livonia, Mich.: Emerson Junior High School Mathematics Department, September 1969-June 1970.

Professional Agreement Between The Livonia Public Schools School District and the Livonia Education Association MEA-NEA: 1968-69. Livonia, Mich.: Livonia Public Schools, 1968.

Professional Agreement Between The Livonia Public Schools School District and the Livonia Education Association MEA-NEA: 1969-70. Livonia, Mich.: Livonia Public Schools, 1969.

Roberts, Bernice. Instructional Guidebook for Elementary Teachers. Livonia, Mich.: Livonia Public Schools, August 1961.

Secondary Mathematics Committee. Results of the Survey of Topics Included in 7th and 8th Grade Mathematics. Livonia, Mich.: Livonia Public Schools, January 1966.

Secondary Spotlight. Livonia, Mich.: Department of Secondary Education, Livonia Public Schools, February 1966-May 1969.

Senior High Subcommittee of the Educational Program Committee, University of Michigan Study of the Livonia Public Schools. Senior High Education in Livonia. Livonia, Mich.: Livonia Public Schools, 15 December 1969.

"Spotlight on Changing Attitudes Toward Learning." Secondary Spotlight. Livonia, Mich.: Department of Secondary Education, Livonia Public Schools, May 1969.

Zoet, Charles J. Secondary Math-Science Newsletter #1. Livonia, Mich.: Livonia Public Schools, October 1964.

_____. Year-End Report 1966-67. Livonia, Mich.: Livonia Public Schools, 15 June 1967.

_____. Year-End Report 1967-68. Livonia, Mich.: Livonia Public Schools, 26 June 1968.

2. Internal Notices, Reports, Letters, and Memoranda

Notices

Bishop, Leslee J. to Secondary Principals. "Joint Junior & Senior High School Principals Meeting Dec. 12, 1962." Notice No. DI-306. Livonia Public Schools, 18 January 1963.

Bishop, Leslee J. to Junior High School Principals. "Junior High School Principals' Meeting of April 11, 1962." Notice No. DI-226. Livonia Public Schools, 7 May 1962.

Bishop, Leslee J. to Secondary Principals. "Meeting of Junior High School Principals, Dec. 11, 1963." Notice No. DI-425. Livonia Public Schools, 16 January 1964.

Bishop, Leslee J. to Secondary Principals. "Meeting of Junior High School Principals, March 25, 1964." Notice No. DI-459. Livonia Public Schools, 7 April 1964.

Bishop, Leslee J. to Secondary Principals. "Meeting of Junior High Principals, May 8, 1963." Notice No. DI-371. Livonia Public Schools, 7 April 1964.

Bishop, Leslee J. to Secondary Principals. "Meeting of Secondary School Principals on April 12, 1961." Notice No. DI-148. Livonia Public Schools, 24 April 1961.

Bishop, Leslee J. to Secondary Principals. "Meeting of Senior High School Principals, February 14, 1964." Notice No. DI-440. Livonia Public Schools, 2 March 1964.

Bishop, Leslee J. to Secondary Principals. "Note on Meeting of Senior High School Principals, February 8, 1963." Notice No. DI-323. Livonia Public Schools, 13 March 1963.

Friedrichs, Donald E. to Secondary Principals. "Notes on Meeting of Junior High School Curriculum Steering Committee, Dec. 10, 1965." Notice No. DI-658. Livonia Public Schools, 21 December 1965.

Friedrichs, Donald E. to Secondary Principals. "Notes on Meeting of Senior High School Curriculum Steering Committee, October 15, 1968." Notice No. DI-1095. Livonia Public Schools, 13 November 1968.

Friedrichs, Donald E. to High School Principals. "Senior High School Curriculum Steering Committee Meeting-August 15, 1969." Notice No. DI-1164. Livonia Public Schools, 5 September 1969.

Garver, George E. and Johnson, Paul E. to the Administrative Staff. "Clarification of Roles Under the New Plan of Central Administration." Notice No. SO-5. Livonia Public Schools, 7 January 1975.

Heusner, Henry C. to Elementary Principals. "Elementary Principals Meeting of May 24, 1966." Notice No. DI-730. Livonia Public Schools, 1 June 1966.

Heusner, Henry C. to Elementary Principals. "Elementary Principals Meeting of May 28, 1968." Notice No. DI-1038. Livonia Public Schools, 19 June 1968.

Heusner, Henry C. to Elementary Principals. "Elementary Principals Meeting of October 28 1969." Notice No. DI-1201. Livonia Public Schools, 13 November 1969.

Heusner, Henry C. to Administrative Staff of Bentley/Stevenson Region. "Minutes of Elementary Principals Meeting Bentley/ Stevenson Region Monday June 26, 1972." Notice No. RBS-443. Livonia Public Schools, 19 July 1972.

Heusner, Henry C. to All Kindergarten Teachers and Elementary Principals. "Plans for In-service and Curriculum Development Activities for 1964-65." Notice No. DI-510. Livonia Public Schools, 28 September 1964.

Heusner, Henry C. and Kumbier, William K. to Elementary Principals. "Geometry in our Elementary Modern Mathematics Program." Notice No. DI-668. Livonia Public Schools, 18 January 1966.

Heusner, Henry C. and Kumbier, William K. to Elementary Principals and Teachers. "Progress Report-New Mathematics." Notice No. DI-639. Livonia Public Schools, 8 November 1965.

Johnson, Paul E. to All Staff Members Involved in Instructional Program Studies. "Clarification of Guidelines Related to Instructional Program Studies and Instructional Materials Selection." Notice No. SO-620. Livonia Public Schools, 15 May 1973.

Johnson, Paul E. to Administrative Staff. "Class for Slow Learning and Remedial Students." Notice No. DI-1245. Livonia Public Schools, 10 June 1970.

Johnson, Paul E. to All Members of the Administrative Staff. "Curriculum and Supervision Emphases for 1962-63." Notice No. DI-260. Livonia Public Schools, 21 September 1962.

Johnson, Paul E. to All Members, Administrative Staff. "Curriculum Studies and Instructional Improvement Programs for 1963-64." Notice No. DI-392. Livonia Public Schools, 26 September 1963.

Johnson, Paul E. to All Principals. "Enclosed 'Resume' of a Number of Major Curriculum Studies and Other Instructional Improvement Efforts in Process." Notice No. DI-121. Livonia Public Schools, 13 February 1961.

Johnson, Paul E. to All Members, Administrative Staff and Committee Chairmen. "Membership of Committees on Instruction for 1963-64." Notice No. DI-522. Livonia Public Schools, 16 October 1964.

Johnson, Paul E. to Junior High School Principals. "Modification of Procedure for Organizing for Mathematics and Science Instruction in Grade Eight." Notice No. DI-686. Livonia Public Schools, 24 February 1966.

Johnson, Paul E. to All Administrative Staff Members. "Needed Study of Standardized Testing Program Results and the Implications for Action." Notice No. SO-319. Livonia Public Schools, 6 December 1971.

Johnson, Paul E. to the Administrative Staff. "Proposed Reorganization of the Division of Instruction." Notice No. DI-576. Livonia Public Schools, 20 April 1965.

Johnson, Paul E. to Instructional Staff. "Statement Describing the Work of the Systemwide Steering Committee on Minimal Instructional Objectives Bulletin #2." Notice No. SO-815. Livonia Public Schools, 7 March 1974.

Nichols, Lawrence J. to High School Principals. "Notes from High School Principals' Meeting April 23, 1975." Notice No. SED-104. Livonia Public Schools, 29 April 1975.

Nichols, Lawrence J. and Friedrichs, Donald E. to Members Systemwide Steering Committee and Building Principals. "Proposed Process for Defining Minimal Instructional Objectives." Notice No. RBS/RFC-699. Livonia Public Schools, 18 October 1973.

Roberts, Bernice to All Elementary Principals. "Notes on Meeting of the Elementary Principals September 26, 1961." Notice No. DI-175. Livonia Public Schools, 3 October 1961.

Yates, Benton to Administrative Staff Members. "Use of 1440 Computer." Notice No. DI-971. Livonia Public Schools, 3 January 1968-

Zoet, Charles J. to K-8 Mathematics Teachers. "Priorities for K-8 Mathematics: Final Report of the Study Group (K-8)." Notice No. RFC-235. Livonia Public Schools, 29 June 1971.

Reports

Algebra-Advanced Algebra Study Committee to Secondary Mathematics Committee. "Final Report and Recommendations." Livonia, Mich., 26 April 1966.

Bentley High School Guidance Department. "Study of Teacher Recommendations for Placement of Ninth Graders in Proper Mathematics Subjects." Livonia, Mich., 12 April 1956.

Bentley High School Mathematics Department. "Mathematics Department Experiment in Independent Study." Livonia, Mich., 26 October 1966.

_____. "Report on Conference of Michigan Council of Teachers of Mathematics." Livonia, Mich., n.d.

_____. "Report on Conference of National Council of Teachers of Mathematics." Livonia, Mich., n.d.

_____. "Reports on Mathematics Department Innovations." Livonia, Mich., 7 March 1967.

Committee on Implications of Electronic Data Processing for Instruction. "Report Summary." Livonia, Mich., 5 December 1963.

Committee on Secondary Mathematics. "Initial Report." Livonia, Mich., 12 March 1962.

Edwards, Allan A. "E.M.U. Institute and Workshop Evaluation." Livonia, Mich., 12 September 1973.

_____. "Summary Report Taft IPI Evaluation 1972-73." Livonia, Mich., 27 September 1973.

Fedraw, Ronald; Herrmann, Allen; and Selke, Robert. "Technical Mathematics Workshop." Livonia, Mich., n.d.

Friedrichs, Donald E. "The Role of the Department Chairman in Livonia Secondary Schools." Livonia, Mich., n.d.

Goldberg, Albert L. "Report Summary-Electronic Data Processing for Instruction." Livonia, Mich., 5 December 1963.

Heusner, Henry C. "Committee on Mathematics." Livonia, Mich. 22 January 1969.

_____. "CTBS/CTMM Results for 1972--Generalizations." Livonia, Mich., 5 June 1972.

_____. "Mathematics Survey-By Grade Level." Livonia, Mich., 12 February 1965.

_____. "Regional Program Goal for Mathematics Curriculum Improvement." Livonia, Mich., 19 October 1972.

Heusner, Henry C. and Kumbier, William K. "Recommendations of the Elementary Mathematics Textbook Committee." Livonia, Mich., 24 May 1965.

Instructional Materials Committee for Students in Grades 7-9 Who Have Difficulty with Mathematics to Donald Friedrichs. "Final Recommendations." Livonia, Mich., 9 April 1973.

Johnson, Paul E. "Organizational Plan for Study, Appraisal, and Revision of the Instructional Program." Livonia, Mich., 18 August 1961.

Knipschild, Kenneth and Smith Lary R. "Performance Goals for Computer Uses in Mathematics." Livonia, Mich., 5 May 1969.

Kumbier, William K. "Proposed Regional Goals for Mathematics Curriculum Improvement." Livonia, Mich., 12 October 1971.

_____. "Summary--Elementary Mathematics Workshop." Livonia, Mich., September 1964.

"The Livonia Elementary Steering Committee." Livonia, Mich., n.d.

Livonia Public Schools. "The High School Department Chairmanship." Livonia, Mich., n.d.

_____. Minutes of Meetings of the Elementary Steering Committee. Meetings 1955-61.

Livonia System Wide Secondary Mathematics Committee. "Comments on the Role of Data-Processing in the Mathematics Curriculum." Livonia, Mich., n.d.

"Mathematics Committee Report." Livonia, Mich., June 1954.

Mathematics Curriculum Study Group. "Mathematics Curriculum Study." Livonia, Mich., n.d.

Moloney, Peter J. "Individualized Math Project Student Attitude Survey #4." Livonia, Mich., 29 February 1972.

"Proposed Experiment in 8th and 9th Grade Mathematics." Livonia, Mich., n.d.

"Recommendations from Study, Planning and Production Project." Livonia, Mich., n.d.

Reeves, James; Rothenberg, Dale; and Zawadzki, Merrilee. "Minimal Objectives for High School Geometry." Livonia, Mich., 25 June 1975.

"Results of Student Questionnaire on TEMAC Algebra." Livonia, Mich. n.d.

Roberts, Bernice. "Elementary Arithmetics Study for 1960-61." Livonia, Mich., 21 March 1961.

_____. "Plan for Making a Survey of Instruction in Arithmetic." Livonia, Mich., 29 September 1958.

_____. "Twenty Methods for Improving Problem Solving in Arithmetic." Livonia, Mich., 25 September 1958.

Secondary Mathematics Advisory Committee to Dr. Paul Johnson. "Concerns about the quality of the mathematics program." Livonia, Mich., n.d.

Secondary Mathematics Committee. "Report of the Secondary Mathematics Committee Meeting of March 15, 1966." Livonia, Mich., n.d.

_____. "Report of the Meeting of October 19, 1965." Livonia, Mich., n.d.

_____. "Report of the Secondary Mathematics Committee Meeting December 6, 1966." Livonia, Mich., n.d.

Selke, Robert. "Report of the Refresher Mathematics Committee." Livonia, Mich., n.d.

"Statistics on Bentley High School Advanced Placement Students." Livonia, Mich., n.d.

"Summary of In-service Center Activities." Livonia, Mich., n.d.

"Summer Workshops for In-Service Education and Curriculum Materials Production: Summer 1961." Livonia, Mich., 29 March 1961.

Vance, Gary L. "An Experimental Approach to Teaching a Mathematics Concept in Trigonometry." Livonia, Mich., n.d.

Zoet, Charles J. "Mathematics and Science Committees 1970-71 Assignments and Meeting Dates." Livonia, Mich., 19 September 1970.

_____. "Mathematics Goals for Livonia Public Schools." Livonia, Mich., 14 March 1973.

Letters and Memoranda

Amerman, David D. Letter to parents. Livonia, Mich., 13 May 1963.

Bentley High School Mathematics Department to Dr. Friedrichs. "Experimental Program in Trigonometry." Livonia, Mich., n.d.

Bentley High School Mathematics Department to Dr. Friedrichs. "Use of Programmed Learning in the Mathematics Department." Livonia, Mich., n.d.

Bentley High School Mathematics Department to Dr. Friedrichs. "Use of Programmed Materials." Livonia, Mich., n.d.

Bingham, John D. to Veryl Schult. "Quarterly Report, January 1, 1967, on Project No. 6-8510; Contract No. OEC-3-7-068510-0185." Livonia, Mich.

Bishop, Leslee J. to Charles Zoet and Allan Edwards. "SMSG Evaluation." Livonia, Mich., 3 October 1961.

Carey, James A. to Dr. Paul Johnson. "Final Recommendations of the 9th Grade Mathematics Textbook Committee." Livonia, Mich., 22 May 1963.

Carey, James A. and Calder, George A. to Mathematics Workshop Participants, Dr. Bishop, Dr. Johnson. "Evaluation of Workshop." Livonia, Mich., September 1962.

Casebere, James to Dr. Paul Johnson. "Agenda Items, Jr. High Principals Meeting." Livonia, Mich., 22 June 1965.

Chairman of the System-wide Secondary Committee on Mathematics to Dr. Leslee Bishop. "Recommendation for Non-Academic Mathematics Program." Livonia, Mich., 28 January 1963.

Edwards, Allan A. to Junior High Mathematics Department Chairmen. "Agreements reached at Meeting of 10/29/71." Livonia, Mich., 9 November 1971.

Edwards, Allan A. to Dr. Leslee Bishop. "Math Consultant from Mich. Bureau of School Services." Livonia, Mich., n.d.

Edwards, Allan A. and Zoet, Charles J. to Secondary Mathematics Advisory Committee. "Report of the Secondary Mathematics Advisory Committee Meeting-March 4, 1969." Livonia, Mich., 17 March 1969.

Friedrichs, Donald E. to Assistant Principals, Counselors and Teachers of Accelerated and Advanced Placement Classes. "Honor Points." Livonia, Mich., 8 February 1962.

Friedrichs, Donald E. to Ray Olson, et al. "Plans for the Equipping and Staffing of the Math-Science Study Center." Livonia, Mich., 21 February 1961.

Friedrichs, Donald E. to Dr. Bishop. "Proposed Changes in Mathematics and Business Department's Course Offerings." Livonia, Mich., 7 November 1963.

Harris, Donald; Brauer, William; and Otto, James to Donald Friedrichs. "Kennedy Math Program in Franklin-Churchill Region." Livonia, Mich., 30 September 1971.

Hartsig, Thomas to Jack Comstock and Charles Zoet. "An experiment in independent study in the learning of trigonometry." Livonia, Mich., n.d.

Hartsig, Thomas to Dr. Paul Johnson. "A Proposal for a Pilot Course in Technical Mathematics." Livonia, Mich., n.d.

Hartsig, Thomas to Dr. Leslee Bishop. "Text Book Adoption." Livonia, Mich., 2 May 1963.

Heusner, Henry C. to Donald Friedrichs. "Extension of the Kennedy/Madison Individualized Mathematics Project to Several Other Schools in September of 1970." Livonia, Mich., 22 April 1970.

Heusner, Henry C. to Donald Harris. "Extension of Kennedy/Madison Math Project to Jefferson School." Livonia, Mich., 23 April 1970.

Heusner, Henry C. to Gene Ehrstin, Ed LaDuke, Jim Otto. "Individualized Mathematics Program Being Developed at Kennedy School." Livonia, Mich., 12 March 1969.

Heusner, Henry C. to Charles Zoet and William Kumbier. "Need to develop a K-12 articulated mathematics program that stresses diagnostic personalized instruction." Livonia, Mich., 5 August 1970.

Heusner, Henry C. to Elementary Principals. "New 1963 revisions of the Winston Arithmetic(consumable)for grades one and two." Livonia, Mich., 29 March 1963.

Heusner, Henry C. to Paul Johnson. "progress Report and Recommendations." Livonia, Mich., 16 February 1965.

Heusner, Henry C. to Dr. Bateman. "Report of Initial Meeting of the Elementary Modern Mathematics Study Committee." Livonia, Mich., 3 October 1962.

Heusner, Henry C. to Anthony Aquino, James Carey, Buddy McCalla and Eldon Price. "Summary of Planning Meeting for Math 'Short' Course." Livonia, Mich., 11 October 1963.

Heusner, Henry C. to Joseph Payne. Letter. Livonia, Mich., 25 October 1962.

Johnson, Paul E. to Administrative Staff. "Allotment of Funds to Schools and Departments for Conference and Travel Expense Outside the School District." Livonia, Mich., 30 November 1962.

Johnson, Paul E. to Members, Elementary Principals' Advisory Committee. "Meeting of Advisory Committee on December 11, 1959." Livonia, Mich., 30 December 1959.

Johnson, Paul E. to Joint Advisory Committee on Professional Agreement Administration. "Memorandum from Secondary Math Advisory Committee re: Released Time for Mathematics Chairmen and Advanced Placement." Livonia, Mich., 24 January 1969.

Johnson, Paul E. to The Superintendent and Board of Education. "proposed Action in Relation to Mathematics-Science Instruction in the Junior High Schools." Livonia, Mich., 22 May 1967.

Junior High School Curriculum Steering Committee to Secondary Mathematics Committee. "Recommendations on 'Junior High School Department Chairman Position' March 17, 1966." Livonia, Mich., 3 June 1966.

Junior High School Instructional Materials Committee, Grades 7-8 to Paul E. Johnson. "Final Report of Instructional Materials Recommendations for Mathematics in Grades Seven and Eight." Livonia, Mich., 15 May 1975.

Junior High School Mathematics Leadership Committee to Secondary Mathematics Committee. "Report and Recommendations." Livonia, Mich., 2 March 1965.

Kumbier, William K. to Henry Heusner. "Additional Work on Riley (7th) and Holmes (9th) Math Programs." Livonia, Mich., 23 June 1971.

Kumbier, William K. to Bentley/Area Math/Science Curriculum Representatives, Department Chairmen, Principals. "CHARGE to Bentley CUMC Group." Livonia, Mich., 9 February 1971.

Kumbier, William K. to Elementary Principals, Dr. Johnson, Dr. Heusner, Mr. Zoet. "Current Programs in Mathematics-Livonia Elementary Schools." Livonia, Mich., 24 November 1964.

Kumbier, William K. to Dr. Heusner, Principals of the Bentley Area. "Establishing Committees for Promoting K-12 Articulation in Science and Mathematics." Livonia, Mich., 14 December 1970.

Kumbier, William K. to Elementary Teachers, Math/Science Representatives, and Principals. "Homework for Fifth-Sixth Grade Mathematics." Livonia, Mich., 4 September 1969.

Kumbier, William K. to Henry Heusner. "Individualized Mathematics--Taylor School." Livonia, Mich., 19 May 1972.

Kumbier, William K. to Henry Heusner. "Iowa Test Math Scores." Livonia, Mich., 4 January 1968.

Kumbier, William K. to Elementary and Secondary Principals, Math. Curriculum Rep's, Department Chairmen. "Mathematics 'Cluster Teams' for school year 1972-73." Livonia, Mich., 15 August 1972.

Kumbier, William K. to George Hoekstra. "Mathematics Textbooks--Grades 1 and 2." Livonia, Mich., 3 June 1968.

Kumbier, William K. to Elementary Math/Science Representatives, Elementary Principals, Dr. Heusner. "Math Workshop Summary." Livonia, Mich., 27 April 1970.

Kumbier, William K. to Mathematics and Counseling Staffs of Riley Junior High, Bentley High School, Mr. Ray, Mr. Laundroche. "Placement of Riley 9th Graders in Bentley Mathematics Classes." Livonia, Mich., 19 November 1971.

Kumbier, William K. to Dean Waldfogel. "Review of Problems Associated with I.M. Project." Livonia, Mich., 1 December 1970.

Kumbier, William K. to Elementary Principals-Cass, Madison, Garfield, Rosedale, McKinley and Tyler. "Selected Mathematics Testing-Grade Six." Livonia, Mich., March 1968.

Kumbier, William K. to Henry Heusner, "Summary of NSF-EMU-LPS Mathematics Activity--June 1972-February 1973." Livonia, Mich., 26 February 1973.

Kumbier, William K. to Regional Math Study Committee, Principals, Math Department Chairmen, Elementary Math/Science Curriculum Representatives, "Summary of the Regional Mathematics Study Committee Meeting, May 23, 1973." Livonia, Mich., 1 June 1973.

Kumbier, William K. to Charles Zoet. "Transition from 6th-7th Grade (Mathematics)." Livonia, Mich., 28 April 1966.

Kumbier, William K. and Zoet, Charles J. to Dr. Donald Friedrichs and Larry Nichols. "Recommendations Related to the Position of Computer Education Specialist." Livonia, Mich., 21 June 1973.

Livonia High School Mathematics Chairmen to Donald Friedrichs and Glenn F. McAdam. "Determining Areas of Agreement on Mathematics Concepts Presently Taught in Mathematics Courses in the Livonia Public High Schools and the Statement of Behavioral Objectives for These Concepts." Livonia, Mich., 13 January 1969.

McMurtrey, William; Price, Eldon; and Zoet, Charles J. to Dr. Paul Johnson and Dr. Donald Friedrichs. "Preliminary Report of the 8th Grade Algebra Experiment at Whitman Junior High School." Livonia, Mich., 11 October 1966.

Mathematic Workshop Committee to Secondary Principals. "Livonia Mathematics Workshop, Summer 1961, July 31-September 1." Livonia, Mich., 7 March 1961.

Mauller, Barbara; Rice, James; Tomlinson, James; and McDonald, John A. to Dr. Paul Johnson and Dr. Donald Friedrichs. "Preliminary Report of the Holmes Algebra Learning Units Project." Livonia, Mich., 17 June 1969.

Mauller, Barbara; Rice, James; Tomlinson, James; and McDonald, John A. "Proposal for Experiment in Teaching Algebra." Livonia, Mich., 22 April 1968.

Moloney, Peter to Ken Haug, Herb Van Hooser, Larry Sroka. "Attitude Survey Results." Livonia, Mich., 12 June 1969.

Moloney, Peter to Kennedy-Madison Mathematics Principals. "Individualized Math Project (Kennedy-Madison Test Results." Livonia, Mich., 29 April 1974.

Nichols, Lawrence J. to Dr. Henry Heusner. "Mathematics Project-Riley Junior High School." Livonia, Mich., 30 April 1970.

Pascaris, Peter A. and Ingram, Marjorie J. to Henry Heusner. "Progress Report on Summer Workshop for Teaming in Basic Math and Basic Algebra." Livonia, Mich., 9 November 1970.

Ploutz, Paul F. and Zoet, Charles J. "The Transition to Modern Mathematics, Grades 7-12." Livonia, Mich., n.d.

Pobanz, Thomas and Sobania, Adele to Dr. Donald Friedrichs. "Summer and Fall Workshop for Year 1969-70." Livonia, Mich., n.d.

Rice, James and Tomlinson, James to John A. McDonald. "Summary of Workshop on Learning Units Program of Continuous Progress at Holmes Junior High School, 1969-70." Livonia, Mich., 22 June 1970.

Secondary Mathematics Committee to Junior High School Principals. "Recommendation for December Curriculum Day." Livonia, Mich., 10 November 1965.

Secondary Mathematics Committee to Junior High School Mathematics Teachers. "Survey of Topics Included in 7th and 8th Grade Mathematics." Livonia, Mich., 29 November 1965.

Smith, Lary R. to Computer Math Teachers. "Meeting to Organize Workshop." Livonia, Mich., 23 March 1973.

Strong, Roger to Albert Zack. "The Advanced Placement Mathematics Program." Livonia, Mich., 20 February 1970.

Strong, Roger to Jack Comstock. "Technical Math Proposal." Livonia, Mich., 20 November 1967.

Talley, Harry to Mathematics Steering Committee, Dr. Bishop and Members of the Committee. "Report on work of the Seventh and Eighth Grade Mathematics Committee." Livonia, Mich., n.d.

Warren, William to Dr. Paul Johnson and Junior High School Principals. "Eighth Grade Mathematics and Science Teachers." Livonia, Mich., 18 March 1965.

Whisler, Norman L. to All Elementary Teachers. "Local School Representative in Curriculum." Livonia, Mich., 7 May 1968.

Zack, Albert to Dr. Donald Friedrichs. "Experimental Class-Basic Algebra." Livonia, Mich., 5 December 1968.

Zoet, Charles J. to Teachers of Advanced Placement Mathematics and Algebra I. "Advanced Placement Mathematics 1968-69." Livonia, Mich., 20 September 1968.

Zoet, Charles J. to Junior High Principals. "Analysis of the Cooperative Algebra Test Results." Livonia, Mich., 8 March 1966.

Zoet, Charles J. to Junior High School Principals and Mathematics Teachers. "An Analysis of the Scores Made by Our 8th Grade Students on the Bobbs-Merrill Arithmetic Achievement Test." Livonia, Mich., 15 September 1965.

Zoet, Charles J. to Junior High School Principals and Mathematics-Science Chairment. "Attached List of Seventh and Eighth Grade Objectives." Livonia, Mich., 11 April 1969.

Zoet, Charles J. to Algebra, Geometry and Advanced Algebra Teachers. "Continuity of Instruction in Algebra and Advanced Algebra." Livonia, Mich., 8 September 1965.

Zoet, Charles J. to Dr. Johnson. "Description of a Course Entitled: Computer Uses in Mathematics." Livonia, Mich., 20 January 1966.

Zoet, Charles J. to Mr. Yates, Drs. Johnson and Bishop. "E101 Computer." Livonia, Mich., 19 May 1965.

Zoet, Charles J. to SENCOM. "E-103 Computers and Computer Uses in Mathematics." Livonia, Mich., 18 March 1968.

Zoet, Charles J. to Junior High School 7th Grade Mathematics Teachers. "Elementary School Mathematics Program." Livonia, Mich., 24 September 1968.

Zoet, Charles J. to Dr. Friedrichs. "End of the Year Report-Mathematics/Science June 1971." Livonia, Mich., June 1971.

Zoet, Charles J. to SENCOM. "Instructional Materials Committee for Applied Math III." Livonia, Mich., 15 May 1967.

Zoet, Charles J. to Junior High School Principals, Mathematics Teachers and Librarians, "Mathematics Library Facilities for Junior High Schools." Livonia, Mich., 8 February 1965.

Zoet, Charles J. to Members of the Secondary Mathematics Committee. "Meeting with Junior High Principals." Livonia, Mich., 15 November 1962.

Zoet, Charles J. to Committee members, Secondary Principals, Dr. Johnson, and Dr. Bishop. "Minutes of Secondary Mathematics Steering Committee Meeting, November 24, 1964." Livonia, Mich., 27 November 1964.

Zoet, Charles J. to High School Mathematics Committee. "Minutes of the Advisory Committee on High School Mathematics Meeting Held at Churchill High School on November 9, 1970." Livonia, Mich., 3 December 1970.

Zoet, Charles J. to High School Mathematics Advisory Committee. "Minutes of the Subcommittee on High School Mathematics Program Changes Related to the Two-year Algebra Program at the Junior High School." Livonia, Mich., 8 December 1969.

Zoet, Charles J. to Dr. Leslee Bishop. "Modernization of the Livonia Public School Math Program." Livonia, Mich., 17 November 1960.

Zoet, Charles J. to High School Mathematics Chairmen: Algebra Teachers. "Preliminary Report of 'Pretest for Algebra II' Test Results." Livonia, Mich., 30 March 1971.

Zoet, Charles J. to JUNCOM. "Progress Report Junior High School Mathematics." Livonia, Mich., 5 April 1968.

Zoet, Charles J. to Esther Heusner. "Projected Needs for Pilots - Use of Materials in Basic Algebra and Geometry - September 1975." Livonia, Mich., 14 May 1975.

Zoet, Charles J. to Dr. Donald Friedrichs. "A Proposal for Educational Uses of the IBM 1440." Livonia, Mich., 20 December 1966.

Zoet, Charles J. to Junior High Surriculum Steering Committee. "A Proposal to Discuss the Use of Block-Time in 7th and 8th Grade Mathematics and Science." Livonia, Mich., 8 December 1965.

Zoet, Charles J. to Dr. Johnson, Dr. Friedrichs, Secondary Principals. "Reflections on a Report of the Whitman Algebra Experiment to Secondary Principals," Livonia, Mich., 8 November 1966.

Zoet, Charles J. to High School Principals and Mathematics Department Chairmen. "Refresher Mathematics." Livonia, Mich., 11 March 1970.

Zoet, Charles J. "Report of the High School Planning Committee on Mathematical Facilities." Livonia, Mich., 18 October 1965.

Zoet, Charles J. to Seventh Grade Mathematics Teachers. "Seventh Grade Mathematics Program." Livonia, Mich., 8 September 1970.

Zoet, Charles J. to SENCOM. "Suggested Charge to the Senior High School Mathematics Advisory Committee." Livonia, Mich., 9 September 1969.

Zoet, Charles J. to Franklin K-12 Mathematics Committee. "Summaries of Diagnostic Testing Related to the Learning of Fractions in Grades 6, 7 and 8." Livonia, Mich., 1 December 1970.

Zoet, Charles J. to Junior High School Mathematics Advisory Committee. "Teams to Prepare Performance Goals for Algebra and Basic Algebra I & II." Livonia, Mich., 5 March 1970.

Zoet, Charles J. to Dr. Johnson, Dr. Bishop, High School Principals and Personnel Concerned with the Use of the E-101 Computer. "Utilization of the E-101 Computer and Related Problems." Livonia, Mich., 22 September 1964.

Zoet, Charles J. to Dr. Paul Johnson. "Whitman Eighth Grade Algebra-Final Report." Livonia, Mich., 7 November 1969.

Zoet, Charles J. and Kumbier, William K. to Participants of Mathematics Workshop. "Details of Mathematics Workshop-Summer 1971." Livonia, Mich., 1 July 1971.

3. Secondary Sources

Bentley High School Alumni Association. The First 25 Years: 1947-1972. Livonia Mich.: the Association, 1972.

Bentley High School Mathematics Staff. "Advanced College Placement Class Added to Mathematics Curriculum at Bentley High School, Livonia." Action 12(January 1959): 6-7.

Bishop, Leslee J. Livonia Michigan. Livonia, Mich.: Livonia Public Schools, 1964.

Darling, Richard L. "Livonia USA (excerpts)." Livonia, Mich., October 1959.

Livonia News. 24 March 1955

Livonia Planning Commission. Statistical Data. Livonia, Mich.: the Planning Commission, 1971.

The Livonian. 19 December 1952; 20 February 1953; 30 October 1953; and 12 August 1955.

The Livonian Observer. 21, 28 April; 5 May 1965.

Paris, Dominic P. Footpaths to Freeways: The Story of Livonia. Livonia, Mich.: n.p., 1975.

Servetter, Leonard. Our City Livonia, Michigan. Livonia, Mich.: Livonia Public Schools, n.d.

Zoet, Charles J. "Computer Education in Livonia." Mathematics in Michigan 8(October 1964): 8.

Zoet, Charles J. "Computer Orientation in Livonia High Schools." Mathematics in Michigan 11(January 1966): 5-8.

B. NATIONAL PROGRAMS

1. Reports of National Significance

College Entrance Examination Board. 1968-70 Advanced Placement Course Descriptions. New York: the Board, 1968.

_____. Advanced Placement Program Descriptions. New York: the Board, 1960.

_____. Annual Advanced Placement Program Participation. New York: the Board, 1975.

_____. A Guide to the Advanced Placement Program 1961-62. New York: the Board, 1961.

Commission on Mathematics. Appendices to the Report of the Commission on Mathematics. New York: College Entrance Examination Board, 1959.

_____. Program for College Preparatory Mathematics: Report of the Commission on Mathematics. New York: College Entrance Examination Board, 1959.

Commission on Post-War Plans of the National Council of Teachers of Mathematics. "First Report of the Commission on Post-War Plans." The Mathematics Teacher 37(May 1944): 225-32.

_____. "Guidance Report of the Commission on Post-War Plans." The Mathematics Teacher 40(July 1947): 315-39.

_____. "Second Report of the Commission on Post-War Plans." The Mathematics Teacher 38(May 1945): 195-221).

Commission on Reorganization of Secondary Education. Cardinal Principles of Secondary Education. Washington, D.C.: Government Printing Office, 1918.

Commission on the Secondary School Curriculum of the Progressive Education Association. Mathematics in General Education. New York: Appleton-Century Co., 1940.

Developing Life Adjustment Education in a Local School. Circular no. 253. Washington, D.C.: Office of Education, February 1949.

Goals for School Mathematics-The Report of the Cambridge Conference on School Mathematics. Boston: Houghton-Mifflin Co., 1963.

"The Imperative Needs of Youth of Secondary School Age." Bulletin of the National Association of Secondary School Principals 31 (March 1947).

The Joint Commission of the Mathematical Association of America and the National Council of Teachers of Mathematics. The Place of Mathematics in Secondary Education Fifteenth Yearbook of the National Council of Teachers of Mathematics. New York: Bureau of Publication, Teachers College, Columbia University, 1940.

National Advisory Committee on Mathematical Education. Overview and Analysis of School Mathematics Grades K-12. Washington, D.C.: Conference Board of the Mathematical Sciences, 1975.

The National Committee on Mathematical Requirements. The Reorganization of Mathematics in Secondary Education. Buffalo, N.Y.: The Mathematical Association of America, 1923.

The National Commission on The Reform of Secondary Education. The Reform of Secondary Education. New York: McGraw-Hill Book Co., 1973.

School Mathematics Study Group. Newsletter No. 1. Yale University: March 1959.

2. Books and Pamphlets

Alexander, William M.; Saylor, J. Galen; and Williams, Emmett L. The High School Today and Tomorrow. New York: Holt, Rinehart and Winston, 1973.

Bruner, Jerome S. The Process of Education. Cambridge: Harvard University Press, 1960.

Conant, James B. The American High School Today. New York: McGraw-Hill Book Co., 1959.

Council of Chief State School Officers. Education in the States: Nationwide Development Since 1900. Washington, D.C.: National Education Association, 1969.

Darnowski, Vincent S. Computers--Theory and Uses. Washington, D.C.: National Science Teachers Association, 1964.

Douglass, Harl R. Secondary Education in the United States. New York: The Ronald Press Co., 1964.

Edwards, Newton, and Richey, Herman G. The School in the American Social Order. 2nd ed. Boston: Houghton Mifflin Co., 1963.

Goodlad, John I.; Stoephasius, Renata V.; and Klein, M. Frances. The Changing School Curriculum. New York: The Fund for the Advancement of Education, 1966.

Inlow, Gail M. The Emergent in Curriculum. New York: John Wiley and Sons, 1968.

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

Krug, Edward A. Salient Dates in American Education: 1635-1964. New York: Harper & Row, Publishers, 1966.

Lawson, Douglas E. Curriculum Development in City School Systems. Chicago, Ill.: University of Chicago Press, 1940.

Mager, Robert F. Preparing Instructional Objectives. Palo Alto, Cal.: Fearon Publishers, 1962.

Michigan State Committee of North Central Association. Requirements for Graduation in Michigan North Central Secondary Schools. Ann Arbor, Mich.: Bureau of School Services, University of Michigan, November 1951.

Miles, Matthew B., ed. Innovation in Education. New York: Bureau of Publications, Teachers College, Columbia University, 1964.

National Council of Teachers of Mathematics. Administrative Responsibility for Improving Mathematics Programs. Washington, D.C.: the Council, 1965.

_____. Computer Oriented Mathematics. Washington, D.C.: the Council, 1963.

_____. The Growth of Mathematical Ideas: Grades K-12. Twenty-fourth Yearbook. Washington, D.C.: the Council, 1959.

_____. A History of Mathematics Education. Thirty-second Yearbook. Washington, D.C.: the Council, 1970.

_____. Insights into Modern Mathematics. Twenty-third Yearbook. Washington, D.C.: the Council, 1957.

National Education Association of the United States Project on the Instructional Program of the Public Schools. Deciding What to Teach. Washington, D.C.: National Education Association, 1963.

_____. Education for a Changing Society. Washington, D.C.: National Education Association, 1963.

_____. Planning and Organizing for Teaching. Washington, D.C.: National Education Association, 1963.

Owens, Robert G. Organizational Behavior in Schools. Englewood Cliffs, N.J.: Prentice-Hall, 1970.

Rogers, Everett M. Communication of Innovations. New York: Free Press, 1971.

Saylor, J. Galen, and Alexander, William M. Curriculum Planning for Modern Schools. New York: Rinehart and Winston, 1966.

Trump, J. Lloyd, and Baynham, Dorsey. Focus on Change. Skokie, Ill.: Rand McNally & Co., 1961.

United States Office of Education. Analysis of Research in the Teaching of Mathematics. Edited by Kenneth E. Brown and Theodore L. Abell. Washington, D.C.: U. S. Government Printing Office, 1965.

3. Articles and Unpublished Works

Atwood, M. S. "Small-scale Administrative Change: Resistance to the Introduction of a High School Guidance Program." In Innovation in Education. pp. 49-78. Edited by Matthew B. Miles. New York: Bureau of Publications, Teachers College, Columbia University, 1964.

Ausubel, David P. "Some Psychological and Educational Limitations of Learning by Discovery." The Arithmetic Teacher 11 (May 1964): 290-302.

Barto, Joseph Allan. "The Mathematics Program in Selected Junior High Schools, 1958-1965." Dissertation Abstracts 27 (April 1967): 3244.

Bell, Max S. "What Does 'Everyman' Really Need from School Mathematics." The Mathematics Teacher 67 (March 1974): 196-202.

Brink, William G. "Secondary Education--Programs." In Encyclopedia of Educational Research. 3rd ed. pp. 410-13. Edited by Robert L. Ebel. New York: Macmillan Co., 1960.

Brumfiel, Charles F.; Eicholz, Robert E.; and Shanks, Merrill E. "The Ball State Experimental Program." The Mathematics Teacher 53 (February 1960): 75-84.

Bruns, Richard F., and Frazier, Alexander. "Sequence and Range of High School Mathematics." The Mathematics Teacher. 50 (December 1957): 562-66.

Buchman, Aaron L. "A High School Digital Computer Program." The Mathematics Teacher 51 (March 1958): 176-80.

Carlson, Richard O. "Barriers to Change in Public Schools." In Change Process in the Public Schools, pp. 1-8. Eugene, Ore.: University of Oregon Press, 1965.

_____. "School Superintendents and Adoption of Modern Math: a Social Structure Profile." In Innovation in Education, pp. 329-42. Edited by Matthew B. Miles. New York: Bureau of Publications, Teachers College, Columbia University, 1964.

Cass, James M. "Changes In American Education in the Next Decade: Some Predictions." In Innovation in Education, pp. 615-30. Edited by Matthew B. Miles. New York: Bureau of Publications, Teachers College, Columbia University, 1964.

Dessar, Donald J., and Frandsen, Henry. "Research on Teaching Secondary School Mathematics." In Second Handbook of Research: A Project of the American Educational Research Association, pp. 1007-30. Edited by Robert M. W. Travers. Chicago: Rand McNally & Co., 1973.

Finkbeiner, Daniel T.; Neff, John D.; and Williams, S. Irene. "The 1969 Advanced Placement Examination in Mathematics--Complete and 'Unexpurgated'." The Mathematics Teacher 63 (October 1971): 499-501.

Fitzgerald, William M., and Vance, Irvin E. "Other Media and Systems." In The Teaching of Secondary School Mathematics Thirty-third Yearbook of the National Council of Teachers of Mathematics. Washington D.C.: the Council, 1970.

Foshay, Arthur W., and Beilin, Lois A. "Curriculum." In Encyclopedia of Education Research, 4th ed., pp. 275-80. Edited by Robert L. Ebel. New York: Macmillan Co., 1969.

Gibb, E. Glenadine; Mayor, John R.; and Treuenfels, Edith. "Mathematics." In Encyclopedia of Educational Research, 3rd ed., pp. 796-807. Edited by Robert L. Ebel. New York: Macmillan Co., 1960.

Greenberg, Herbert J. "The Objectives of Mathematics Education." The Mathematics Teacher 67 (November 1974): 639-43.

Griffiths, Daniel E. "Administrative Theory and Change in Organizations." In Innovation in Education, pp. 425-36. Edited by Matthew B. Miles. New York: Bureau of Publications, Teachers College, Columbia University, 1964.

Hale, William T. "UICSM's Decade of Experimentation." The Mathematics Teacher 54 (December 1961): 613-19.

Hodgin, Katharine Wyatt. "A Study of Aspects of Curriculum Change in Mathematics as Perceived by Selected Mathematics Teachers in Alabama Secondary Schools." Dissertation Abstracts 27 (March 1967): 2733.

Jones, Philip S., and Coxford, Arthur F. Jr. "Mathematics in the Evolving Schools." In A History of Mathematics Education in the United States and Canada, Thirty-second Yearbook of the National Council of Teachers of Mathematics, pp. 11-90. Washington, D.C.: the Council, 1970.

Keedy, Mervin L. "Mathematics in Junior High School." Educational Leadership 17 (December 1959): 157-61.

Maclane, Saunders. "The Impact of Modern Mathematics." The Bulletin of the National Association of Secondary School Principals 38 (May 1954): 66-70.

McCoy, M. Eleanor. "A Secondary School Mathematics Program." The Bulletin of the National Association of Secondary School Principals 43 (May 1959): 12-18.

Miles, Matthew B. "Innovation in Education: Some Generalizations." In Innovation in Education, pp. 631-62. Edited by Matthew B. Miles. New York: Bureau of Publications, Teachers College, Columbia University, 1964.

_____. "Planned Change and Organizational Health." In Change Process in the Public Schools, pp. 9-27. Eugene, Ore.: University of Oregon Press, 1965.

Nichols, Eugene D. "The Many Forms of Revolution." In The Continuing Revolution in Mathematics, pp. 16-37. Washington, D.C.: National Council of Teachers of Mathematics, 1968.

Osborne, Alan R., and Crosswhite, F. Joe. "Forces and Issues Related to Curriculum and Instruction, 7-12." In A History of Mathematics Education in the United States and Canada Thirty-second Yearbook of the National Council of Teachers of Mathematics, pp. 155-300. Washington, D.C.: the Council, 1970.

Pierson, Elliot. "Junior High Mathematics and the Computer." The Mathematics Teacher 56 (May 1963): 298-301.

Pieters, Richard S., and Vance, Elbridge P. "The Advanced Placement Program in Mathematics." The Mathematics Teacher 54 (April 1961): 201-8.

Price, G. Baley. "Progress in Mathematics and Its Implications for the Schools." In The Revolution in School Mathematics, pp. 1-14. Washington, D.C.: The National Council of Teachers of Mathematics, 1961.

Recker, Frank W. "Status and Trends in Mathematics in Ohio Secondary Schools." Dissertation Abstracts 27 (August 1967): 333.

Rees, Mina. "Impact of the Computer." The Mathematics Teacher 51 (March 1958): 162-58.

Rogers, Everett M. "What Are Innovators Like?" In Change Process in the Public Schools, pp. 55-64. Eugene, Ore.: University of Oregon Press, 1965.

Schaefer, Mary Geralda, Sister. "Revision of Secondary Mathematics in a Selected Number of Schools." The Mathematics Teacher 61 (February 1968): 157-61.

Sowards, G. Wesley. "Elementary Education." In Encyclopedia of Educational Research, 4th ed., pp. 420-35. Edited by Robert L. Ebel. New York: Macmillan Co. 1969.

Stubblefield, Betty I. "The Development of the Mathematics Curriculum in the Chicago Public High Schools from 1856 to 1962." Ed.D. dissertation, Northwestern University, 1964.

Van Tassel, Lowell T. "Digital Computer Programming in High School Classes." The Mathematics Teacher 54 (April 1961): 217-19.

Willoughby, Stephen S. "Mathematics." In Encyclopedia of Educational Research, 4th ed., pp. 766-77. Edited by Robert L. Ebel. New York: Macmillan Co., 1969.

C. TEXTBOOKS AND INSTRUCTIONAL MATERIALS

1. Algebra

Banks, J. Houston; Sobel, Max A.; and Walsh, William. Algebra: Its Elements and Structure Book I. New York: Webster Division, McGraw-Hill Book Co., 1965.

Brumfiel, Charles F.; Eicholz, Robert E.; and Shanks, Merrill E. Algebra I. Reading, Mass.: Addison-Wesley Publishing Co., 1962.

Brumfiel, Charles F.; Eicholz, Robert E.; and Shanks, Merrill E. Algebra II. Reading, Mass.: Addison-Wesley Publishing Co., 1962.

Dolciani, Mary P.; Berman, Simon L.; and Wooton, William. Modern Algebra and Trigonometry: Structure and Method Book Two. Boston: Houghton Mifflin Co., 1965.

Dolciani, Mary P.; Berman, Simon L.; and Wooton, William. Modern Algebra and Trigonometry: Structure and Method Book Two. rev ed. Boston: Houghton Mifflin Co., 1973.

Dolciani, Mary P., and Wooton, William. Modern Algebra Structure and Method: Book I. Boston: Houghton Mifflin Co., 1970.

Drooyan, Irving; Hadel, Walter; Hyatt, Herman R.; Carico, Charles C.; and Hardesty, James N. Algebra 2 With Trigonometry. New York: Macmillan Co., 1970.

Fehr, Howard F.; Carnahan, Walter H.; and Beberman, Max. Algebra: Course 1. Boston: D. C. Heath and Co., 1955.

Fitzgerald, William M.; Dalton, Leroy C.; Brunner, Vincent F.; and Zetterberg, Jack P. Algebra 2 and Trigonometry: Theory and Application. River Forest, Ill.: Laidlaw Brothers, 1968.

Fisher, Robert C., and Ziebur, Allen D. Integrated Algebra and Trigonometry. Englewood Cliffs, N.J.: Prentice-Hall, 1958.

Freilich, Julius; Berman, Simon L.; and Johnson, Elsie P. Algebra for Problem Solving: Book 2. Boston: Houghton Mifflin Co., 1953.

Jacobs, Russell F. Introductory Algebra 1. New York: Harcourt, Brace & World, 1969.

_____. Introductory Algebra 2. New York: Harcourt, Brace & World, 1969.

Keedy, Mervin L.; Griswold, Alice L.; and Schacht, John F. Contemporary Algebra and Trigonometry. New York: Holt, Rinehart and Winston, 1961.

Lennes, N. J., and Maucker, J. W. A First Course in Algebra. sec rev. New York: Macmillan Co., 1949.

Murphy, Daniel P. TEMAC Programmed Learning Materials: First Year Algebra. n.p.: Encyclopedia Britannica Films, 1961.

Nichols, Eugene D., and Collins, Wagner G. Modern Elementary Algebra. New York: Holt, Rinehart and Winston, 1961.

School Mathematics Study Group. First Course in Algebra, Parts I & II. rev. ed. New Haven, Conn.: Yale University Press, 1961.

_____. Intermediate Mathematics, Parts I & II. rev. ed. New Haven, Conn.: Yale University Press, 1961.

Schorling, Raleigh; Smith, Rolland R.; and Clark, John R. Second-Year Algebra. Yonkers-on-Hudson, N.Y.: World Book Co., 1942.

Welchons, A. M.; Krickenberger, W. R.; and Pearson, Helen R. Algebra Book Two. rev. ed. New York: Ginn and Co., 1957.

2. Applied and Technical Mathematics

Betz, William; Miller, A. Brown; Miller, F. Brooks; Mitchell, Elizabeth B.; and Taylor, H. Carlisle. Everyday General Mathematics: Book One. Boston: Ginn and Co., 1956.

Betz, William; Miller, A. Brown; Miller, F. Brooks; Mitchell, Elizabeth B.; and Taylor, H. Carlisle. Everyday General Mathematics: Book Two. Boston: Ginn and Co., 1956.

Brumfiel, Charles F.; Eicholz, Robert E.; and Shanks, Merrill E. Introduction to Mathematics. Reading, Mass.: Addison-Wesley Publishing Co., 1964.

Leeper, Hugh; Massey, Robert; and Strong, Roger. Numerical Trigonometry: Related Topics and Applications. Livonia, Mich.: Livonia Public Schools, 1968.

Keal, Harry M., and Leonard, Clarence J. Essential Mathematics for Skilled Workers. New York: John Wiley & Sons, 1942.

Nelson, Gilbert D.; Moore, Frank C.; Hamburger, Carl; and Becker, Philip. General Mathematics for the Shop. Boston: Houghton Mifflin Co., 1956.

3. Basic and Refresher Mathematics

Bernstein, Allen L., and Wells, David W. Trouble-Shooting Mathematics Skills. New York: Holt, Rinehart and Winston, 1963.

Potter, Mary A.; Dunn, Flora M.; Allen, Emmy H.; and Goldthwaite, John S.; Mathematics to Use. Boston: Ginn and Co., 1950.

Stein, Edwin I. Refresher Mathematics. Boston: Allyn and Bacon, 1968.

4. Calculus

Thomas, George B., Jr. Elements of Calculus and Analytic Geometry. Reading, Mass.: Addison-Wesley Publishing Co., 1959.

_____. Elements of Calculus and Analytic Geometry. rev. ed. Reading, Mass.: Addison-Wesley Publishing Co., 1967.

5. Computer Mathematics

Department of Secondary Education. A Student Manual: Computer Uses in Mathematics. Livonia, Mich.: Livonia Public Schools, 1966.

Farina, Mario V. Programming in BASIC. Englewood Cliffs, N.J.: Prentice-Hall, 1968.

Jacobs, Zeney P.; French, Francis G.; Moulds, William J.; and Schuchman, Jacob G. Communicating with the Computer-BASIC. Boston: Allyn and Bacon, 1975.

6. Elementary School Mathematics

Brueckner, Leo J.; Merton, Elda L.; and Grossnickle, Foster E. Gaining Number Power. New York: Holt-Rinehart and Winston, 1959.

Brueckner, Leo J.; Merton, Elda L.; and Grossnickle, Foster E. Making Number Discoveries. New York: Holt-Rinehart and Winston, 1959.

Brueckner, Leo J.; Merton, Elda L.; and Grossnickle, Foster E. Moving Ahead in Arithmetic: Books 1-6. New York: Holt-Rinehart and Winston, 1963.

Brueckner, Leo J.; Merton, Elda L.; and Grossnickle, Foster E. Reaching Number Goals. New York: Holt-Rinehart and Winston, 1959.

Brueckner, Leo J.; Merton, Elda L.; and Grossnickle, Foster E. Ready to Begin Numbers. New York: Holt-Rinehart and Winston, 1959.

Brueckner, Leo J.; Merton, Elda L.; and Grossnickle, Foster E. Using More Numbers. New York: Holt-Rinehart and Winston, 1959.

Brueckner, Leo J.; Merton, Elda L.; and Grossnickle, Foster E. Using Number Ideas. New York: Holt-Rinehart and Winston, 1959.

Brueckner, Leo J.; Merton, Elda L.; and Grossnickle, Foster E. Winston Arithmetics. Philadelphia: John C. Winston Co., 1952.

Dilley, Clyde A.; Rucker, Walter E.; and Jackson, Ann E. Heath Elementary Mathematics: Books 1-6. Lexington, Mass.: D. C. Heath and Co., 1972.

Eicholz, Robert E.; O'Daffer, Phares G.; Brumfiel, Charles F.; and Shanks, Merrill E. Elementary School Mathematics: Books 1-6. Reading, Mass.: Addison-Wesley Publishing Co., 1964.

Hartung, Maurice L. et al. Seeing Through Arithmetic. Chicago: Scott Foresman and Co., 1958.

Math Modules: Individualized Math Program. New York: Appleton Century Crofts/New Century, 1971.

Sponner, George. Mathematics Enrichment. New York: Harcourt, Brace & World, 1962.

7. Geometry

Andrews, John; Lidster, Jack; and Vance, Gary. Practical Geometry. Livonia, Mich.: Livonia Public Schools, n.d.

Brumfiel, Charles F.; Eicholz, Robert E.; and Sharks, Merrill E. Geometry. Reading, Mass.: Addison-Wesley Publishing Co., 1960.

Clark, John R.; Smith, Rolland R.; and Schorling, Raleigh. Modern-School Geometry. Yonkers-on-Hudson, N.Y.: World Book Co., 1943.

Coxford, Arthur F. and Usiskin, Zalman P. Geometry: A Transformation Approach. River Forest, Ill.: Laidlaw Brothers, 1971.

Mallory, Virgil S., and Oakley, Chauncey W. Plane Geometry. Chicago: Benjamin H. Sanborn and Co., 1953.

Moise, Edwin E., and Downs, Floyd L., Jr. Geometry. Reading, Mass.: Addison-Wesley Publishing Co., 1964.

Schacht, John F., and McLennan, Roderick C. Plane Geometry. New York: Henry Holt and Co., 1957.

School Mathematics Study Group. Geometry, Parts I & II. rev. ed. New Haven, Conn.: Yale University Press, 1961.

Skolnik, David, and Hartley, Miles C. Dynamic Solid Geometry. Princeton: D. Van Nostrand Co., 1952.

Smith, Rolland R., and Clark, John R. Modern-School Solid Geometry. Yonkers-on-Hudson, N.Y.: World Book Co., 1939.

Welchons, A. M.; Krickenberger, W. R.; and Pearson, Helen R. Essentials of Solid Geometry. Boston: Ginn and Co., 1959.

8. Probability and Statistics

Commission on Mathematics. Introductory Probability and Statistical Inference for Secondary Schools. pre. ed. New York: College Entrance Examination Board, 1957.

Goldberg, Samuel, Probability: An Introduction. Englewood Cliffs, N.J.: Prentice-Hall, 1960.

Mosteller, Frederick; Rourke, Robert E. K.; and Thomas, George B., Jr. Probability: A First Course. Reading, Mass.: Addison-Wesley Publishing Co., 1961.

9. Senior (Consumer) Mathematics

Dressler, Isidore. Preliminary Mathematics: Review Text. New York: Amsco School Publications, 1962.

Lankford, Francis G., Jr., and Goe, William E. Consumer Mathematics. sec. ed. New York: Harcourt Brace Jovanovich, 1974.

Lankford, Francis G., Jr.; Schorling, Raleigh; and Clark, John R. Mathematics for the Consumer. rev. ed. Yonkers-on-Hudson, N.Y.: World Book Co., 1953.

Lewis, Harry. Mathematics for Daily Living. Cincinnati, Ohio: McCormick-Mathers Publishing Co., 1970.

Piper, Edwin B., and Gruber, Joseph. Applied Business Mathematics. 8th ed. Cincinnati, Ohio: South-Western Publishing Co., 1963.

10. Seventh and Eighth Grade Mathematics

Brumfiel, Charles F.; Eicholz, Robert E.; Shanks, Merrill E.; and O'Daffer, Phares G. Arithmetic: Concepts and Skills. Reading, Mass.: Addison-Wesley Publishing Co., 1963.

Deans, Edwina; Kane, Robert B.; McMeen, George, H.; and Oesterle, Robert A. Extending Mathematics. New York: American Book Co., 1968.

Deans, Edwina; Kane, Robert B.; McMeen, George, H.; and Oesterle Robert A. Structuring Mathematics. New York: American Book Co., 1968.

Dolciani, Mary P.; Wooton, William; Beckenbach, Edwin F.; and Chinn, William G. Modern School Mathematics: Structure and Method 7. Boston: Houghton Mifflin Co., 1967.

Dolciani, Mary P.; Wooton, William; Beckenbach, Edwin F.; and Chinn, William G. Modern School Mathematics: Structure and Method 8. Boston: Houghton Mifflin Co., 1967.

Douglass, Harl R.; Kinney, Lucien B.; and Lentz, Donald W. Everyday Arithmetic: Junior Book 1. New York: Henry Holt and Co., 1954.

Douglass, Harl R.; Kinney, Lucien B.; and Lentz, Donald W. Everyday Arithmetic: Junior Book 2. New York: Henry Holt and Co., 1954.

Duncan, Ernest R.; Capps, Lelon R.; Dolciani, Mary P.; Quast, W. G.; and Zweng, Marilyn J. Modern School Mathematics: Structure and Use. rev. ed. Boston: Houghton Mifflin Co., 1972.

Eicholz, Robert E.; O'Daffer, Phares G.; Brumfiel, Charles F.; and Shanks, Merrill E. Basic Modern Mathematics: First Course. Reading, Mass.: Addison-Wesley Publishing Co., 1965.

Eicholz, Robert E.; O'Daffer, Phares G.; Brumfiel, Charles F.; and Shanks, Merrill E. Basic Modern Mathematics: Second Course. Reading, Mass.: Addison-Wesley Publishing Co., 1965.

Fleenor, Charles R.; O'Daffer, Phares G.; Ellis, June G.; and Eicholz, Robert E. Success with Mathematics 2. Reading, Mass.: Addison-Wesley Publishing Co., 1972.

Keedy, Mervin L.; Jameson, Richard E.; and Johnson, Patricia L. Exploring Modern Mathematics: Book 1. New York: Holt, Rinehart and Winston, 1963.

Keedy, Mervin L.; Jameson, Richard E.; and Johnson Patricia L. Exploring Modern Mathematics: Book 2. New York: Holt, Rinehart and Winston, 1963.

Nichols, Eugene D.; Anderson, Paul A.; Dwight, Leslie A.; Flournoy, Frances; Kalin, Robert; Schluep, John; and Simon, Leonard. Holt School Mathematics: 7 and 8. New York: Holt, Rinehart and Winston, 1974.

O'Daffer, Phares G.; Ellis, June G.; Fleenor, Charles R.; and Eicholz, Robert E. Success with Mathematics 1. Reading, Mass.: Addison-Wesley Publishing Co., 1972.

Rosskopf, Myron F.; Morton, Robert L.; Hooten, Joseph R.; and Sitomer, Harry. Modern Mathematics for Junior High School: Book 1. Morristown, N.J.: Silver Burdett Co., 1961.

11. Trigonometry and Math Analysis

Allendoerfer, Carl B., and Oakley, Cletus O. Principles of Mathematics. New York: McGraw-Hill Book Co., 1955.

Coxford, Arthur F., and Payne, Joseph N. Advanced Mathematics: A Preparation for Calculus. New York: Harcourt, Brace & World, 1972.

Kline, William; Oestele, Robert; and Willson, Leroy. Foundations of Advanced Mathematics. New York: American Book Co., 1959.

Mallory, Virgil S., and Fehr, Howard F. Senior Mathematics for High Schools. new ed. Chicago: Benjamin H. Sanborn and Co., 1955.

Meserve, Bruce E.; Pettofrezzo, Anthony J.; and Meserve, Dorothy T. Principles of Advanced Mathematics. New York: L. W. Singer Co., 1964.

Mills, Clifford N.; Atkin, Edith I.; and Flagg, Elinor B. Plane Trigonometry. New York: Scott Foresman and Co., 1947.

Welchons, A. M., and Krickenberger, W. R. Trigonometry with Tables. Boston; Ginn and Co., 1957.

12. Other

Calder, George A. A Unit on Fractions for Low Achievers. Livonia, Mich.: Livonia Public Schools, 1967.

Calder, George A., and Carey James A. Introduction to Modern Mathematics. Livonia, Mich.: Livonia Public Schools, August 1962.

Calder, George A., and Segowski, Edward. Activities Cards for Use in a Mathematics Laboratory. Livonia, Mich.: Livonia Public Schools, n.d.

Department of Secondary Education. Livonia Mathematics Diagnostic Tests: 1A and 1B. Livonia, Mich.: Livonia Public Schools, November 1969.

Department of Secondary Education. Livonia Mathematics Diagnostic Tests: 2A and 2B. Livonia, Mich.: Livonia Public Schools, November 1969.

Livonia Public Schools. A Collection of Supplementary Exercises and Activities. Livonia, Mich.: Livonia Public Schools, August 1960.

Livonia Public Schools. Games and Challenges. Livonia, Mich.: Livonia Public Schools, August 1968.

Lundy, Henry. Twelve Exercises for Supplemental Use in Mathematics. Livonia, Mich.: Livonia Public Schools, January 1966.

May, Lola J. Major Concepts of Elementary Modern Mathematics. Wilmette, Ill.: John Colburn Associates, 1962.

Mueller, Francis J. Arithmetic: Its Structure and Concepts. Englewood Cliffs, N.J.: Prentice-Hall, 1956.